

NEO-PIAGETIAN THEORIES: CROSS-CULTURAL AND DIFFERENTIAL PERSPECTIVES

Pierre R. DASEN and Anik de RIBAUIERRE *

University of Geneva, Switzerland

The neo-Piagetian theories represented in this special issue are examined from the cross-cultural and differential perspectives. The goals, methods and achievements of these two approaches are briefly reviewed, and the similarities and differences between the two are pointed out. Six criteria are proposed that psychological theories should meet from the point of view of these perspectives. After a review of the few existing empirical cross-cultural and differential studies inspired by neo-Piagetian theories, the latter are matched to the six criteria, and the potential advantages of these new models over classical structuralist approaches are spelled out.

1. Introduction

For this paper, the editor of this special issue asked us specifically to review the literature on neo-Piagetian theories in general and the papers contributed to this issue in particular, and to elaborate on the following three related sets of issues:

- (1) Which type of structural description of the capacities characterizing successive developmental levels appears more flexible with regard to accommodating cross-cultural variation in cognitive performance during development;
- (2) How the changes from the one to the next developmental level are best to be modelled and explained so as to capture cross-cultural

* Both authors have contributed equally to this paper, and the order does not reflect a hierarchical relationship. We wish to thank several colleagues who have provided comments on earlier drafts of this paper, particularly J.W. Berry, A. Blanchet, M. Bovet, R. Case, A. Demetrious, K. Fischer, G. Halford and L. Rieben. Any remaining errors are, however, our sole responsibility. Requests for reprints should be addressed to either author at the following address: F.P.S.E., University of Geneva, CH-1211 Geneva 4, Switzerland.

diversity in the course of cognitive development and in the ways the various cultures attempt – formally or informally – to stimulate cognitive development;

(3) In which of these aspects each of the neo-Piagetian theories referred to above appears to succeed better.

At first we were rather reluctant to undertake such an evaluative task, certainly not an easy one. However, since we have claimed several times that no psychological theory can be satisfactory unless it is able to take cultural variations (Dasen 1980a, 1983a) or individual differences (e.g., Lautrey et al. 1981; de Ribaupierre and Rieben 1985; de Ribaupierre, in press) into account, it indeed seemed essential to include a discussion from the cross-cultural and differential points of view. The purpose of this paper, however, is not so much to judge the extant theories, nor to bet on one particular horse in a race that has no finishing line (Sternberg, this issue). We will rather review some of the empirical work already carried out, and especially point to potentially useful paths for further, cross-cultural and differential research inspired by neo-Piagetian theories.

The differential and the cross-cultural approaches have partly overlapping methods and goals. Both are using the comparative method to look for naturally occurring variations between different types of subjects, and trying to assess the extent to which general models can accommodate such variation. Beyond being two separate disciplines with their own wealth of accumulated data, their own literature and their experts, the two approaches share a lot of common ground, and can be considered to be complementary. Cross-cultural psychology typically deals with group data, i.e., central tendencies within a culture and often neglects the existence of organismic individual differences, the possibility that these may interact with situational aspects, and that these differences may even be more pronounced in some cultures than in others, through the interaction between individual and environmental factors. Thus, cross-cultural psychology usually addresses differences at the macro-level of human societies, while differential psychology adopts a finer grain of analysis, studying inter-individual and intra-individual differences at the micro-level. The two approaches meet when they address inter-individual differences in sub-groups (such as social classes) within a single society. Cross-cultural psychology has always set out to test general models established in mainstream psy-

chology, while this is a more recent endeavour in differential psychology.

The two approaches are also similar in the requirements they set for psychological theories: these should be able to accommodate individual as well as cultural differences. We have therefore decided to structure most of this discussion around both cross-cultural and differential criteria. In the first part of the paper, we will attempt to define which characteristics a developmental theory ought to have in order to meet the requirements of cross-cultural and differential psychology. At the same time, we will review, in broad outline, what cross-cultural and differential research had been carried out in relation to Piaget's theory before the advent of neo-Piagetian theories. In a second part, we will briefly review some of the empirical research with a cross-cultural orientation, and will reach the conclusion that these new theories have the potential to take into account both cultural and individual differences, but that this potential has only just started to be explored. In a third part, we will take the neo-Piagetian theories represented in this special issue, and attempt to match them against our criteria, pointing out where they go beyond the previous theorizing, and where limitations remain.

In this paper, we will not summarize explicitly the various neo-Piagetian theories, since this has been done by Sternberg and by Case, as well as by the other contributors to this special issue. Furthermore, we will not deal explicitly with the papers by Shayer and Siegler whose interesting contributions do not propose, as such, a full-fledged neo-Piagetian theory.

Part 1: Cross-cultural and differential requirements of developmental theories

The cross-cultural perspective

One of the goals of cross-cultural research is to distinguish empirically the universal from the culturally relative; an a priori claim to universality, without empirical proof, is unfortunately common in western 'mainstream' psychology. Any theory which claims generality has to explain the behaviour of the entire human species, specifying which aspects are common to all humans, and which vary according to

which cultural factors. The comparative method is often used to test the impact of cultural factors, particularly those that are too homogeneous within a society. It is sometimes advantageous to maximize the differences on the variable of interest, which is possible when selecting cultural groups appropriately. The comparative method, including its specific methodological problems, also applies when social groups are studied that are less widely different, such as social classes within western societies, or even individuals within these groups.

Although cross-cultural psychology is centrally concerned with individual-level behaviour, its specificity is that it always attempts to link it with population-level phenomena that are studied by related social sciences such as anthropology, sociology and linguistics. At the population level, the background variables are the ecological and socio-political context, which influence psychological characteristics (including both observable behaviours and inferred characteristics) through intervening process variables. Individual behaviour can be understood across cultures only when the cultural features of the population are taken into account, as well as the ways in which culture is transmitted (enculturation and socialization).

This general scheme has the following methodological implications (Berry 1980): any psychological measurement will have behavioural validity only insofar as it has eco-cultural validity. The latter is achieved if the assessment context is nested in a culturally appropriate situational context, which is nested in the habitual learning context, itself part of the eco-cultural context. Therefore, what is needed is a theory, and the corresponding techniques, that can deal systematically with all four nested levels.

Berry et al. (1988) distinguish three theoretical orientations. The *absolutist*, or 'imposed etc' approach postulates the universality of the theory without seeking empirical proof. It therefore considers that comparisons across cultures are easy to achieve with standardized tests, and that any differences will be quantitative. A good example is the psychometric assessment of 'intelligence' across cultures. At the other extreme, the *relativist* approach of the ethnologist considers that each culture is unique, that differences are always qualitative, and therefore that any comparison is impossible. The third approach, that has the authors' preference, is called the *universalist* orientation, in which cross-cultural comparisons are deemed difficult, but possible if handled with care; universal characteristics of psychological functioning are

searched for empirically, and are usually found at the level of 'deep' structures, with cultural variations at the 'surface'. The latter may be qualitative and/or quantitative.

A brief review of previous cross-cultural Piagetian research

Cross-cultural research using Piaget's theory has been reviewed by Dasen and Heron (1981). Despite its reference to a single theory, and most often to a set of more or less standardized tasks, it is not a homogeneous research venture. The 'orthodox' tradition tends to follow an *absolutist* orientation, taking the sequence of stages and the definition of the end state of development as universally given (for a critique, see Greenfield 1976), and paying little attention to the cultural validity of the assessment context. Piaget himself basically posited the universality of the theory, both across cultures and across individuals, without empirical test, even though the very first article in this journal (Piaget 1966) paid lip-service to the need for a comparative method. An examination of the space devoted to the four developmental factors outlined in Piaget's paper is of some interest: while the first three factors (biological, equilibration and interpersonal coordination) that theoretically lead to universality are given about one page each, the fourth of Piaget's factors, 'educational and cultural transmission', the only one deemed to account for cultural differences, is given only one paragraph.

In orthodox Piagetian theory, no attempt is usually made to account for individual or cultural differences. The theory deals with an 'epistemic' subject, that often does not have a counterpart in a 'real' child. Furthermore, the stages are defined by unitary structures that lead to the expectation of a '*structure d'ensemble*' that is not unlike 'general intelligence', except that it is related to underlying psychological mechanisms instead of being only an empirical construct.

Such an absolutist Piagetian approach has been criticized repeatedly, notably because the interpretation of cultural (or socio-economic) differences in terms of a standard developmental sequence may easily lead to value judgements in terms of 'retardation' or 'deficit' against an ethnocentric, middle-class, western norm (Cole and Scribner 1977). However, Dasen et al. (1979a) have argued that it is not necessary to link developmental sequences to value judgements if an eco-cultural model is used as the guiding paradigm.

Berry's *ecological functionalism* (Berry 1976, 1980) has provided the major impetus for exploring the links between the larger ecological context and behavioural outcomes, particularly in terms of Witkin's theory of psychological differentiation that has the advantage of incorporating a strong socialization component (learning context). Berry (1984), on the basis of his own empirical research and of a careful reading of the cross-cultural literature, rejects the 'absolutist' (or 'imposed etc') theories, that group cognitive abilities into a single package (i.e., 'general intelligence'), assuming it to be universally valid, and allowing only for quantitative differences (or 'level' of development). However, he also rejects any theory (such as that of M. Cole) that allows for only specific abilities linked to specific contexts, because it is quite obvious that there are patterns of inter-task relationships, just as there are patterns in the socio-cultural variables that determine the latter.

Dasen (1980b, 1983b) proposed a similar model, rejecting both the orthodox structuralism of Piaget and the extreme contextualism of Cole, to prefer a mid-line position illustrated by the metaphor 'valleys of construction' proposed by Harris and Heelas (1979).

These critiques should not belittle the major importance of the work of M. Cole and his colleagues (Cole et al. 1971; Cole and Scribner 1974; Scribner and Cole 1981; LCHC 1979, 1983) that emphasizes the *context specificity* of cognitive processes. Basic processes are deemed to be universal, but they combine into 'functional cognitive systems' that are triggered by culturally specific contexts.

Two major contributions of Cole's experimental anthropology are methodological ones: (a) Much importance is given to the cultural validity of the assessment context, systematically embedded in the eco-cultural context thanks to exhaustive ethnological documentation. (b) This leads to much caution in the interpretation of 'scores'; a task is modified in various ways so as to insure optimal performance, and never is a hasty conclusion made to any cognitive 'deficiency' or to the absence of a capacity.

Applying the eco-cultural model to Piagetian psychology, Dasen (1975) has demonstrated links between the eco-cultural context (and related learning contexts) and performance differences in various domains of concrete operational concepts (space, quantification). Against the background of the universality of the sequence of stages and the 'qualitative' characteristics of concrete operational reasoning, 'quantitative'

tative' performance and competence differences occur according to which conceptual domains are more valued in any given society. For example, nomadic hunting-and-gathering societies will foster the development of the spatial domain, while sedentary agricultural societies will place more value on quantitative reasoning. These eco-cultural factors do not influence the sequence of sub-stages, but the rate at which they are attained, and this is so at the competence (deep) as well as at the performance (surface) levels (Dasen 1977). However, further research using training techniques (Dasen et al. 1979b) has shown that the so-called asymptote (or apparent levelling-off in the developmental curves of some concrete operational concepts) is purely a performance phenomenon, that disappears after repeated testing or after a small number of training sessions.

