COGNITIVE DEVELOPMENT IN ABORIGINES OF CENTRAL AUSTRALIA :

CONCRETE OPERATIONS AND PERCEPTUAL ACTIVITIES

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This thesis incorporates original research carried out by the author during the tenure of an Australian National University Research Scholarship in the Department of Psychology of the Australian National University from November 1967 to December 1970.

This thesis has been submitted for the degree of Doctor of Philosophy, but has not yet been examined. It is circulated on the understanding that it will not be quoted or otherwise used without the written consent of the author.

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ABSTRACT

This study investigates aspects of the cognitive development in Australian Aborigines which are related to the theory of Jean Piaget.

The following tests were used:

(a) Logico-mathematical tests: Conservation of Quantity, Weight, Volume and Length, and the Seriation of lengths;

(b) Spatial tests: Linear, reverse and circular Orders, Rotation of landscape models and Horizontality;

(c) Illusions: Müller-Lyer, Horizontal-Vertical, Delboeuf and Oppel-Kundt figures, and the Size-Weight illusion.

These tests were administered to children aged 5 to 16 years (and to some adults) in the following three samples:

(1) 65 "low-contact" Aborigines, living on a remote reserve in Central Australia ('Areyonga').
(2) 100 "high-contact" Aborigines, living on a mission station in Central Australia with a long history of European contact ('Hermannsburg').
(3) 80 European children, living in Canberra.

Three hypotheses were derived from previous cross-cultural studies in genetic psychology and from an analysis of the ecological and cultural background of the Australian Aborigines:

Hypothesis 1: The qualitative aspects of operational development (i.e. the stages) are identical in Australian Aborigines and in Europeans, but the rate of development is slower in Aborigines.

Hypothesis 2: The rate of operational development is faster in the high-contact group than in the low-contact group.

Hypothesis 3: Aborigines, because of their cultural background will develop spatial concepts more readily than logico-mathematical concepts.

Hypotheses 4 and 5 were respectively based on Piaget's theory of perception (Piaget, 1966, 1969a), and on Segall et al.'s (1966) ecological cue validity theory:

Hypothesis 4: The following phenomena are inversely related to operational level: (a) the susceptibility to primary illusions; (b) the extent of the decrease with practice in susceptibility to primary illusions; (c) the age at which the maximum susceptibility to secondary illusions is reached.

Hypothesis 5: (a) The order of susceptibility to the Müller-Lyer illusion is the following (from highest to lowest): Canberra, Hermannsburg, Areyonga; (b) the order of susceptibility to the Horizontal-Vertical illusion is the following (from highest to lowest): Areyonga, Hermannsburg, Canberra.

The following hypotheses were set up on the basis of the results of a previous study dealing with the development of conservation concepts in Australian Aborigines (de Lemos, 1966, 1969b):

Hypothesis 6: The order of difficulty usually found with the tests of conservation of Quantity and Weight is reversed in Australian Aborignes: Weight is found to be easier than Quantity.

Hypothesis 7: At Hermannsburg, the performance of part-blood Aborigines is better than that of full-blood Aborigines.

Hypotheses 1, 2 and 3 were confirmed. Hypotheses 4 and 5 received only qualified support, and hypotheses 6 and 7 were rejected.

The results confirm Piaget's general theory of intellectual development, but indicate that specific environmental, cultural and ecological factors may influence the rate at which cognitive development occurs.

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The following abbreviations will be used throughout this report:

Conservation tests:

Q	=	Quantity			
S	=	Substance (e.g. plasticine)			
Liq.	=	Liquids	N	=	Number
W	=	Weight	F	=	Failure to communicate
V	=	Volume	NC	=	Non-conservation
L	=	Length	T	=	Transitional
A	=	Area	C	=	Conservation

Illusions:

M-L	=	Müller-Lyer illusion
H-V	=	Horizontal-Vertical illusion
Delb.	=	Delboeuf illusion
O-K	=	Oppel-Kundt illusion
S-W	=	Size-Weight illusion
PSE	=	Point of subjective equality

Definitions:

Genetic psychology :	The developmental psychology of Jean Piaget.
Operations:	Internalized, schematic and reversible representational actions which are an integral part of an organized network (or 'structure') of related acts. (Flavell, 1963, p.165-6)
Concrete operations :	The set of operations dealing with concrete situations or events, and obeying the laws of the 'grouping' (reversibility, associativity, composition, identity, and tautology) or of the group (reversibility, associativity, composition and identity).
Operational :	Related to the development of operations, in particular of concrete operations.
Pre-operational:	Related to the period preceding the development of concrete operations.

Logico-mathematical operations : Subset of concrete operations related to classification, seriation, conservation of physical properties and number.

