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ABSTRACT

Analysis of 65 children over a 4-year period on tests of operational and causal thinking offers support for Piaget's notion of stage progression. In kindergarten and grade one, the majority of children in this longitudinal study were between preoperational and the achievement stage of operational thought. By grade two, the majority had attained the terminal stage on seven of nine tests given. By grade three, the children achieved terminal stages on all tests. Over a 3-year period only eight true regressions occurred. This number constituted less than one percent of the total possible regressions. Both the Piaget test scores and the Wechsler Intelligence Scale for Children measures were slightly higher for the regressing children. In this study, "regressing children" were not less intelligent than nonregressing children. However, the numbers were too small to warrant any conclusions. (WY)

A LONGITUDINAL STUDY OF PIAGET'S DEVELOPMENTAL STAGES AND OF THE CONCEPT OF REGRESSION*

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The present longitudinal study is concerned primarily with Piaget's concept of growth of the intellect by stages, and with the concept of regression from more advanced to earlier levels of thinking as this affects the notion of developmental stages. It is secondarily concerned with the personality characteristics of slow as opposed to fast maturing children and children with regressing as opposed to fast maturing children and children with regressing as opposed to non-regressing patterns in the acquisition of terminal stages of operational thought. It covers the period of pre-operational pre-causal causal thinking. Our sample extends over 4 years from Kindergarten to Grade III, covering the ages 5 to 9 inclusive.

The validity of Piaget's notion of developmental stages can only be tested within a longitudinal study as cross-sectional studies reveal little about the invariance of stage development on the same children. State

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processes are defined by certain criteria involving the constant order of succession, the integration of structural operations, the appearance of structural wholes, the presence of the preparatory level of operation, and finally the process of equilibration leading to structures of final equilibrium in operation. Piaget's stages are described by Inhelder as "processes of formation leading to structurer of equilibrium". Since the order of succession of stages is constant, a reversal of this order would constitute a regression in the developmental system as established by Piaget.

The present study uses Nine out of a battery of 25 Piagetian tests developed by the research team at the University of Montreal, under the supervision of Prof. A. Pinard and Prof. Monique Laurendeau. The scoring of stages used is that established by Laurendeau and Pinard (1958). Stages in the period of pre-operational and pre-causal thinking can be divided into three types. Stage I is primitive and the intellectual operation is inferior when compared to that of a later period. Stage 2 is intermediate and may be described as a highly fluid type of behavior, characterized by instability of intellectual structures which are in the process of being formed. State 3 is a final stage in which equilibrium of operations is established and stability of intellectual structures is found. Since stage 3 is already a stage of established equilibrium and structured wholes, it is predicted that thinking at this level is firmly rooted in the operations which integrate and coordinate the thinking of the preceding levels while at the same time having transformed them.

Each stage is subdivided into substages A and B, and sometimes C in which substage A is preparatory and B would be terminal for that stage. Not all tests have a uniform subdivision of substages. E.G., in the dream test, the intermediate stage is subdivided into A, B, and C, whereas in the time and inclusion tests, the substages are not subdivided further (only

stages 1, 2 and 3 exist).

Stage regression is defined as a return from a superior level of cognitive functioning to an inferior level. Several types of regressions are possible. Regression from Stage I is theoretically impossible, except as a reflection of the preceeding period. Stage 2, as an intermediate stage in which structures are not as yet in equilibrium, is by definition unstable. Theoretically, therefore, one would expect to find more regression here than at Stage 1 or 3. Thought at this stage is fluid, unstable and momentary lapses into primitive thinking as well as momentary lunges into more advanced thinking are characteristic. However, at stage 3 a child is not expected to revert to previous, inferior forms of thinking because these earlier forms have already been transformed in the acquisition of structures of a terminal equilibrium. A regression within a terminal stage; a regression from 2B to 2A is also intra-stage at the intermediate level. Neither are examples of true regression, a regression from stage 2B to 1B would be defined as an inter-stage regression, but it is still from intermediate to more primitive and again not a true regression. A regression from stage 3B to 1B would be defined as a two-step regression, and would constitute a true regression, where a child at a terminal stage of acquisition has shown a reversal to a primitive and preparatory stage of thinking.

Intelligence Measures

Dudek et al have found that Piagetian measures of intelligence show a strong positive relationship to standard tests of intelligence. The relationship between Kindergarten WISC and a total of 9 Piaget tests was .52; in Grade I it was .56, and Grade II it was .62. Thus, the brighter children tend to show faster acquisition of operational and causal thinking, but the correlation accounts for only 38% of the variance in grade II.

To what extent may the emotional development of the children who acquire operational thinking faster be more complex or more mature? Piaget maintained that cognitive and emotional reactions are two sides of the same coin. Inhelder & Piaget describe them as interdependent. "Affective life, like intellectual life, is a continual adaptation, and the two are not only parallel but interdependent, since feelings express the interest and value given to actions of which intelligence provides the structure (1951, pp. 205-206). One would therefore hypothesize that an analysis of the personality of the child who shows a faster rate of intellectual maturation would show a more mature and better developed affectivity and ego structure. To test this hypothesis, the Cattell Early School Inventory and the Rorschach Test were used as measures of personality development. This study is reported in a separate paper.