Working among the Oksapmin of Papua New Guinea, Saxe (1981, 1982; Saxe and Moylan 1982) has demonstrated how the indigenous body-part numerical system influences the development of concepts of number and measurement in such a way as to produce additional sub-stages within the usual Piagetian sequence (in addition to differences in the ages at which the sub-stages are attained).

Such approaches within Piagetian theory may be deemed *universalist* (or 'derived etc') rather than absolutist, in Berry et al.'s (1988) terminology: the universal characteristics of operational thought have been established empirically, rather than postulated a priori, and the cultural variations are linked to the eco-cultural context. The empirical research shows that there is species-wide continuity of basic cognitive processes, but cultural variation in the way these are developed and deployed.

The link between the eco-cultural variables and the developmental outcomes occurs through the learning context, i.e., the enculturation and socialization practices during infancy and childhood. A useful summary and model of research in this area has been provided by Super and Harkness (1986) in terms of the 'developmental niche', that has three components: (a) the physical and social settings in which the child lives; (b) the customs of child care and child rearing; (c) the psychology of the caretakers, or parental ethnotheories of development.

Recent work in cross-cultural Piagetian psychology, after establishing the internal and external validity of Piagetian tasks in a non-western cultural context (Dasen 1984), has paid some attention to the developmental niche of concrete operational thought. The links be-

As already mentioned, the method adopted by the two disciplines of cross-cultural and of differential psychology are very close, particularly when differential psychology focuses on inter-individual variability (see below) and when differences between sub-groups of a single society are studied. However, while the role of cross-cultural psychology is to focus on the influence of eco-cultural variables, the specific task of differential psychology, as we see it, is to search for general laws accounting for the apparently infinite individual variations, by defining organismic constructs within individuals (Lautrey et al., in press; Reuchlin 1964, 1977; de Ribaupierre and Pascual-Leone 1984) that interact with environmental variables. Differential psychology has to help us understand which individual variables may modulate a general level, and by which psychological mechanisms environmental variables are mediated so as to produce a given performance.

The study of individual differences takes two complementary directions: the study of inter-individual variability and that of intra-individual variability (e.g., Reuchlin 1969). The first approach centers on differences between individuals, either to merely assess the amplitude of such differences or to determine the influence of an independent variable; in this case, groups of individuals may be defined a priori on the basis of some variable, whether environmental such as SES or culture, biological such as gender, or psychological such as cognitive style. Analyses of inter-individual differences have dealt either with average differences between groups or with the variance, assessing how much of the observed variance can be predicted from the variance in the independent variables. By attempting to quantify these effects, differentialists have until recently often neglected the issue of underlying mediating psychological processes.

The second type of approach, namely the study of intra-individual variability presents greater specificity and is quite distinct from the cross-cultural method. Through the use of various methodological approaches, and by comparing the same individuals across different types of situations, it attempts to capture the organization of processes within individuals, and to assess the number of dimensions underlying performances. This direction corresponds to what Cronbach (1957) labelled the correlator's approach. An illustration of this type of approach is provided by the factor analytic models proposed by differentialists with respect to cognition. The general consensus (see for instance Gustafsson 1984) is to consider that cognitive behaviours, as

tween operational development and locally valued aptitudes have been studied in terms of the parental ethnotheory of intelligence (Dasen et al. 1985), and ongoing work deals in more detail with the learning context assessed through behaviour observations (Dasen, in press).

Occasionally, a completely *relativist* or 'emic' approach is being advocated for cross-cultural Piagetian psychology (e.g., Greenfield 1976, Davids 1983). Such an approach attempts to study cognition as it occurs in its local context, without any outside reference or attempt to compare. The contribution of this approach is extremely important, because it points to the existence of qualitatively divergent sets of cognitive skills, and different paths of development. A good example is the study of the navigational skills of micronesians (Gladwin 1970), and an overview of 'emic' research has been provided by Berry and Irvine (1986). No such empirical research has been carried out from a Piagetian perspective, although Saxe's research mentioned above comes close to it. Potentially this option would lead to 'a Piagetian theory to each culture' (Dasen 1977: 336).

While an 'emic' validation is a necessary part of the cross-cultural research process, a totally relativist strategy precludes the search for what is common to mankind. Cognitive development, according to the existing cross-cultural data, is neither totally universal, nor totally culturally specific; only an approach that allows for both dimensions can be deemed appropriate.

A brief review of differential psychology

Differential psychology basically intends to understand individual differences in behaviour. Historically, differential psychology has often been restricted to an applied outlook, developing measures for predicting performances in a given context, often through elaborate statistical analyses. Epistemologically, it has therefore tended to remain apart from the main trends of psychology. Consequently, it has often been restricted to the description of the types and extents of individual differences. When it addressed more theoretical issues, such as the origin of individual differences, it has characteristically attempted to quantify the effects of independent variables, rather than to specify the mechanisms through which such effects are produced. A good example is the futile attempt to obtain a quantitative estimate of the relative importance of heredity versus environment (see for instance de Ribaupierre et al. 1986).

assessed through standard psychometric tests, are organized according to a hierarchical model (a general factor and several large group factors). This supports the hypothesis that different individuals can reach a same general level through different (although not completely independent) means, and that subjects can resort to different processes for solving the same problem; with respect to developmental aspects, it also points to the possibility that different individuals may develop along different paths.

Inter- and intra-individual approaches are complementary; indeed, a study of intra-individual variability is often conducted with the objective to define groups of individuals, that is, to end up in a study of inter-individual variability (e.g., de Ribaupierre and Rieben 1985). In this case, groups of individuals are defined a posteriori on the basis of their intra-individual organisation (similarity of profiles for instance).

Unfortunately, differentialists dealing with psychometric tasks have too often confounded task content and psychological processes (see de Ribaupierre and Pascual-Leone 1984). Factor analyses demonstrate the structural similarity of task contents, which is not to say that a one-to-one correspondence can be established between task content and psychological processes. For instance, the well-established fact that task scores cluster according to whether the tasks are verbal or spatial does not necessarily imply that there are verbal and spatial processes. It only implies that there are processes more adequate for dealing with verbal content, and processes more appropriate for spatial content.

It thus proves necessary to better dissociate task scores and underlying psychological processes, surface and deep structures, or performance and competence. The same holds true for the study of inter-individual variability: if the effect of an environmental variable can be empirically demonstrated, for instance that high SES contributes positively to cognitive scores, it remains to be explained through which psychological mechanisms (organismic constructs) this influence is mediated (see Reuchlin 1972). This is why we call for an integration between general models and differential psychology (de Ribaupierre and Pascual-Leone 1984; de Ribaupierre and Rieben 1985; Lautrey et al., in press). General models can help clarifying the issue of processes at work in individual performances. Reciprocally, differential psychology may lead general models to be refined or modulated; for instance, the influence of variables such as socio-economic status on the performance in Piagetian tasks results in questioning the universal-

ity of Piaget's theory. The focus on intra-individual variability may end up in even more serious transformations of the general theoretical model, such as dismissing the underlying postulate of unidimensionality.

A differentialist approach to Piagetian psychology has mainly focused on the study of inter-individual differences. Numerous studies have demonstrated a great inter-individual variability, which proves almost as important (with respect to the role of SES for instance) in Piagetian tasks as in psychometric ones; further, inter-individual variability is at times as important as age differences. Within this research tradition, Lautrey's study (1980) on the influence of educational practices is noteworthy; not only does Lautrey study their impact on performances in Piagetian tasks, but he also uses the Piagetian model to understand which processes mediate this influence (for example the triggering of equilibration by flexibly structured environments, that introduce both perturbations and occasions of regulations). Cognitive styles have also proven important to account for the variability in a number of Piagetian tasks (Huteau 1980, 1987).

The focus on intra-individual variability in Piagetian tasks has been less frequent, although it can be quite fruitful. A number of studies resorted to factor analyses; unfortunately several authors in this direction were apparently satisfied to find that a general factor could account for a relatively high proportion of the variance (e.g., Humphreys et al. 1985) thus remaining within a global and unidimensional perspective. From a theoretical standpoint, the focus on intra-individual variability, and on the emergence of group factors, is more interesting in that it casts doubts on the unidimensionality of development implicit in Piaget's writings. In Reuchlin's (1964) early discussion of the relevance of factor analysis for a modification of the Piagetian model, he suggested that some of the horizontal *décalages* (i.e., the time lags in the application of a same structure to different contents) be understood in terms of group factors or regional acquisitions. In essence, this means that development is not as unidimensional as claimed by the Piagetian model, and that a same developmental level can be attained through different means. The study of *décalages* proves thus a privileged means to access the issue of individual variability.

Longeot (1969) showed that during a preparatory phase, subjects could enter the stage of formal operations either through a 'combinatorial path' or through an 'INRC path', demonstrating that these two

structures do not necessarily develop concurrently in the same individual. He later (Longeot 1978) suggested that development on the whole can consist of various developmental loops: during a preparatory phase, individuals can differ in the order of their acquisitions, while they rejoin at the end of a substage.

In a research program commonly led by A. de Ribautpierre, L. Rieben and J. Lautrey (1985; Rieben et al. 1983, 1986), it has been shown that both inter- and intra-individual variability is very large between 6 and 12 years of age, and almost exceeds the developmental changes. During this period, subjects exhibit different types of *décalages*, including individual ones, that is, *décalages* that are not in the same direction for all subjects, and which are incompatible with a unidimensional view of development. The authors have demonstrated, in particular, that the relations between the figurative and the operative aspects of thought do not entertain univocal relationships: figurative aspects cannot simply be subordinated to operative aspects; depending on both the subjects and the situations, each can play a monitoring role in cognitive development.

Such findings lead back to the study of inter-individual variability. Thus the hypothesis of these authors, following Reuchlin's (1978) suggestion, is that there are vicarious or optional processes within the individual, that may develop differently in different subjects, and that are also differentially elicited by different situations. On the basis of research with Piagetian tasks, Rieben et al. (1986, in press) were led to postulate the existence of at least two modes of processing within each individual: a digital or propositional mode, and an analogical mode. These modes differ in their adequacy for handling different types of situations: the digital mode is more adequate for treating discontinuous situations (or Piagetian logico-mathematical tasks), while the analogical mode seems more appropriate in continuous situations (infra-logical tasks). Subjects may in turn differ with respect to the ease with which they can apply and/or access these modes in a given situation. Within a same developmental level, this model postulates an interaction between types of subjects and types of situations; across developmental levels, the differential weight of the two modes of processing may well change too. These findings demonstrate that development is multiterminated, that is, a same performance (score) can result from different processes, either in isolation or combined.

