

THE UNIVERSITY OF LEEDS

"A study of the effect of teaching method on the
growth of logical thought with special
reference to the teaching of history."

A Dissertation

Presented as Part of the Requirement for the Degree of Ph.D.

by

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April 1975.

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ACKNOWLEDGEMENTS

I am particularly indebted to Professor K. Lovell for his most assiduous and discerning supervision from the initiation to the completion of the research. I also wish to declare my sincere gratitude to Dr. H.M. Pollard, Principal of S. Martin's College, Lancaster, and Mr. W. Etherington, now Principal of Keswick Hall College, Norwich. Without their support and co-operation I should never have been able to carry out the empirical work in the schools. Finally, as with all educational researchers, nothing would have been achieved without the friendly and willing co-operation of the staff and children of the various schools: to these I give my unreserved thanks.

ABSTRACT

"A study of the effect of teaching method on the
growth of logical thought with special
reference to the teaching of history."

The thesis begins with an explanation of the Piagetian background to the research together with a survey of a number of training experiments. After relating the aims and methods of the research to a simple plan of the curriculum an examination of the possible relationships between history, history as taught in schools, and the Piagetian framework is outlined. The major part of the thesis is concerned with an attempt, through empirical work in classrooms, to develop the logical thinking of primary and secondary pupils. Using criteria derived from Piaget's developmental theory of intelligence children aged 9-10 years and 13-14 years were assessed through the clinical technique on their responses to a number of questions on historical passages at the beginning and at the end of a school year. In each age range two classes were taught history for one school year by the investigator, one in a "traditional" manner and the other in an "experimental" manner. There were non-taught control classes for the two age ranges, one for the primary and two for the secondary pupils. In order to make the numbers at each age level comparable the final samples consisted of fourteen boys and fourteen girls in each of the primary groups with thirteen boys and thirteen girls in each of the secondary groups. Each pupil was also assessed individually before and at the end of the school year on two Piagetian experiments, equilibrium in the balance and the combination of colourless liquids.

Analysis of covariance was used to discover whether the teaching techniques had made any significant difference to the nature of the children's responses on the passages after the year's teaching. The

stability of the levels of response across the different historical passages and across the historical passages and two Piagetian experiments was also analysed. The research further involved a consideration of the children's moral judgments on certain selected questions and an examination of some variables which may be associated with children's thinking in history such as reading ability (primary pupils), measured intelligence, social class and personality characteristics. Some spoken replies of the secondary pupils were analysed against written replies. Using the Osgood Differential technique an assessment was made of the secondary pupils' attitudes towards concepts associated with the teaching of history. The data obtained from these and other measures were submitted to factor analysis for each of the two age groups.

The major results are as follows:

- (1) The primary boys in the experimental group reached significantly higher levels of thinking after a year's teaching than did the boys in the traditional and control groups on (a) the "taught" story and (b) the three stories used as criterion passages, two of which were not taught.
- (2) The primary girls in the experimental group reached significantly higher levels of thinking after a year's teaching than did the girls in the traditional and control groups on the "taught" story. A similar result occurred only against the girls of the control group when the average scores on the three stories were used in an analysis of covariance.
- (3) The only significant gains made by the secondary pupils occurred (a) when the scores of the boys in the experimental group on the "taught" story were covaried against the scores of the boys in one of the two control groups and, (b) when the average scores of the three stories for the boys in the traditionally taught group were

covariated against the scores of the boys in the other of the control groups.

- (4) Friedman's two way analysis of variance showed that the stories presented similar levels of difficulty on the first occasion of testing; this was true for both the primary and the secondary groups. On the second occasion, however, at both age levels the subjects in the taught groups tended to answer the "taught" stories at a higher level than the two "non-taught" stories used in the initial assessment.
- (5) Kendall's coefficient of concordance indicated that the pupils at both age levels maintained similar positions in relation to each other more across the historical passages than when the pupils' average scores on the historical passages were analysed against scores on the two Piagetian tasks. There were, however, moderate degrees of consistency across the three measures, that is, history and the Piagetian tasks, for both the primary and the secondary subjects.
- (6) The Osgood Semantic technique seemed to show that the pupils in general remained favourably disposed towards history, with a significant improvement for the boys in the traditionally taught group on "History in School" and "Visiting Historic Places".

The thesis concludes with a discussion of the results at the two age levels together with an examination of some possible implications of the findings for the teaching of history and further research.

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PART I

THE PIAGETIAN BACKGROUND

CHAPTER I : SOME FUNDAMENTAL CONSTRUCTS

1. The process of assimilation and accommodation

Piaget conceives of life, including the development of logical thinking, as a continuous creative action between the organism and the environment. All living matter has to adapt to its environment. Such an adaptation takes place through the operation of two general processes, assimilation and accommodation, under the control of an internal self-regulating mechanism, equilibration. (Bellin in Mischel 1971, pp.88-89) Assimilation is the incorporation of environmental data, through physical or mental activity, into existing cognitive structures. The data is incorporated only to the extent that it is accepted by the organism. This developmental process starts with the infant's innate reflexes. These provide the original base from which experience is assimilated. Accommodation is the process by which the organism adapts its structures to the particular environmental reality with which it is confronted. Bellin (ibid, p.89) explains that this can occur independently of the demands of the external environment as in, say, the kind of thinking that occurs in mathematics, so that it can occur in response to the data generated by the thought process itself.