METHOD

Tests

The nine Piaget tests have been described in detail in a previous publication (Dudek et al; Perceptual Motor Skills, 1969). They will be only briefly outlined here. The tests measure the following operations:

1) Notions of space and position in space (man in a countryside test). Egocentrism and irreversibility are the main preoperational characteristics of this test.

2) Age - measuring concepts of relative age, size and order of birth. Disequilibrium and phenomenalism are preoperational characteristics.

3) Quantity test, measuring concepts of conservation of mass and weight (plasticine balls test). Centration, lack of transformations, and action quality are the main preoperational characteristics here.

4) Conservation of surface (cows in the field test). Centration and lack

of transformations are the main preoperational characteristics.

5) Origin of dreams, measuring concepts of causality. Realism and subjectivism are the common precausal notions.

6) Origin of night, also measuring concepts of causality. Artificialism and finalism are the preoperational characteristics evident on this test.

7) Class inclusion (wooden and colored beads). Centration is the dominant preoperational characteristic.

8) Two directions of orientation (marbles, chips and tunnel). Inability to make transformations, irreversibility, and disequilibrium are the main characteristics.

9) Seriation and ordinal correspondence (houses and trees). Transduction, lack of transformations, and irreversibility are preoperational characteristics.

All nine tests were administered at yearly intervals for three successive years. In the 4th year of research, due to lack of research time, and the initiation of a replication study, only the tests on which terminal stages of acquisition had not yet been attained were administered to the children in question.

The Piaget tests were converted into numeral scores for purposes of statistical analysis. Each test was given a weight of 18, with scores of 3 points for each sub-stage, eg., 1A and 1B total 6 points. Where 3 subdivisions were used, each obtained a score of 2 points. Thus 162 would constitute a perfect score on all 9 tests. The 9 Piaget tests have been shown to correlate very highly with the total (Dudek et al, 1969).

I.Q. Tests

Intelligence was assessed by individual yearly testing with the WISC over a three year period. In the fourth year of the research, only the Lorge Thorndike Group Test of Intelligence was administered.

RESULTS

Table 1

Characteristic Stages for Kindergarten Grade I, Grade II, and Grade III

School Grade	Space	Quant.	Surface	Dreams	Night	Time	Inclusion	Movement	Seriation
Kindergarten	2B	2A	1B	2C	2	2B	1B	2A	2A
% of Children	85	66	51	61	59	66	98	90	67
Grade I	3A	2A	1B	3A	3A	2B	2B	2B	2B
% of Children	84	74	72	77	51	90	63	60	55
Grade II	3B*	3*	3*	3A	3A	3B*	3B*	2B	2B
% of Children	71	58	58	83	78	69	59	81	75
Grade III	3B	3	3	3B*	3B*	3B	3B	3B*	3B*
% of Children	87	83	76	65	61	95	82	78	54

*terminal stage acquired.

Level of stage determined by 51% of children passing at mot level.

Table 1 indicates that the data of the present study has supported Piaget's stage development concepts. There has been a slow and steady progression from simple to more complex thought forms in the acquisition of operational and causal thinking for the group of 65 children as a whole. To what extent has this progression been persistent and invariant in the individual child? This can only be answered by a study of regression.

Table 2

Distribution of regressions by test, stages regressed from and to, number according to year occurring, raw total number for each test, and percentage of the total regressions for each test N = 65

Test	Stage regressed from and to	Regressions N = 122 number according to year occurring		Total for each test	
		Grade I	Grade II	n	Percentage
Space	3B---3A	2	5		8.2
	3A---2B		2		
	2B---1	1		10	
Quantity	3 ---2B	2			
	3 ---2A	1			
	2B---2A	3	2		12.3
	2B---1	1			
	2A---1	5	1	15	
Surface	3 ---2		1		
	3 ---1B*		1		
	3 ---1A*	1			
	2 ---1B	6	2		
	2 ---1A	2		13	10.6
Dreams	3B---3A	4	5		
	3B---2C	1			
	3B---2B		1		
	3A---2C		3		
	3A---2B		1		
	2C---2A	1		16	13.1

Table 2 continued

Night	3B---3A	3	6			
	3B---2	3				
	3A---2	2	1			
	3A---1B*	2	1			
	3A---1A*	3				
	2 ---1B	3	1			
	2 ---1A	4	1			
	1B---1A		1		31	25.4
Time	3 ---2	3	4		7	5.5
Inclusion	3 ---2	3	3			
	2 ---1	1	3		10	8.2
Movement	3 ---2B		2		12	9.9
	2B---2A	5	4			
	2A---1	1				
Seriation	2 ---2B	2	2		8	6.5
	3 ---2A		2			
	2B---2A		2		5	
Total		65	57	= 122		

* true regressions

Intra-stage 43

1 Step 71

2 Step 8

Table 2 indicates the total number of regressions at the end of Grade I and II. Study of regressions from Grade II to Grade III was not possible due to the change in testing procedure where only the tests on which the terminal stage had not been achieved were administered to the children in question for the purpose of allowing time for a replication study. There were 10 regressions among the 229 tests administered, i.e. 4.3%. Seven of these 10 regressions were from 3A or 3B to the intermediate stage 2A, B or C. Two regressions were at the intermediate stage and only one (.43%) was a true regression (from stage 3A to 1B).