Summary criteria for a theory taking individual and cultural differences into account

In a 'metamethodological evaluation' of psychological theories from a cross-cultural perspective, Eckensberger (1979) lists the following three essential criteria: (1) The theory should explain both culture and behaviour. (2) The theory should relate individual change to cultural change. (3) The theory should allow 'the determination of general laws and concepts on the one hand, but maintain the uniqueness of single concrete events, processes, persons, objects, times and spaces for single subjects' (Eckensberger 1979: 260). The author then distinguishes five metaphysical models or leading world views, and the theories built upon them: (1) descriptive; (2) learning theories; (3) cognitive development; (4) socio-biology; (5) action theories. The author demonstrates his preference for action theories, especially the ecological psychology of Boesch (1976), for a variety of reasons among which that it 'implies a *dialectical* relationship between him (the subject) and the environment via his actions' (1979: 269).

Eckensberger's analysis inspired our attempt to define our own criteria, that are derived from the above review of the cross-cultural and differential approaches:

- (1) The theory should predict both commonality and individual, situational and cultural differences, i.e., it should not only pay lip service to their occurrence, but build them into the model. This is an important criterion for both approaches; it implies that differences should not be seen as mere modulations of a single general phenomenon, but should be considered to reflect fundamental variations.
- (2) The theory should allow for a distinction between deep and surface phenomena, and specify the relationships between the two levels in different contexts; it should also predict which differences will occur at which level.
- (3) The theory should specify the learning context linked to development, or in other words, the 'developmental niche'.
- (4) The cross-cultural aspects of the theory should link individual behaviour to population-level data (i.e., provide an interdisciplinary link to other social sciences).
- (5) The assessment context should be nested successively in the situational, learning and eco-cultural contexts, ensuring cultural valid-

ity. This item also relates to explicit construct validation in each culture, and to the demonstration of functional, conceptual and metric equivalence across cultures (Berry 1969; Berry and Dasen 1974; Malpass and Poortinga 1986).

(6) The differential aspects of the theory should link inter- and intra-individual variability to the underlying psychological processes, and should specify the interaction between types of subjects and types of situations.

Among these criteria, the first three apply equally to differential and to cross-cultural psychology, the next two are specifically cross-cultural requirements, while the last one is particular to differential psychology.

Part 2: A critical review of the cross-cultural and differential studies inspired by neo-piagetian theories

In this part of the paper, we shall briefly review some of the empirical research that has been carried out comparatively in different social classes (inter-individual differences) or different societies (cross-cultural differences), commenting as we move along, on some of the advantages or lacunae of each study. In contrast to the upcoming Part 3, we are dealing here not with the potential relevance of the theories, but with the particular way individual researchers have carried them to the field. This review does not pretend to be exhaustive, but is based mainly on the material the individual contributors have provided us with.

Pascual-Leone

(1) Case (1975)

This study, although carried out by Case, really refers to Pascual-Leone's model. It was designed to compare children aged 6-11 years from low and high socio-economic groups on four factors: mental space, repertoire of specific cognitive schemes, repertoire of executive structures (control strategies), and cognitive style of field-dependence/independence. Through several studies including a brief training experiment, and using different tasks, Case found that lower-class children did not differ from upper-class children in *M*-space or in

the degree of field-dependence/independence; they differed, however, in their repertoire of schemes, both task-related and higher order executive schemes. This implies that they do not differ in their basic information-processing capacity, but in the information they have stored and in the strategies they use for retrieving and processing information. Case also discusses his results in relation with Jensen's model, as do Miller and Pascual-Leone (1981), who also showed that SES groups mainly differ in their repertoire of executive schemes.

(2) Globerson (1983)

This study demonstrates that *M*-capacity, measured with the Compound-Stimulus Visual Information Test (CSVI) of Pascual-Leone (1970), and the Serial-Stimulus Visual Information Test (SSVI) of Parkinson (1975), develops similarly in same-age children (268 subjects of ages 8, 10 and 12 years), regardless of social class background (high vs. low, in Israel). On the other hand, SES differences were evidenced in short-term memory (Digit Placement Test of Case, and Backward and Forward Digit Span of Wechsler), and even more so in spatial abilities and tasks of field-dependence/independence (Rod and Frame Test of Oltman, WISC Block Design and Raven's Progressive Matrices). The effect of age was greatest on the *M*-capacity measures. The paper also mentions a study that found no differences on *M*-capacity in 10- and 12-year-old gifted children, but no data are provided.

In sum, the paper establishes *M*-capacity tests as 'pure developmental measures' in contrast to other tests that confound attentional capacity with learning factors, specific knowledge and cognitive style.

(3) Miller, Pascual-Leone, Campbell and Juckes (in prep.)

This research is carried out with 292 Zulu-speaking children aged 7 to 12 years, in an underprivileged township near Durban (South Africa), and comprises two studies. The first one uses the CSVI, and provides a very impressive fit of the empirical data to the theoretical prediction based on age only, in the same way as data from middle-class Canadian children.

In terms of cross-cultural methodology, the procedures followed have the following advantages: (1) The comparison occurs with an explicitly defined theoretical model, not directly between two samples of different cultural backgrounds. In other words, the scale identity of the comparison standard is theoretically assured, which guarantees a

valid cross-cultural comparison (Poortinga and Malpass 1986). (2) Pre-training insures that all subjects have the same response-repertoire.

At the same time as a distinct advantage, this second feature represents a limitation: the sample is reduced to the subjects who reach the pre-training criterion, in this case only 68% of the initial sample. This raises the question of the representativeness of the results: would the claimed 'universality' also apply to the other 32% of the children that were discarded from the study?

The authors claim to provide a 'culture free or culture fair quantitative measure of developmental intelligence' (p. 23). It would surely be hard to find a more restrictive definition of intelligence than the one equating it directly with *M*-capacity. The latter only sets the limits for a variety of other more complex skills, an adequate sampling of which could possibly be labeled 'intelligence', but for which the study does not demonstrate any universality.

The second study reported in the same paper uses the Figural Intersections Test (FIT), introducing the novelty of four repeated testings. In this case, the 'norm' is taken to be the performance of Canadian children who are tested only once: the Zulu 'underperform' slightly on trial 1, reach criterion on trial 2, and 'overperform' on trials 3 and 4, which shows that the required strategies are acquired during the first testing.

Demetriou (Shayer, Demetriou and Perwez, in press)

This monograph reports a post-hoc combination of three studies, carried out before the advent of neo-Piagetian perspectives, respectively in Pakistan (360 children aged 7 to 11 years in grades 1, 3 and 5), Greece and Australia (60 children per group, aged 6 to 8 years, in grades 1, 2 and 3: Greek, English-speaking native Australians and bilingual Greek immigrant children), and Britain (271 children aged 9 through 13).

Although the monograph provides a wealth of data that should be of value to those interested in psychometrics, particularly in terms of a discussion of scaling techniques, the specifically cross-cultural aspects are rather weak. No cultural analysis is provided that would lead to a prediction of cultural differences linking individual to population-level data. The authors take a distinctly absolutist stance, and expect no qualitative nor quantitative cultural differences. Previous reports of

cultural differences in the literature are attributed to the alleged non-representativeness of the samples. The differences reported in this monograph between Pakistani and British children are also explained by sampling artefacts: the dropping out of school of the lower-ability children, on the one hand, and the fact that high-ability children may be attending fee-paying schools which were not sampled. Under such conditions, the data cannot speak to either universality or quantitative cultural differences.

The fact that the tasks scale in the same way in the different groups tested, on the other hand, confirms the conclusions of most previous cross-cultural Piagetian research, but in this study this is done through a careful construct validation. Unfortunately the links with experiential structuralism are not absolutely clear. The results are supposed to 'justify regarding concrete operational thinking as a unitary construct', which seems in direct contradiction with the 'principle of domain specificity of capacities' (Demetriou and Efklides, this issue, p. 683). Furthermore, if one looks at some of the details of the factor analyses provided, for example in the Pakistani study, inconsistencies provide some doubts about the claimed universality and the model itself. In the analysis for grade 3, for example, some conservation and classification tasks load on the first factor, conservation of mass, seriation and the water-line task load on a second factor, and the other two spatial tasks on a third; a straightforward identification of the quantitative-relational, qualitative-analytic (or logico-verbal, as it is called in the monograph) and imaginal-spatial capacities is clearly difficult with such data.

Halford (Boulton-Lewis, Neill and Halford, in press)

The study provides a very neat adaptation of some of the tasks to suit Australian Aboriginal culture. Case's Short-Term Storage Space (STSS) test, renamed Mr. Peanut, is certainly a good choice because of the well-known skills of Australian Aboriginal children in the spatial domain (see for example Dasen 1974, 1975; Kearns 1976). Tasks dealing with family relationships and with playing cards, other highly valued aspects of Aboriginal culture, as well as Halford's matrix completion task, were used to assess relational and system mappings, among which transitive inferences. A third set of tasks was used to

study basic mathematical concepts, specifically in the area of number and measurement of length. The study was carried out with 75 Australian Aboriginal children, aged 4 to 9 years, living in a community 290 km north of Brisbane.

No cultural differences were found in basic cognitive processes such as short-term memory (STSS) and simple inferences and integration of relations. On the other hand, the influence of the familiarity with task content appears when comparing the matrix task (34% success) with the card-playing and family-relations tasks (64% success). Cultural differences appear also on the number tasks. The Cherboung aboriginal community is fairly acculturated, or 'high contact' in De Lacey's (1970) terms; in particular, dialectical English instead of an aboriginal language is spoken. One could therefore expect even greater differences with 'low-contact' (more traditional) Aborigines, or with older children.

This study is of interest for several reasons. First of all, the two tasks that were specifically devised for the occasion (family relationships and playing cards) demonstrate an important methodological point: on the basis of the structural model, new tasks that embody the relevant processes can be devised in a culturally appropriate way. Secondly, the results show that the school failure these children experience is not due to a lack of capacity in short-term memory or basic inferential reasoning. Ginsburg and Allardice (1984) came up with a similar conclusion concerning African and black American children.

Reserved for further study is the search for the factors that do explain school failure; the authors turn to the learning context in suggesting a lack of using number in the home, a lack of motivation to use mathematics in everyday life, and a lack of precision in maths-related language. It seems that even in a fairly acculturated community, the traditional value orientations that determine child rearing practices remain unchanged for a long time; in his research with more traditional groups of Australian Aborigines, Dasen (1974, 1975) also attributed the slow acquisition of conservation concepts, relative to the spatial domain, to the value placed on spatial skills rather than on quantification.

Conclusion of Part 2

In sum, the studies just reviewed suggest that some basic features of cognition, particularly basic information-processing capacity (*M-capac-*

ity assessed through CSM and SSM, and STSS), and some aspects of system mappings (e.g., transitive inferences) may be universal; at least, no social class and cultural differences were found in these particular studies. These results based on neo-Piagetian theories confirm the conclusion drawn from both the research in experimental anthropology (Cole and Scribner 1974) and in cross-cultural Piagetian psychology (Dasen and Heron 1981), namely that there are no cultural differences in cognitive capacity, nor in the existence of cognitive processes.