Spatial operations: Subset of concrete operations related to the topological, projective and euclidean properties of space.

Primary illusions : "The primary illusions have two fundamental characteristics. The first is that their qualitative characteristics (...) do not change with age, while their absolute quantitative values, the extent of illusion, usually diminish, occasionally remain constant, but do not increase with age. The second characteristic ... is that they occur even in tachistoscopic presentations which are so short as to exclude ocular movements and consequently secondary activities of exploration, transportation, etc. These primary illusions can therefore be considered to result from simple field effects, that is to say from the quasi-simultaneous interaction of elements perceived together in one single field of centration without the involvement of a displacement of fixation". (Piaget, 1969a, p.3)

Secondary illusions: Illusions which are not always qualitatively constant at different ages, and which increase with age under the influence of multiple perceptual activities.

Perceptual activities: "... those perceptual processes which occur when centrations or their effects have to be related across spatial or temporal intervals. These include activities of exploration, of transportation, of spatio-temporal or purely temporal transposition, of referral (to perceptual co-ordinates), of schematisation, etc." (Piaget, 1969a, p.133).

INTRODUCTION

Cross-cultural research tends to follow in the footsteps of the major movements in psychology. Thus, during the first half of the century, interest has centered on intelligence testing. But cross-cultural research along these lines proved unrewarding, the tests being, often subtly, culturally loaded; attempts at devising culture-free, or culture-fair tests have generally been unsuccessful and, although some instruments have been devised which prove useful in applied psychology, their contribution to theory has been minimal. Indeed, it has been suggested (e.g. Berry, 1969) that the term 'intelligence', as defined by these performance tests, be abandoned completely in comparative work.

Recently, interest has turned to work which is concerned with basic mental functioning, and one of the seminal influences has been that of Jean Piaget. His approach to intelligence represents a radical departure from quantitative measures in favour of an attempt to uncover the nature of the structures of thought as they unfold in the development of the individual. Intelligence is defined as adaptation to the environment, and its ontogenetic development is shown to occur in a hierarchical series of stages, according to general laws of equilibration.

The nature of the structures and the stages through which they develop seem to be identical in all western cultures, whereas the rate of progression is affected by environmental influences, sensory dissabilities or mental retardation.

However the western cultures are usually considered to be too homogeneous to allow an adequate test to be made of the theory in respect of the universality of the nature of the structures and of the order of their unfolding. As a consequence of this, attention has turned to cross-cultural studies in non-Western societies.

There are three ways in which Piaget's genetic psychology can be applied to cross-cultural research:

(1) One may wish to know whether the concepts and thought structures Piaget has described apply equally well to non-western cultures and, if so, at what rate they develop.

This is a completely ethnocentric, or 'etic' (Berry, 1969) approach, but is potentially useful in its application if the population under study is in the process of adopting Western technology and Western values.

Piaget's tests may be used either in their original form, or adapted to the culture being studied. In this respect, this approach is subject to the same methodological inadequacies as 'culture-fair' tests, but the emphasis is changed: the interest no longer lies in the score on a test, but in the underlying concept.[1]

(2) A second way is to search for Piagetian concepts in the actions, communications, customs and mythology of the cultural group under study, either by direct observation or by referring to anthropological material, but without using tests.

Since the concepts under investigation would still be the products of Western psychological theory, this second method would also be ethnocentric, but it would not be subject to the difficulties of test administration. On the other hand, this approach would raise the problem of the relationship between individual thought structures and collective, cultural structures.

In regard to this, however, Piaget (1968b, p.98) has the following to say about Lévi-Strauss' structuralism:

> Without doubt the kinship systems described by Lévi-Strauss bear witness to a far more advanced logic. But, for the ethnologist especially, it is obvious that these are not the products of individual inventions (of Tylor's "savage philosopher"), and that only a long collective elaboration has made them possible. It is then a matter of "institution" and the problem is thus identical to that of linguistic structures, the power of which goes beyond that of the average speaker. If the concepts of collective autoregulation or equilibration have any meaning, it is clear that in order to judge of the logic or the prelogic of members of a given society, it is not enough to refer to its cristallized cultural products: the real problem is the use made of these collective instruments in day to day reasoning. These instruments could well be of an appreciably higher level than everyday logic.

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[1] Although this has never been done, one could easily imagine that, given a particular Piagetian concept, an experimenter could invent a completely new test to study it, a test which would be devised in the terms of the target culture.