In the three year period from Kindergarten to Grade II, theoretically

1,170 regressions are possible (9 tests x 2 sessions x 65 subjects). A total number of 122 regressions were found; 65 at the end of Grade I and 57 at the end of Grade II. This constitutes 10.4% of the total number of regressions possible.

Type of regression and percentage on each test is indicated in table 2. Of the total of 122 regressions made, 72 (59%) were made from stages 3A or 3B to intermediate levels. Of these 72 regressions, at stage 3, 25 were made from 3B to 3A, i.e. within the same stage, while 39 were from 3A or 3B to the intermediate levels (2A, 2B or 2C), i.e. a one-step regression. Forty-nine were at the intermediate level. Seventeen of these were within stage regression while 32 were from stage 2 to stages 1A and 1B. There was only one regression at stage I (from 1B to 1A).

Eight regressions involved a two-step jump, from the terminal stages 3A or 3B to the initial or preparatory stage of operational and causal thinking. Thus, only 6.5% of the total number may be called true regressions. Six of these occurred in the night test (from 3A to 1A and 1B), while the other two were in the surface test (from 3 to 1A and 1B). Five of the 6 children responsible for the regressions on the night test gave 3 regressions each. The largest number of regressions (table 2) occurred on the causal tests; night, dream. There were a total of 31 regressions on the night test, 16 on the dream test. The quantity test yielded a total of 15 regressions.

Table 3

Regressions in Grade III with a Total of 229 Tests Given

3A	--	1B	= 1
2B	--	2A	= 2
3	--	2A	= 1
3	--	2B	= 2
3A	--	2	= 2
3A	--	2C	= 1
3B	--	3A	= 1
		Total	10 = 4.5%

Table 3 summarizes the number of regressions found among the 229 tests administered in grade III.

Intelligence and Regression

Since Dudek et al (1969) found that intellectual measures indicated a reasonably high correlation between WISC and Piaget measures (.62 in Grade II) the relevance of intelligence to regression in thinking was examined. It is to be noted that we are not concerned here with the problem of true regression, as defined by regression from terminal to early stage. We are dealing simply with number of regressions at any level over a three year period. Of the 65 children in the group, there were 9 children who gave no regressions, 16 children who gave 3 or more, and the remaining 40 gave between 1 and 2 regressions each.

Table 4

WISC Intelligence and Piaget Scores of Regressing and Non-regressing children

	K	Grade I	Grade II
No regression (n = 9)			
IQ Full Scale	101.8	103	109.4
Piaget Score	69.5	101.7	129
Regression 3 + (n = 16)			
IQ Full Scale	108	110	116
Piaget Score	93	114	140
Total Group (n - 65)			
IQ Full Scale	106.4	109.5	111.9
Piaget Score	87.6	114.4	132.6

Table 4 summarizes the differences in I.Q. and in Piaget scores in regressing and non-regressing children; as well as the IQ for the group of 65 Ss. The tendency to regress does not appear to be significantly related to level of intelligence in the small number of children examined. Contrary to the exp tions, the level of intellectual maturity, as measured by both the WISC and the Piaget tests, is higher in the regressing children. The Full Scale Piaget is 23, 12 and 11 points higher in Kindergarten, Grade I and Grade II for the children who show some regressions, while I.Q. is 6, 7 and 7 points higher in Kindergarten, Grade I and Grade II. Since level of intelligence as measured by the WISC and level of intellectual maturity as measured by Piaget tests appear to be related to each other, while regression is found in the unexpected direction, the question arises as to whether personality characteristics may not offer an explanatory clue for this phenomenon of "regressio

SUMMARY

1. Analysis of 65 children over a 4 year period on tests of operational and causal thinking offers support for Piaget's notion of stage progression.

2. In Kindergarten and grade 1 the majority of children were at the intermediate stage; that is, at the level of thinking between pure pre-operational thought and the achievement stage of operational thought. By grade two, approximately age 7, the majority have attained the terminal stage on all but two of the nine tests given, that is, on movement and seriation. They achieve terminal stages on these two tests by grade III.

3. Over a 3 year period there were only 8 true regressions - from terminal stages to the initial or preparatory stage of operational and Causal Thinking. This constitutes only 6.5% of the total number of actual regressions made and less than 1% of the total of possible regressions for this period.

4. Both the Piaget scores and the WISC measures were slightly higher for the regressing children but the numbers are too small to warrant any conclusions. However, they serve to demonstrate that "regressing children", in the sense used here, are not less intelligent than non-regressing children.

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