There are differences, however, in the way these processes are applied to particular situations, and the studies just reviewed demonstrate some of these differences, although they do not relate them explicitly to the eco-cultural, learning or situational contexts. What is also striking is the small number of differential or cross-cultural studies. The main tenets of the various neo-Piagetian theories have not yet been fully tested in a non-western culture, and the true potential and the advantages these new theories have for differential and cross-cultural psychology have not yet been fully explored. This is why we turn, in the next section, to a more theoretical discussion of this potential.

Part 3: The differential and cross-cultural potential of neo-Piagetian theories

Before assessing the possible contributions of neo-Piagetian models to cross-cultural and differential psychology, some comments are in order on their epistemological history and on the emerging similarities from the standpoints of developmental psychology. It is interesting to observe a resurging interest for structuralist approaches to development, that is particularly striking in all neo-Piagetian models discussed here. As mentioned above and well documented by Case (1985) for instance, the Piagetian claim of general structures encountered a number of obstacles in empirical replications, and as a reaction, there was a period in the 70's where the emphasis was laid on processes and on contextualist approaches, with a strong focus on the exceptions to the general laws of development described by Piaget. Research concentrated on specific task factors, learning, cultural backgrounds and individual differences. The role of context was seen as preponderant. Merging with the empiricist tradition of constructing local models, and

also with the newly elaborated models of information-processing, several authors insisted on the domain-specificity of developmental processes. However, it soon appeared that theories asserting that development is only local in turn encounter problems: they cannot explain why there are nevertheless gross regularities in development, and cross-task parallels. Furthermore, the need was felt to explain an enormous amount of data through more parsimonious and general models.

Thus, by the end of the 70's, a reviscence of structuralist approaches occurred, trying to integrate both structural and functional aspects. Many models, including those discussed in this paper, look for structural invariants accounting for developmental changes, or for commonalities across situations, while insisting on the necessity to take situational variables into account. As a result, most theorists do not necessarily attempt a complete formalisation of structural invariants, that are often of a quantitative nature (e.g., attentional capacity), thus providing an integration of qualitative with quantitative developmental changes. Indeed, neo-Piagetian models attempt to combine a Piagetian qualitative-structuralist framework (the existence of qualitatively different stages) with functional approaches; they draw heavily on Piaget's description of development, while refining it (by describing more stages and substages), but most of them (with the exception of Halford and Demetriou) reject the use of general logical structures such as Piaget's groupings. Some of the theories import contributions from information-processing approaches, such as the concept of attentional capacity (or working memory) and the necessity of task analyses.

As a consequence, all these theories present a strikingly similar picture of development, even though they may use different terminologies and resort to different underlying mechanisms. The similarity is particularly striking between Fischer's, Cases's and Halford's theories, to which could be added Mounoud's model (1979, 1983) that is not discussed in detail here. These models describe development as consisting of major stages reflecting qualitative reorganisations. Each of these major stages is further refined, consisting of a recurrent cycle of levels, defined by quantitative increases (Case) or qualitative changes (Mounoud and Fischer, although in the latter case, these qualitative changes could probably be depicted as quantitative). By looking for structural invariants, all models try to dissociate observable performances from underlying competences, although few explicitly state what would be considered as software and hardware.

Demetriou and Efklides's model is somewhat different in that it focuses on differences rather than similarities across types of situations. Structures are empirically determined through factor analyses and are described as corresponding to 'domains of reality' rather than to developmental structural invariants like in the other models discussed here. Similarly, developmental levels are empirically established (Demetriou and Efklides 1985, 1987), their number varying from domain to domain. As a consequence, although the possibility of general stages is mentioned with respect to the development of an 'overall problem-solving orientation of thought' (e.g., Demetriou and Efklides 1986), universals are not clearly defined. A 'general assembly mechanism' or 'energy generator' is postulated producing ever more complex components, but this complexity is not defined in structural terms.

Even if they postulate different developmental mechanisms, most models have in common the important role played by attentional capacity, i.e., the number of units of information that a subject can process simultaneously. This concept was implicit in Piaget's work, and was referred to as the field of centration, or later the field of equilibration (e.g., Piaget 1923, 1975), but was never empirically studied. For Case, Fischer and Halford, this quantitative mechanism is seen as coexisting with qualitative changes, whereas for Pascual-Leone, it is seen as sufficient to account for the qualitative changes (see also Sternberg, this issue). Indeed, not only does Pascual-Leone, as other neo-Piagetians, reject the general logical structures defined by Piaget, but he considers that the notion of qualitatively different stages is not necessary. Development only consists in an increment of the number of units that can be integrated (*M*-power), seen as sufficient to understand qualitative changes in the structures built by the subjects. For instance, the treatment of 3 to 5 units can only result in what Piaget described as concrete operations, while formal operations necessitate to be able to simultaneously attend to 6 or 7 units (de Ribaupierre 1975; de Ribaupierre and Pascual-Leone 1979). In that sense, Pascual-Leone's model is more parsimonious, since it postulates the same type of developmental change throughout. However, it is also more complex, since it views development as multi- or over-determined by a number of organismic mechanisms, that are anchored both in individuals and in situations and account for the individual and situational variability.

The fit to criteria

In this section, we shall attempt to discuss how the different neo-Piagetian models answer the 6 criteria we have developed. Although there are clear theoretical differences between these criteria, they are nevertheless related, and it is sometimes difficult to discuss them separately. This is particularly true of the first criterion and the second, that are also related to the sixth. Our discussion is summarized in table 1.

(1) *Allowing for both commonality (universality) and cultural and individual differences*

The question to be asked here is whether the neo-Piagetian models acknowledge the existence of individual and/or cultural differences better than the original Piagetian theory, and whether they make clear predictions on which aspects are expected to be universal, and which are subject to cultural differences.

Given the importance all these models attach to functional aspects, they all allow for differences in surface structures. Indeed, even if their objective is to search for the existence of invariance across situations, they do not claim that synchronism in performance will necessarily be observed. The universal aspects reside in the deep structure, and in particular in the increase in quantitative resources. Fisher even claims that unevenness in development is the rule (Fischer et al. 1984) and that synchronism can only be observed in special cases (Fischer and Silvern 1985). For Fischer, invariance can be found only if optimal conditions of environmental support pertain (Fischer and Pipp 1984; Lamborn and Fischer, in press), and for Pascual-Leone it is to be found only in specially constructed tasks where most variables are controlled.

The characteristic of all the models is to acknowledge situational variability, more than individual or cultural differences. This leads to often elaborate task analyses, that tend to focus on task complexity, and to predict the subjects' performances given their attentional capacity: the situations are classified according to their structure and to the demands they place on the subjects' capacity. If each model also acknowledges the importance of individual variability, it is often attributed, implicitly, to situational and environmental variables: subjects are seen as differing by the amount and quality of previous experience

Table 1
Fit of neo-Piagetian theories to six requirements of cross-cultural and differential psychology.

Criteria	Theories				
	Pascual-Leone	Case	Fischer	Halford	Demetriou
1. Predict both commonality and differences					
1a. Hypothesized <i>M</i> -operator universal at given age		STSS, Structural level	Optimal level, Macrodevelopmental changes	Basic capacity, Structure-mapping	General assembly mechanism
1b. Loci of cultural and individual differences	Schemes	Structural sequences (executive structures)	Functional level, Microdevelopmental changes	Performance level	Capacity spheres
1c. Hypothesized sources of differences	Weight of silent operators, Environment	Exploration, Imitation, Mutual regulation, Instruction	Socialization, Motivation and emotions	Maturation	Capacity, person-environment specificity
1d. Deals more explicitly with	Individual differences	Cultural differences	Individual and cultural differences	Cultural differences	Individual differences
2. Deep and surface structures	Observable behaviour, Schemes, Silent operators	Task content, Domain, Across-domain	Functional level, Optimal level	Observable behaviour, Structural level	Observable behaviour, Capacity
3. Importance of learning context	Mentioned	Stressed role of social processes	Stressed	Mentioned	Mentioned
4. Link with population level	-	-	-	-	-
5. Nesting of contexts	Task-analysis	Culturally appropriate domains	Attention to culturally appropriate tasks	Familiarity, Construction of culturally appropriate tasks	-

Table 1 (continued)

	Theories				
	Pascual-Leone	Case	Fischer	Halford	Demetriou
6. Underlying specific processes responsible for individual differences					
6a. Organismic constructs	Yes	No	No	No	No
6b. Interaction individual/situation explicitly mentioned	Yes	No	Collaboration child-environment	No	No

or learning. Individual variables, except for non-specific motivational variables, are confounded with environmental variables, by lack of mediating organismic individual constructs (cf. criterion 6).

Pascual-Leone's model differentiates, at the organismic level, between universal and differential constructs: the *M*-operator is seen as universal for all subjects of a given age. By contrast, the other operators are at the origin of individual differences; although present in each individual, their force of activation may differ from subject to subject (c.g., Pascual-Leone 1980, 1984; Pascual-Leone et al. 1978; Pascual-Leone and Goodman 1979). Further, they could be differentially reinforced by environmental variables, although Pascual-Leone is not explicit on this point. Thus, development is seen as multi- or over-determined through the interplay of these different operators and of the environment; it can take different forms, since different schemes (which are still at the deep level) can be constructed by different subjects, or the same schemes can be constructed through the interplay of different underlying mechanisms. This model thus predicts an active interaction between types of individuals and types of situations (our 6th criterion). Indeed, the so-called 'silent operators' are conceptualised as anchored both in individuals and in situations, providing for interactions between subjects and situations (Pascual-Leone 1969). The objective of

task analysis is then not only to analyse the task complexity, but also to classify the types of context according to which operators are called into action. However, these task analyses place more emphasis on the interplay of the different mechanisms, or underlying processes (whether they elicit compatible or incompatible groups of schemes), and do not focus on the contents as such. They therefore remain general, and, for the moment at least, are not fine enough to predict precise types of differences according to the context.

Case's theory (1985; Case et al. 1986) seems potentially able to integrate individual and cultural differences, for instance in assuming the possibility of different structural sequences between domains (e.g., Case 1987) or even within a domain, that may be socially and/or physically facilitated; however, most of his work to date has been devoted to demonstrating that, on the average, a given level constitutes a universal, reached at approximately the same age in different domains. When mentioned, individual differences, both in terms of inter- and intra-individual variability (e.g., Case 1985; Case et al. 1986), are attributed, in a rather non-specific manner, to previous experience (learning, imitation, mutual regulation).

In many theoretical and review papers, Fischer addresses the issues of individual and cultural differences. Also, in all of Fischer's work, when average ages are given, they are always referred to 'middle-class children in Western cultures', which leaves scope for cultural differences. Fischer and Bullock (1984) address specifically the question of the relativity and/or universality of developmental sequences. It is argued that the two are not opposed, that it is a question of scale: 'For large-scale (macrodevelopmental) changes, there seem to be some universals, but for small-scale (microdevelopmental) changes, individual differences appear to be the norm' (1984: 73).