> Lévi-Strauss does remind us, however, that some individuals work out with accuracy the relations involved in a kinship system.[1] But this is not sufficient, for this system is already completed, regulated and limited in scope, while we would like to witness individual inventions.
>
> Thus we believe that the question will remain open until detailed investigations on the operational level of adults and children in various societies have been carried out in a systematic way.[2]

(3) Thirdly, the cognitive development of a particular cultural group can be studied from within that culture, adopting Piaget's framework and methodology, but without any prior reference to the concepts and structures described by Piaget. This can best be done by a psychologist belonging to that particular cultural group.

The present study, along with all previous cross-cultural Piagetian investigations, is an example of the first

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[1] The Aranda, for example, have developed a very complex kinship system which seems to display the combinatory and reversibility properties of formal thought (in Piaget's definition), but, as the present study shows, most of the Arandas (even adults) do not display even concrete operational thought when tests are used. (Our footnote. See also Romney and d'Andrade, 1964).

[2] "Sans doute les systèmes de parenté décrits par Lévi-Strauss témoignent-ils d'une logique bien plus poussée. Mais il va de soi, surtout pour l'ethnographe, que ce ne sont pas là des produits d'inventions individuelles (du "philosophe sauvage" de Tylor) et que seule une longue élaboration collective les a rendus possibles. Il s'agit donc d'"institutions" et la question est ainsi la même que pour les structures linguistiques, dont la puissance dépasse celle de la moyenne des locuteurs. Si les notions d'autorégulation ou d'équilibration collectives présentent le moindre sens, il est alors clair que pour juger de la logique ou de la prélogique des membres d'une société donnée il ne suffit pas de se référer à ses produits culturels cristallisés: le vrai problème est celui de l'utilisation de l'ensemble de ces instruments collectifs dans les raisonnements courants de la vie de chacun. Or, il se pourrait que ces instruments soient d'un niveau sensiblement supérieur à celui de cette logique quotidienne. Lévi-Strauss nous rappelle, il est vrai, des cas d'indigènes qui "calculent" avec précision les relations impliquées dans un système de parenté. Mais cela ne suffit pas, car ce système est achevé, déjà réglé et de portée spécialisée, tandis que nous aimerions assister à des inventions individuelles.

Nous croyons donc, pour notre part, que la question reste ouverte tant que des recherches précises sur le niveau opératoire des adultes et enfants de sociétés variées n'auront pas été faites de facon systématique."

of these approaches. It is clearly ethnocentric, and does not claim to use culture-free tests.

It's aim is to investigate whether certain concepts, which are basic to Western scientific thinking, develop through the same stages, and at the same rate, in Australian Aborigines as in Europeans.

In this respect, it is a direct follow-up of earlier research which was also carried out under the supervision of Ass. Prof. G.N. Seagrim (de Lemos, 1966, 1969b; de Lacey, 1970a, in press). With the former study, it has in common some of the tasks (conservations) and one Aboriginal population (Arandas at Hermannsburg). With the second study, it introduces the study of two sub-samples of the same ethnic group, differing in the amount of European contact.

The present study attempts to assess the relative development of different areas of cognitive development (namely logico-mathematical operations, spatial operations, and visual perception), and attempts to make specific predictions from the cultural and ecological characteristics of the populations under study to performance in those areas.

It is assumed that the reader if familiar with the theoretical background of the study, namely Piaget's work, including his theory of visual perception (1961, 1969a), and with the general area of cross-cultural psychology. With this assumption in mind, it was thought preferable to devote more space to a detailed review of cross-cultural studies of genetic psychology and of perception.

As the design of this research is very complex, it will also be necessary to depart from standard practice and to discuss each set of results as they are reported. This should avoid confusion. An attempt will, however, be made, in the last chapter, to draw the different aspects of the study together in the interests of a general discussion of the findings and of their implications.

Cross-cultural research may have at least three functions (Strodtbeck, 1964; Frijda and Jahoda, 1966).

(a) It may serve as a process of decentration or of 'decentering' (Werner and Campbell, 1970): theories established in one society may be tested for generality by attempting to establish whether they apply to different cultures; the ultimate goal of such investigations is the elaboration of general ('universal') laws. (e.g. Campbell, 1961; Doob, 1965).

(b) When cultural or sub-cultural groups can be selected so as to differ in specific ways, their characteristics may be used as independent variables; the aim is usually to uncover casual relationships. The cross-cultural setting acts as a 'natural laboratory' (Brown, 1964).

These first two functions, or goals remain ethnocentric, in so far as the results are useful to the scientist, rather than to the cultural group(s) under study. Cross-cultural research, however, can have a third goal, albeit often an implicit or long-term one:

(c) the findings can be applied in some way, either to foster cross-cultural understanding, or to explain and assist social and cultural change. Education is the most obvious application of genetic psychology, whether cross-cultural or not.

It is hoped that the present study may be able to make a small contribution towards attaining all three of these goals.