The following quote from Fischer and Silvern will further demonstrate how the authors have integrated the findings of cross-cultural cognitive psychology into their model:

'The sequence of stages is therefore neither a characteristic of the entire human mind unaffected by context, as structuralists would have it, nor the product of context-bound performance on particular tasks, as functionalists would have it. Instead, the sequence reflects the development of certain intellectual functions under a limited class of environmental conditions. The specific tasks mastered are not universal. Individual and cultural differences occur routinely in the specifics of sequences. Predicting which tasks will reflect the universal stages for given cultures or individuals requires intimate knowledge of both the contexts

familiar to those people and the goals they are pursuing (Cole et al. 1982). *The sequence holds only when performance and assessment conditions are described in highly abstract terms, not when particular behaviors, tasks, or procedures are specified.* (Fischer and Silvern 1985: 632)

Halford does not grant a particular status to individual differences, although he acknowledges their existence; they essentially seem related to differences in maturation, or, in other terms, to variations around a universal norm. Cultural differences, as mentioned in the study reviewed above, play a role important enough that tasks have to be adapted.

Finally, Demetriou and Efklides' experiential structuralism describes, on the basis of factor analysis, domain-specific capacities rather than a single integrated competence, as was already mentioned. Through the methodology on which it is based, it necessarily deals with individual differences; further, the model potentially should allow to predict cultural differences, particularly according to which domain is more or less valued in particular cultures.

The first three capacities that are distinguished, quantitative-relational, qualitative-analytic and imaginal-spatial seem to correspond more or less to the three domains defined by Piaget as conservation, logico-mathematical reasoning and spatial concepts. Dasen (1984) provided construct validation data relative to these three domains for 8-9-year-old Baoulé children (Côte d'Ivoire). Lautrey et al. (1986, in press) also found the same group factors.

On the basis of the eco-cultural model (Berry 1976; Dasen 1975), one might expect, in terms of Demetriou and Efklides' theory, that the quantitative-relational domain would be particularly valued in sedentary-agricultural populations, while the imaginal-spatial domain would be valued in nomadic hunting-and-gathering groups; cultural differences in cognitive development can be expected accordingly. No specific cultural difference would be predicted by the eco-cultural model on qualitative-analytic capacities.

The other three capacities, in the theory, are the causal-experimental, the verbal-propositional, and the metacognitive-reflecting, in all of which one might expect important cultural differences to occur.

Thus, for all these authors, differences obviously exist, at least at a surface level, whereas universals can only be defined at the deep level. In this respect, the neo-Piagetian models come close to the *universalist* position advocated in cross-cultural psychology. The potential clearly exists in these theories to take cultural differences into account; how-

ever, this is usually not yet done in practice, as we have seen in the review of the empirical literature. In fact, variation sometimes still seems to be seen as a disturbing factor, or as mere modulations of an underlying universal, but not as the source of an interesting research paradigm. No attempt has been made so far to link differences to the eco-cultural context and the cross-cultural studies that do exist are all geared to demonstrating universality.

(2) *The distinction between deep and surface phenomena*

By definition, a structuralist approach searches for invariants across types of situations and/or types of subjects, which necessarily requires to go beyond the subjects' performances, and look for deep structures. Thus a distinction between at least two levels is necessary, and all the models mentioned here introduce such a distinction, although they differ in the explicitness with which they do so. The novelty of the neo-structuralist models, as has been noted previously, is to try to combine structural and functional aspects, that is, to try to understand how structural invariants may be modulated by contextual and/or (although less frequently) individual variables. As a consequence, all models assert the importance of these modulations, and achieve a clearer distinction between deep and surface structures than Piaget's theory. Most of them reject Piaget's logical formalisation of deep structures, and one common structural invariant that emerges across the models is in terms of a quantitative increase in the resources, whether it represents a real augmentation as in Pascual-Leone and Halford, or an optimisation of existing resources as in Case.

The authors who most explicitly introduce a distinction between deep and surface phenomena, and give guidelines for making valid inferences about the deep structures, are Fischer and Pascual-Leone. Fischer (e.g., Fischer and Pipp 1984; Lamborn and Fischer in press) distinguishes between a functional level, defined as an upper natural limit of spontaneous performance for a particular child in a particular culture, and an optimal level, defined as an upper limit on the structural complexity of skills that can be evidenced in a particularly well controlled situation. The functional level can thus be understood as the level of the observable performances, that is, as an actualisation of an underlying deep structure that occurs only under special conditions. It is not always clear whether the optimal level represents a structural underlying construct, determining the subjects' performance, or an

can also exist at a deep level: the relative ease of moving the functional level up toward the optimal level, the existence of different developmental sequences linked to a specific deficit, the role of emotions, and the influence of psychopathology.

Pascual-Leone's model defines not only two levels, such as performance-competence, but three, each of which is susceptible of individual and cultural differences. In addition to the observable performance level, Pascual-Leone posits two levels within the subject: the underlying schemes or structures constructed by the subject (software), and the silent or hidden operators which represent truly organismic constructs (hardware). These operators are seen as operating on the schemes which constitute mental objects, by modifying their activation weight (e.g., Pascual-Leone 1984; de Ribaupierre 1983).

The differences between surface and deep levels exist in the other models too, but are possibly less extensively discussed as different levels within the subject. Case presents several levels of analysis (from the most specific to the most general structure), which to us, are to be distinguished from various levels of psychological mechanisms within the subject; he also differentiates several types of processes, such as those activating and controlling schemes, and those imposing limits on the complexity of schematic coordination. In Demetriou and Efklides' model, it is at times difficult to see a clear difference between surface and deep levels, since tasks contents are not systematically differentiated from the subject's psychological processes, e.g., 'cognitive performance is a direct reflection of the structural organization of the persons' experience, their mind and possibly their brain' (this issue, p. 681).

(3) *Specification of the learning context*

Each author acknowledges to some extent the role of socialisation practices; for instance, Case (e.g., 1985) assigns a great importance to processes of mutual regulation and instruction, acknowledging explicitly the socio-historical tradition of Vygotsky, Bruner and Cole. Lamborn and Fischer (in press) also refer to Vygotsky's zone of proximal development (although distinguishing it from their concept of developmental range). Case (1985) shows how entire groups of structures that appear to be acquired through independent problem solving and exploration at one stage, often depend on basic operations that are acquired via social processes at the previous stage. A concrete example

observable variable that can only show under special conditions. Indeed, Fischer stipulates that, for the optimal level to 'show', it is necessary to meet different organismic and environmental conditions, such as adequate emotional and motivational states, familiarity with content, opportunity to practice the skill, and most importantly, high environmental support.

Lamborn and Fischer (in press) propose to characterize individuals not as being at a single stage or point on a developmental scale, but as being within a 'developmental range', defined in terms of optimal and functional levels. Under high environmental support conditions, children show optimal levels of performance, and across familiar situations (i.e., culturally appropriate tasks), those optimal levels appear to show the same upper limit; the domains where children ordinarily demonstrate those levels will vary strongly across cultures. Under low-support conditions, children show functional levels of performance that are much lower, and that seem to vary widely both across cultures and across situations within cultures.

According to Lamborn and Fischer (in press), the concept of developmental range leads to specific hypotheses about where to look for both differences and commonalities in cognitive development across cultures. Briefly summarized, these are the following:

- (a) Children in all cultures will develop through the same series of optimal levels, but the domains where they ordinarily demonstrate those levels will vary (implying the use of culturally appropriate tasks).
- (b) Functional levels for particular domains will vary widely both within and across cultures. Indeed, cultures probably induce not only differences in level but even differences in the specific steps in developmental sequences (Fischer and Bullock 1984).
- (c) The nature and size of the developmental range will vary across cultures, since cultures will use different techniques for socializing functional levels in various domains (cf. our criterion 3).

It is not always clear, in Fischer's writings, whether individual differences are situated at the surface level only or also at the deep level; Fischer (personal communication, 1987) has specified four models of particular types of individual differences, which show that they

is counting (Case 1985, 1986; Case and Sandieson 1987), that can be considered as a 'cultural tool', that is first culturally transmitted, and then internally reconstructed and used as a vehicle for independent thought.

Fischer (e.g., Fischer and Canfield 1986) is constantly stressing the importance of context. Fischer and Bullock, for example, conclude: 'The central unresolved issue in the study of cognitive development today seems to be the manner in which child and environment collaborate in development. (...) An analysis of the collaboration of child and environment in development is just as unlikely to arise from a functionalist emphasis on the environment as from a structuralist emphasis on the child' (1984: 84). Therefore, research has to 'explicitly deal with both child and environment' (ibid.: 86). Here we have a clear analogy with the 'developmental niche' of Super and Harkness (1986) or 'action theory' (Eckensberger 1979).

(4) *Establishing links to population-level data*

This requirement is specific to a cross-cultural approach, and as was seen in Part 2, little empirical research has been carried out so far. With the exception of a few studies dealing with social class, population-level data have not yet been used widely. It is our contention that the true integration of the functionalist and the structuralist approaches in neo-Piagetian models will only be complete when these theories will have managed to break out of the laboratory, to encompass more than experimentally contrived situations (see Siegler, this issue), and to reach beyond the limited confines of a single discipline.

(5) *Nesting the assessment context into a culturally valid situational context*

Each of the authors shows some methodological concern for the validity of the assessment context; at the very least, the subject has to be familiar with the type of questions asked, and often a training sequence is incorporated to ensure that the required component behaviours are part of the subject's repertoire. Pascual-Leone et al. (1978; de Ribauipierre and Pascual-Leone 1979) mention an 'ecological' moment in task analysis, that is the necessity to insure that the schemes required to solve the task, according to the theoretical analysis, are likely to be contained in the subject's repertoire. In most of Pascual-Leone's empirical papers, however, the appropriate nesting of

the assessment context is assumed and not explicitly demonstrated, a lack of concern that is likely to produce problems if the research is extended to subjects of other cultures.

Case's research program illustrates a distinct advantage that can be found in all of the neo-Piagetian theories. While Piaget's theory was heavily dependent on western mathematics and logic, any domain of competence can be modeled with the neo-structural systems, including – in principle – domains particularly valued in different cultures. Case and his team, for example, have been working on art, recreational motor activities, and story telling; a study of this last domain in a society with an oral tradition would be particularly interesting.

Fischer and Silvern remark that only a 'few studies have used tasks appropriate to nonindustrial cultures' (1985: 628), and refer to a few studies with an emic approach, such as Gladwin's (1970) study of navigation in Micronesia, as commendable exceptions. They describe the non-universality of major stages as a methodological artefact: 'People develop through something like Piaget's sequence of four universal stages so long as the assessments of their development use culturally appropriate, familiar tasks (Greenfield 1976; Dasen 1977; Super 1980, Cole et al. 1982).' (Fischer and Silvern 1985: 632.)

Demetriou and Efklides' sixth capacity includes several component abilities, among which acquaintance estimators that answer the question: 'Have I previously encountered this or a similar task?' This provision allows for precise content and task analyses, that will allow the theory to insure the nesting of the assessment context into a culturally valid situational context.

The research with Australian Aboriginal children by Boulton-Lewis et al. (1987), reviewed above, is a good illustration on how new, culturally appropriate, tasks can be constructed, instead of adapting or simply translating the task used in the western context in which the theory was initially elaborated.

In addition of producing tasks to suit a particular cultural context, neo-Piagetian models show how naturally occurring events (observed in everyday settings) could be subjected to a task analysis. Siegler (this issue) shows great concern not only about using tasks that are familiar to the subjects but especially in studying the development of knowledge and skills in familiar, everyday contexts. Siegler's approach is close to a field of study called 'everyday cognition' (Rogoff and Lave 1984), that has emerged recently as a very promising one, owes a great deal to the

cross-cultural work by M. Cole and his team, and is situated at the cross-roads of cognitive psychology, anthropology and education (Dasen 1987).

(6) *Linking variability to underlying psychological processes*

This requirement stems from our conception of what the links between differential and structural approaches should be, and is, again, programmatic of a necessary future orientation. As we have said previously, while all the models acknowledge variability, none, except Pascual-Leone's, goes very far in linking it empirically with explicitly defined underlying psychological processes, i.e., organismic sources of individual differences, or individual differences in the deep structures. Case, Fischer, Halford and Demetrio acknowledge the existence of individual differences, however they do not describe any organismic construct specifically responsible for such individual variability; therefore individual differences could be considered as tucked onto the models instead of truly built into them. Halford (e.g., this issue) ascribes individual differences in the age of attainment of a given structure mapping to 'variations in capacity', which is itself linked to maturation. Fischer mentions the possibility of different developmental paths (e.g., Fischer and Bullock 1984; Fischer and Silvern 1985), but one has the impression that these differences are more at the surface level (when skills are specific) than at a deep level.

Our sixth criterion implies that the theory establishes a very clear distinction between processes and task contents; the anchoring of organismic processes in the situations also has to be clearly spelled out, so as to be able to define interactions between types of subjects and types of situations. Pascual-Leone's theoretical analyses of field-dependence-independence (1969, 1974) can serve as an example. Two types of analyses are conducted simultaneously: (1) on subjects, hypothesizing which silent operators are most likely to differentiate between field-dependent and field-independent subjects (for instance field-dependent subjects seem to present a particularly strong *F*-operator); (2) on tasks, through task-analyses, in order to assess which operators are likely to be triggered by the situation, and in particular to determine which operators will lead to a correct solution versus an incorrect solution (for instance the *M*-operator together with executive schemes will contribute to a correct solution, while the *F*-operator will contribute to an erroneous response); this is what Pascual-Leone refers

to as the 'processual formula' of the tasks. Then, different predictions can be made with respect to the performance of different types of subjects on a range of tasks, given a same developmental level. In this manner, Pascual-Leone (1969) was able to predict the factorial clustering of Piagetian tasks given the fact that some of them, but not all, presented the same processual formula as FDI tasks.

Conclusion

What has been gained, in relation to our criteria, from the neo-Piagetian models discussed in this paper, compared to the classical Piagetian perspective, and compared to what was already known from cross-cultural cognitive psychology?

The existing empirical differential and cross-cultural literature inspired by neo-Piagetian theories is not yet very impressive. Basically, the studies demonstrate the universality of information-processing capacity or *M*-space if it is assessed through culturally appropriate means (i.e., given adequate pre-training to establish the repertoire, not assuming number knowledge in unschooled populations, etc.). This is an interesting finding that seems to confirm the analysis of the cross-cultural research on memory by Wagner (1981), namely that the structural properties of memory (short-term memory, recency-effect, forgetting) are universal, while the control mechanisms (rehearsal, clustering, etc.) are culturally influenced.

A second interesting finding, that is also in line with previous cross-cultural cognitive research (e.g., Cole and Scribner 1974; Saxe and Moylan 1982), is the universality of some basic cognitive processes, such as the possibility to reason according to transitive inferences if this is assessed with culturally relevant tasks.

The studies reviewed confirm social-class and cultural differences on other types of tasks involving previous learning, whether these be called 'executive structures' or not. This will come as a surprise to no-one, but unfortunately little can be done with these findings, since the research was not designed to link any of these differences to the learning or eco-cultural contexts. The cultural characteristics of the samples are not described in detail, no prior hypothesis is developed concerning cultural differences, and the samples were not selected to test such a hypothesis.

From a general developmental point of view, these models have the merit to produce a finer picture of development; by suggesting recurring cycles through stages, or like Pascual-Leone, by analysing intermediate behaviours and different ways to solve a same problem, the models can account for some anomalies better than the Piagetian theory. While neo-Piagetians integrate structural and functional aspects, they are looking, after a period of strong contextualism, for invariants across situations and individuals.

None of the theories presently fulfills all the criteria we suggested for what ought to constitute a complete model, able to take both cultural and individual differences into account, and linking them to the eco-cultural context. However all of the neo-piagetian theories have the potential to comply to the six criteria outlined in this paper.

In this respect, the neo-Piagetian models discussed here have distinct advantages that we have pointed out in the course of our discussion.¹ We could summarize the main points as follows:

- (1) The structural invariants that are defined are independent of western logic.
- (2) Models can be applied to various domains, choosing culturally valued ones; this includes social cognition, moral development and emotions.
- (3) Therefore new, culturally appropriate tasks can be devised, or spontaneous behaviour can be observed in naturalistic settings.
- (4) The models link structural and functional aspects, and introduce a clearer distinction between deep and surface phenomena.
- (5) There is a convergence between the socio-historical school and genetic epistemology; social factors are acknowledged in the process of stage transition.
- (6) They allow for domain specificity.

Not all of the theories take equal advantage of these points, but none of them could be pointed out as a clear winner if they were to enter a race (Sternberg, this issue). It seems also unlikely to us that a broader meta-theory will emerge in the near future that would combine the advantages of each. As in other areas, diversity has its value.

¹ We wish to acknowledge in particular the contribution of R. Case to this discussion.

None of the neo-Piagetian models has as yet gone through a complete replication in a non-western culture or in different types of subjects. Developmental psychologists may find it interesting to consider the differential and the cross-cultural methodology as one of the ways to move out of the restricted confines of the laboratory (Dasen and Jahoda 1986), to insure that what they are studying is indeed Human behaviour, i.e., behaviour of Mankind and not only that of a restricted social and cultural group. The theories discussed in this special issue clearly have the potential to do just that.

Cross-cultural psychology in its 'theory-testing' role has an important contribution to make; however, it regularly lags behind mainstream 'laboratory' psychology by some years. In the case of neo-Piagetian theories, this lag may have been increased by the jargon and technicalities of the models, and the difficulty of choosing among them. However, collaborative teams of researchers, comprising at least a specialist in cross-cultural methodology, and preferably a researcher originating in the society to be studied, would be well advised to dig into one of these neo-Piagetian theories, and take it to the field for a complete replication.

References

- Berry, J.W., 1969. On cross-cultural comparability. *International Journal of Psychology* 4, 119-128.
- Berry, J.W., 1976. Human ecology and cognitive style. New York: Sage/Halstead/Wiley.
- Berry, J.W., 1980. 'Ecological analyses for cross-cultural psychology'. In: N. Warren (ed.), *Studies in cross-cultural psychology*, Vol. 2. London: Academic Press. pp. 214-230.
- Berry, J.W., 1984. Towards a universal psychology of cognitive competence. *International Journal of Psychology* 19, 335-361.
- Berry, J.W. and P.R. Dasen, 1974. *Culture and cognition: readings in cross-cultural psychology*. London: Methuen.
- Berry, J.W. and S.H. Irvine, 1986. 'Bricolage: savages do it daily'. In: R.J. Sternberg and R.K. Wagner (eds.), *Practical intelligence: origins of competence in the everyday world*. New York: Cambridge Univ. Press. pp. 271-306.
- Berry, J.W., P.R. Dasen and N. Sartorius, 1988. 'Conclusions'. In: P.R. Dasen, J.W. Berry and N. Sartorius (eds.), *Cross-cultural psychology and health: towards applications*. Newbury Park, CA: Sage.
- Boesch, E.E., 1976. *Psychopathologie des Alltags*. Bern: H. Huber.
- Boulton-Lewis, G.M., H. Neill and G.S. Halford, 1987. Capacity of Aboriginal children in southeast Queensland to process information and potential to learn mathematics. *The Journal of Mathematical Behaviour*.

- Case, R., 1975. Social class differences in intellectual development: a neo-Piagetian investigation. *Canadian Journal of Behavioral Science* 7, 244-261.
- Case, R., 1985. Intellectual development: birth to adulthood. New York: Academic Press.
- Case, R., 1986. 'The new stage theories in intellectual development: why we need them; what they assert'. In: M. Perlmutter (ed.), *Perspectives for intellectual development*. Minnesota symposium on child development, Vol. 19. Hillsdale, NJ: Erlbaum, pp. 57-93.
- Case, R., 1987. *Developmental theory and measurement*. Paper presented to the 9th advanced course of the Jean Piaget Archives Foundation, Geneva, Sept. 21-25, 1987.
- Case, R. and R. Sandieson, 1987. A developmental approach to the identification and teaching of central conceptual structures in middle school mathematics and science. Toronto: OISE, Centre for Applied Cognitive Science, manuscript.
- Case, R., Z. Marin, A. McKeough, S. Dennis and J. Goldberg, 1986. 'Horizontal structure in middle childhood: cross-domain parallels in the course of cognitive growth'. In: I. Levin (ed.), *Stage and structure. Reopening the debate*. Norwood, NJ: Ablex, pp. 1-39.
- Cole, M. and S. Scribner, 1974. *Culture and thought: a psychological introduction*. New York: Wiley.
- Cole, M. and S. Scribner, 1977. 'Developmental theories applied to cross-cultural cognitive research'. In: L.L. Adler (ed.), *Issues in cross-cultural research*. Annals of the New York Academy of Sciences 285, 366-373.
- Cole, M., L. Hood and R. McDermott, 1982. 'Ecological niche picking: ecological invalidity as an axiom of experimental cognitive psychology'. In: U. Neisser (ed.), *Memory observed*. San Francisco, CA: W.H. Freeman.
- Cole, M., J. Gay, J.A. Glick and D.W. Sharp, 1971. *The cultural context of learning and thinking: an exploration in experimental anthropology*. New York: Basic Books.
- Cronbach, L., 1957. *The two disciplines of scientific psychology*. *American Psychologist* 12, 671-684.
- Dasen, P.R., 1974. 'The influence of ecology, culture and European contact on cognitive development in Australian Aborigines'. In: J.W. Berry and P.R. Dasen (eds.), *Culture and cognition*. London: Methuen, pp. 381-408.
- Dasen, P.R., 1975. *Concrete operational development in three cultures*. *Journal of Cross-Cultural Psychology* 6, 156-172.
- Dasen, P. (ed.), 1977. *Piagetian psychology: cross-cultural contributions*. New York: Gardner (Holted/Wiley).
- Dasen, P.R., 1980a. *Différences individuelles et différences culturelles*. *Bulletin de Psychologie* 33, 675-683.
- Dasen, P.R., 1980b. *Psychological differentiation and operational development: a cross-cultural link*. *Quarterly Newsletter of the Laboratory of Comparative Human Cognition* 2, 81-86.
- Dasen, P.R., 1983a. 'Apports de la psychologie à la compréhension interethnique'. In: G. Baer and P. Centlivres (eds.), *L'ethnologie dans le dialogue interdisciplinaire*. Fribourg: Editions universitaires, pp. 47-66.
- Dasen, P.R., 1983b. *Aspects fonctionnels du développement opératoire: les recherches interculturelles*. *Archives de Psychologie* 51, 57-60.
- Dasen, P.R., 1984. *The cross-cultural study of intelligence: Piaget and the Baoulé*. *International Journal of Psychology* 19, 407-434.
- Dasen, P.R., 1987. *Savoirs quotidiens et éducation informelle*. Document de travail DPSE, Université de Genève, no. 22.
- Dasen, P.R., sous presse. *Les activités quotidiennes d'enfants africains dans leur contexte naturel: la méthode des observations ponctuelles*. *Enfance*.
- Dasen, P.R. and A. Heron, 1981. 'Cross-cultural tests of Piaget's theory'. In: H.C. Triandis and A. Heron (eds.), *Handbook of cross-cultural psychology*. Vol. 4: *Developmental psychology*. Boston, MA: Allyn & Bacon, pp. 295-342.

- Dasen, P.R. and G. Jahoda (eds.), 1986. *Cross-cultural human development*. Special issue. *International Journal of Behavioural Development* 9(4).
- Dasen, P.R., J.W. Berry and H.A. Witkin, 1979a. 'The use of developmental theories cross-culturally'. In: L. Eickensberger, Y. Poortinga and W. Lonner (eds.), *Cross-cultural contributions to psychology*. Lisse: Swets & Zeitlinger, pp. 69-82.
- Dasen, P.R., L. Ngnri and M. Lavalée, 1979b. 'Cross-cultural training studies of concrete operations'. In: L. Eickensberger, Y. Poortinga and W. Lonner (eds.), *Cross-cultural contributions to psychology*. Lisse: Swets & Zeitlinger, pp. 94-104.
- Dasen, P.R., B. Inhelder, M. Lavalée et J. Retschitzki, 1978. *Naissance de l'intelligence chez l'enfant baoulé de Côte d'Ivoire*. Berne: H. Huber.
- Dasen, P.R., B. Dembele, K. Ettien, K. Kabran, D. Kamagate, D.A. Koffi et A. N'Gouessan, 1985. *N'goulé, l'intelligence chez les Baoulé*. *Archives de Psychologie* 53, 293-324.
- David, M.F., 1983. 'Some implications of the emergence of regional psychologies for a Piagetian approach to the development of cognition'. In: J.B. Derogowski, S. Dziurawiec and R.C. Annis (eds.), *Explications in cross-cultural psychology*. Lisse: Swets & Zeitlinger, pp. 129-143.
- De Lacey, P.R., 1970. *An index of contact for Aboriginal communities*. *Australian Journal of Social Issues* 5, 219-223.
- Demetriou, A. and A. Efklides, 1985. *Structure and sequence of formal and postformal thought: general patterns and individual differences*. *Child Development* 56, 1062-1091.
- Demetriou, A. and A. Efklides, 1986. *Dynamic patterns of intra- and inter-individual change in the acquisition of complex thinking abilities from 10 to 17 years of age: a longitudinal study*. Paper presented at the AERA Annual Meeting, San Francisco, CA.
- Demetriou, A. and A. Efklides, 1987. 'Towards a determination of the dimensions and domains of individual differences in cognitive development'. In: E. De Corte, H. Lodewijks, R. Parmentier and P. Span (eds.), *Learning and instruction*. London: Pergamon Press/Leuven University Press, pp. 41-52.
- Eickensberger, L.H., 1979. 'A methodological evaluation of psychological theories from a cross-cultural perspective'. In: L.H. Eickensberger, W.J. Lonner and Y.H. Poortinga (eds.), *Cross-cultural contributions to psychology*. Lisse: Swets & Zeitlinger, pp. 255-275.
- Fischer, K.W. and D. Bullock, 1984. 'Cognitive development in school-age children: conclusions and new directions'. In: W.A. Collins (ed.), *Development during middle childhood: the years from six to twelve*. Washington, DC: National Academy of Sciences Press, pp. 70-146.
- Fischer, K.W. and R.L. Canfield, 1986. 'The ambiguity of stage and structure in behavior: person and environment in the development of psychological structures'. In: I. Levin (ed.), *Stage and structure: reopening the debate*. Norwood, NJ: Ablex, pp. 246-267.
- Fischer, K.W. and S.L. Pipp, 1984. 'Processes of cognitive development: optimal level and skill acquisition'. In: R.J. Sternberg (ed.), *Mechanisms of cognitive development*. New York: WH Freeman, pp. 45-80.
- Fischer, K.W. and L. Silvern, 1985. *Stages and individual differences in cognitive development*. *Annual Review of Psychology* 36, 613-648.
- Fischer, K.W., S.L. Pipp and D. Bullock, 1984. 'Detecting developmental discontinuities. Methods and measurement'. In: R.N. Emde and R.J. Harmon (eds.), *Continuities and discontinuities in development*. New York: Plenum, pp. 95-121.
- Ginsburg, H.P. and B.S. Allardice, 1984. 'Children's difficulties with school mathematics'. In: B. Rogoff and J. Lave (eds.), *Everyday cognition: its development in social context*. Cambridge, MA: Harvard University Press, pp. 194-219.
- Gladwin, T., 1970. *East is a big bird. Navigation and logic on Puluwat atoll*. Cambridge, MA: Harvard University Press.
- Globerson, T., 1983. *Mental capacity and cognitive functioning: developmental and social class differences*. *Developmental Psychology* 19, 225-230.

- Greenfield, P.M., 1976. 'Cross-cultural research and Piagetian theory: paradox and progress'. in: K.F. Riegel and J.A. Meacham (eds.), *The developing individual in a changing world*, Vol. 1. The Hague: Mouton, pp. 322-333.
- Gustaffson, J.E., 1984. A unifying model for the structure of intellectual abilities. *Intelligence* 8, 179-203.
- Harris, P. and P. Heelas, 1979. Cognitive processes and collective representations. *Archives Européennes de Sociologie* 20, 211-241.
- Humphreys, L.G., S.A. Rich and T.C. Davey, 1985. A Piagetian test of general intelligence. *Developmental Psychology* 21, 872-877.
- Huteau, M., 1980. Dépendance-indépendance à l'égard du champ et développement de la pensée opératoire. *Archives de Psychologie* 184, 1-40.
- Huteau, M., 1987. Style cognitif et personnalité. La dépendance-indépendance à l'égard du champ. Presses Universitaires de Lille.
- Kearns, J., 1976. 'Skills of desert Aboriginal children'. In: G.E. Kearney and D.W. McElwain (eds.), *Aboriginal cognition: retrospect and prospect*. Canberra: Australian Institute of Aboriginal Studies, pp. 199-212.
- Lamborn, S.D. and K.W. Fischer, in press. Optimal and functional levels in cognitive development: the individual's developmental range. *Newsletter of the ISSBD*.
- Lautrey, J., 1980. Classe sociale, milieu familial, intelligence. Paris: Presses Universitaires de France.
- Lautrey, J., A. de Ribautpierre et L. Rieben, 1981. Le développement opératoire peut-il prendre des formes différentes chez des enfants différents? *Journal de Psychologie Normale et Pathologique* 4, 422-443.
- Lautrey, J., A. de Ribautpierre et L. Rieben, 1986. Les différences dans la forme du développement cognitif évalué avec des épreuves piagetiennes: une application de l'analyse des correspondances. *Cahiers de Psychologie Cognitive* 6, 575-613.
- Lautrey, J., A. de Ribautpierre et L. Rieben, in press. L'intégration des aspects génétiques et différentiels du développement cognitif. In: M. Reuchlin (éd.), *Les différences individuelles dans le développement cognitif*. Nancy: Presses Universitaires de Nancy.
- LCHC, 1979. What's cultural about cross-cultural cognitive psychology? *Annual Review of Psychology* 30, 145-172.
- LCHC, 1983. 'Culture and cognitive development'. In: W. Kessen (ed.), *Handbook of child psychology*. Vol. 1: History and methods. New York: Wiley, pp. 295-356.
- Longeot, F., 1969. *Psychologie différentielle et théorie opératoire de l'intelligence*. Paris: Dunod.
- Longeot, F., 1978. Les stades opératoires de Piaget et les facteurs de l'intelligence. Grenoble: Presses Universitaires de Grenoble.
- Maipass, R.S. and Y.H. Poortinga, 1986. 'Strategies for design and analysis'. In: W.J. Lonner and J.W. Berry (eds.), *Field methods in cross-cultural research*. Newbury Park, CA: Sage, pp. 47-84.
- Miller, M.S. and J. Pascual-Leone, 1981. Disconfirming Jensen experimentally: intellectual versus executive-structural deficiency in underperforming low SES children. Paper presented at the Society for Research in Child Development, Boston, MA.
- Miller, R., J. Pascual-Leone, C. Campbell and T. Jukes, in prep. Learning and development: A neo-Piagetian cross-cultural analysis. Durban: University of Natal.
- Mounoud, P., 1979. Développement cognitif: construction de structures nouvelles ou construction d'organisations internes. *Bulletin de Psychologie* 343, 107-118.
- Mounoud, P., 1983. L'évolution des conduites de préhension comme illustration d'un modèle du développement. In: S. de Schonen (éd.), *Le développement dans la première année*. Paris: Presses Universitaires de France.
- Parkinson, G.M., 1975. The limits of learning: a quantitative investigation of intelligence. Unpublished doctoral dissertation, York University.
- Pascual-Leone, J., 1969. Cognitive development and cognitive style: a general psychological integration. Unpublished doctoral dissertation, University of Geneva.
- Pascual-Leone, J., 1970. A mathematical model for the transition rule in Piaget's developmental stages. *Acta Psychologica* 32, 301-345.
- Pascual-Leone, J., 1974. A neo-Piagetian process-structural model of Witkin's psychological differentiation. Paper presented at the 2nd conference of the International Association for Cross-Cultural Psychology, Kingston.
- Pascual-Leone, J., 1980. 'Constructive problems for constructive theories: the current relevance of Piaget's work and a critique of information-processing simulation psychology'. In: R. Kluge and H. Spada, *Developmental models of thinking*. New York: Academic Press, pp. 263-296.
- Pascual-Leone, J., 1984. 'Attention, dialectic and mental effort: toward an organismic theory of life stages'. In: M.L. Commons, F.A. Richards and C. Armon (eds.), *Beyond formal operations*. New York: Praeger, pp. 182-215.
- Pascual-Leone, J. and D. Goodman, 1979. Intelligence and experience. *Instructional Science* 8, 301-367.
- Pascual-Leone, J., D. Goodman, P. Amimon and I. Subelman, 1978. 'Piagetian theory and neo-Piagetian analysis as psychological guides in education'. In: J. McC. Callagher and J.A. Easley (eds.), *Knowledge and development*, Vol. 2. New York: Plenum, pp. 243-289.
- Piaget, J., 1923. Une forme verbale de la comparaison. *Archives de Psychologie* 18, 141-172.
- Piaget, J., 1966. Nécessité et signification des recherches comparatives en psychologie génétique. *Journal International de Psychologie* 1, 3-13.
- Piaget, J., 1975. *L'équilibration des structures cognitives*. Paris: Presses Universitaires de France.
- Poortinga, Y.H. and Maipass, R.S., 1986. 'Making inferences from cross-cultural data'. In: W.J. Lonner and J.W. Berry (eds.), *Field-methods in cross-cultural research*. Newbury Park, CA: Sage, pp. 17-46.
- Reuchlin, M., 1964. L'intelligence: conception génétique opératoire et conception factorielle. *Revue Suisse de Psychologie* 23, 113-134.
- Reuchlin, M., 1969. *La psychologie différentielle*. Paris: Presses Universitaires de France.
- Reuchlin, M., 1972. 'Les facteurs socio-économiques du développement cognitif'. In: F. Duyckaerts, C.B. Hindley, I. Lézine, M. Reuchlin and A. Zemplén (eds.), *Milieu et développement*. Paris: Presses Universitaires de France, pp. 1-44.
- Reuchlin, M., 1977. Piaget et la psychologie différentielle. *Bulletin de Psychologie* 327, 336-340.
- Reuchlin, M., 1978. Processus vicariants et différences individuelles. *Journal de Psychologie* 2, 133-145.
- de Ribautpierre, A., 1975. *Mental space and formal operations*. Unpublished doctoral dissertation, University of Toronto.
- de Ribautpierre, A., 1983. Un modèle neo-piagetien: la théorie des opérateurs constructifs de Pascual-Leone. *Cahiers de Psychologie Cognitive* 3, 327-356.
- de Ribautpierre, A., in press. 'Operational development and cognitive style: a review of French literature and a neo-Piagetian reinterpretation'. In: T. Globerson (ed.), *Cognitive development and cognitive style*. New York: Ablex.
- de Ribautpierre, A. and J. Pascual-Leone, 1979. 'Formal operations and M-Power: a neo-Piagetian investigation'. In: D. Kuhn (ed.), *Intellectual development beyond childhood (New directions in child development)*. San Francisco, CA: Jossey-Bass, pp. 1-43.
- de Ribautpierre, A. et J. Pascual-Leone, 1984. Pour une intégration des méthodes en psychologie: approches expérimentale, psycho-génétique et différentielle. *L'Année Psychologique* 84, 227-250.
- de Ribautpierre, A. et L. Rieben, 1985. Étude du fonctionnement opératoire: quelques problèmes méthodologiques. *Bulletin de Psychologie* 38 (372), 841-852.
- de Ribautpierre, A., L. Rieben and J. Lautrey, 1985. 'Horizontal decalages and individual differences in the development of concrete operations'. In: V. Shulman, L. Restamo-Baumann

- Pascual-Leone, J., 1969. Cognitive development and cognitive style: a general psychological integration. Unpublished doctoral dissertation, University of Geneva.
- Pascual-Leone, J., 1970. A mathematical model for the transition rule in Piaget's developmental stages. *Acta Psychologica* 32, 301-345.
- Pascual-Leone, J., 1974. A neo-Piagetian process-structural model of Witkin's psychological differentiation. Paper presented at the 2nd conference of the International Association for Cross-Cultural Psychology, Kingston.
- Pascual-Leone, J., 1980. 'Constructive problems for constructive theories: the current relevance of Piaget's work and a critique of information-processing simulation psychology'. In: R. Kluge and H. Spada, *Developmental models of thinking*. New York: Academic Press, pp. 263-296.
- Pascual-Leone, J., 1984. 'Attention, dialectic and mental effort: toward an organismic theory of life stages'. In: M.L. Commons, F.A. Richards and C. Armon (eds.), *Beyond formal operations*. New York: Praeger, pp. 182-215.
- Pascual-Leone, J. and D. Goodman, 1979. Intelligence and experience. *Instructional Science* 8, 301-367.
- Pascual-Leone, J., D. Goodman, P. Amimon and I. Subelman, 1978. 'Piagetian theory and neo-Piagetian analysis as psychological guides in education'. In: J. McC. Callagher and J.A. Easley (eds.), *Knowledge and development*, Vol. 2. New York: Plenum, pp. 243-289.
- Piaget, J., 1923. Une forme verbale de la comparaison. *Archives de Psychologie* 18, 141-172.
- Piaget, J., 1966. Nécessité et signification des recherches comparatives en psychologie génétique. *Journal International de Psychologie* 1, 3-13.
- Piaget, J., 1975. *L'équilibration des structures cognitives*. Paris: Presses Universitaires de France.
- Poortinga, Y.H. and Maipass, R.S., 1986. 'Making inferences from cross-cultural data'. In: W.J. Lonner and J.W. Berry (eds.), *Field-methods in cross-cultural research*. Newbury Park, CA: Sage, pp. 17-46.
- Reuchlin, M., 1964. L'intelligence: conception génétique opératoire et conception factorielle. *Revue Suisse de Psychologie* 23, 113-134.
- Reuchlin, M., 1969. *La psychologie différentielle*. Paris: Presses Universitaires de France.
- Reuchlin, M., 1972. 'Les facteurs socio-économiques du développement cognitif'. In: F. Duyckaerts, C.B. Hindley, I. Lézine, M. Reuchlin and A. Zemplén (eds.), *Milieu et développement*. Paris: Presses Universitaires de France, pp. 1-44.
- Reuchlin, M., 1977. Piaget et la psychologie différentielle. *Bulletin de Psychologie* 327, 336-340.
- Reuchlin, M., 1978. Processus vicariants et différences individuelles. *Journal de Psychologie* 2, 133-145.
- de Ribautpierre, A., 1975. *Mental space and formal operations*. Unpublished doctoral dissertation, University of Toronto.
- de Ribautpierre, A., 1983. Un modèle neo-piagetien: la théorie des opérateurs constructifs de Pascual-Leone. *Cahiers de Psychologie Cognitive* 3, 327-356.
- de Ribautpierre, A., in press. 'Operational development and cognitive style: a review of French literature and a neo-Piagetian reinterpretation'. In: T. Globerson (ed.), *Cognitive development and cognitive style*. New York: Ablex.
- de Ribautpierre, A. and J. Pascual-Leone, 1979. 'Formal operations and M-Power: a neo-Piagetian investigation'. In: D. Kuhn (ed.), *Intellectual development beyond childhood (New directions in child development)*. San Francisco, CA: Jossey-Bass, pp. 1-43.
- de Ribautpierre, A. et J. Pascual-Leone, 1984. Pour une intégration des méthodes en psychologie: approches expérimentale, psycho-génétique et différentielle. *L'Année Psychologique* 84, 227-250.
- de Ribautpierre, A. et L. Rieben, 1985. Étude du fonctionnement opératoire: quelques problèmes méthodologiques. *Bulletin de Psychologie* 38 (372), 841-852.
- de Ribautpierre, A., L. Rieben and J. Lautrey, 1985. 'Horizontal decalages and individual differences in the development of concrete operations'. In: V. Shulman, L. Restamo-Baumann

- and L. Buller (eds.), *The future of Piagetian theory: the neo-Piagetians*. New York: Plenum, pp. 175-197.
- de Ribaupierre, A., L. Rieben et P. Mounoud, 1986. Régulations épigénétiques et développement cognitif de l'enfant. *Confrontations Psychiatriques* 27, 121-151.
- Rieben, L., A. de Ribaupierre et J. Lautrey, 1983. Le développement opératoire de l'enfant entre 6 et 12 ans. *Elaboration d'un instrument d'évaluation*. Paris: Editions du CNRS.
- Rieben, L., A. de Ribaupierre et J. Lautrey, 1986. Une définition structuraliste des formes du développement cognitif: un projet chimérique. *Archives de Psychologie* 54, 95-123.
- Rieben, L., A. de Ribaupierre et J. Lautrey, in press. Cognitive development and individual differences: on the necessity of a minimally structuralist approach for educational sciences. *Educational Psychologist*.
- Rogoff, B. and J. Lave (eds.), 1984. *Everyday cognition: its development in social context*. Cambridge, MA: Harvard University Press.
- Saxe, G.B., 1981. Body parts as numerals: a developmental analysis of numeration among remote Oksapmin village populations in Papua New Guinea. *Child Development* 52, 306-316.
- Saxe, G.B., 1982. Developing forms of arithmetical thought among the Oksapmin of Papua New Guinea. *Developmental Psychology* 18, 583-594.
- Saxe, G.B. and T. Moylan, 1982. The development of measurement operations among the Oksapmin of Papua New Guinea. *Child Development* 53, 1242-1248.
- Scribner, S. and M. Cole, 1981. *The psychology of literacy*. Cambridge, MA: Harvard University Press.
- Shayer, M., A. Demetriou and M. Pervez, in press. The structure and scaling of concrete operational thought: three studies in four countries and only one story. *Genetic Psychology Monographs*.
- Super, C.M., 1980. Cognitive development: looking across at growing up. *New Directions in Child Development* 8, 59-69.
- Super, C.M. and S. Harkness, 1986. The developmental niche: a conceptualization at the interface of society and individual. *International Journal of Behavioral Development* 9, 545-570.
- Wagner, D.A., 1981. 'Culture and memory development': in: H.C. Triandis and A. Heron (eds.), *Handbook of cross-cultural psychology. Vol. 4: Developmental psychology*. Boston, MA: Allyn and Bacon. pp. 187-232.

Les théories neo-piagétienne représentées dans ce numéro spécial sont passées en revue du point de vue des perspectives interculturelle et différentielle. Les auteurs dégagent les buts, les méthodes et les acquis de ces deux approches et font remarquer les similitudes et les différences entre elles. Ils proposent six critères que les théories psychologiques doivent remplir du point de vue de ces perspectives. Après une revue de question portant sur quelques études interculturelles et différentielles empiriques inspirées par des théories neo-piagétienne, ces dernières sont comparées aux six critères, et leurs avantages potentiels par rapport aux approches structuralistes classiques sont relevés.