Assimilation and accommodation initially are opposed to each other "since assimilation is conservative and tends to subordinate the environment to the organism as it is, whereas accommodation ... bends the organism to the successive constraints of the environment" (Piaget 1955, p.352) The role of mental operations is to inter co-ordinate these initially antagonistic functions, especially as they are also essentially dependent on each other: every assimilation involves an accommodation and vice versa. The basic unit of analysis is thus the organism within its environment. "A response is always the response of a living organism, always something

constructed in part according to determinants that are intrinsic to its own structure. A stimulus, too, is ... something that can be 'assimilated' by the structure". (Furth 1969, p.13) If it could not be assimilated in a meaningful way by the organism the stimulus would not exist conceptually for that particular organism, although it might be used in rote fashion. Furth gives the example that four sticks in a series does not "exist" for a child who fails to perceive that an ordered arrangement is different from one without order. "To know is therefore an activity of the subject" (Op. cit, p.15)

Parents and teachers are often reminded that children either have not the necessary structures by which they can make sense of new information or they are ready to "parrot" words and ideas without understanding. Children must play an active role in creating knowledge.

2. Knowledge

What is this "knowledge" of which Furth and Piaget write? The problem of "knowledge" could be considered as much a philosophical as a psychological question. Peters (1967, pp.6-7) argues that being educated implies the possession of knowledge. This is not mere knowledge seen in, say, the recapitulation of dates in history but "some understanding of principles, of the 'reason why' of things" is required. To be educated, for Peters, is to travel with a different view derived from understanding such knowledge. It would seem a fair analogue to say that to be knowledgeable in Piaget's sense is also to regard the world with a different view.

Lovall (1971) considers "knowledge" from two aspects, general and particular. The former way of knowing may be defined as "the totality of the action co-ordinations which are available to the individual at a given stage of development, the actions being physical ones at first, these later being internalised with the aid of language as implicit mental actions". (p.240)

Thus, a child at the sensori-motor level, through his organisation of actions, will not forget that he can use a stick to obtain an object otherwise out of

reach for the scheme involved is "now part of his general objective knowing".

^{of.cit.}
 (ibid, p.242) He may, however, forget where his mother keeps some specific object if he has been absent from the house for some time; this is an example of particular knowing. Again, at the concrete operational level, through actions performed on objects or from the form of conversations with other persons, new structures are developed so that the child will never again be unsure, say, as to whether a class can be smaller or not in extension than its sub-class. ^{of.cit.}
 (ibid, p.245) Once an adolescent has reached the level of formal operations he will appreciate that the facts in front of him are a subset of the possible transformations that have actually come to pass.

^{of.cit.}
 (ibid, p.246) These are all examples of ways of general knowing. Particular knowledge, on the other hand, results from special experience within the physical, social or educational environment. "Thus specific opportunities are necessary, generally in school, to learn of the physical features of the local environment ... or of some of the consequences of the Norman Conquest".
 (ibid, p.246) But it seems that it is "the general ways of knowing which determine the level and quality of understanding of the particular knowledge".
 (ibid, p.246)

The essence of general knowledge, then, is the operations, sets of reversible actions, seen, for example, in such structured forms of thought as classification and seriation. An operation enables the knower to "get at the structures of the transformation". (Piaget in Ripple and Rockcastle 1964, p.8) The understanding of number is not achieved simply through verbal repetition of "one", "two", "three" etc. by the child but by actions which demand the construction of the basic operational structures of classification and seriation. The term "construction" is used here as it seems to convey the sense that the structures are brought about through the interaction of the organism and the environment: "a thing in the world is not an object of knowledge until the knowing organism interacts with it and constitutes it as an object". (Furth 1969, p.9)

These operational structures for Piaget are "the basis of knowledge ... and the central problem of development is to understand the formation, elaboration, organisation and functioning of these structures". (Ripple and Rockcastle 1964, p.9) Structures or schemes are abstracted from experience but Piaget thinks it necessary to distinguish between two kinds of experience: a physical experience that abstracts from the physical things themselves and a logico-mathematical experience that abstracts from the knowing activity itself. He suggests that operational schemes derive principally from the second kind of abstraction. (Furth 1969, p.65) This is evidently so because such "abstractions" express laws of general co-ordination that are implicit in all living structures. (, p.66) Piaget also uses the term "reflecting" abstraction since he conceives the organism as reflecting on its own co-ordinating activity in a self-regulatory sense. As an internal enrichment it becomes the principal source of growth of the operative structures. (, p.65) Presumably, Furth is here referring to the crucial concept of equilibration. Furth illustrates an operational structure by contrasting how an infant and an adult might react to the stimulus of a thrown ball. An infant would react externally to the ball whereas an adult would assimilate the stimulus to existing operational structures, for instance, by classifying it as a particular example of thrown objects or balls. In history, perhaps, the stimulus of the word "democracy" might be assimilated by an experienced adult to his operational scheme of democracy based on knowledge of democracy in Ancient Athens, in Britain today, on thoughts of how far were democratic principles in the U.S.A. compromised during 1973, and so on. On the other hand, a child of thirteen years with no such developed operational structures available will have to bring to bear such possibly rudimentary schemes as majority, vote, government to his understanding of the term. This example possibly shows that earlier schemes are subsumed in, and are necessary for, later operational thinking.

3. Memory

As happens in the study of history in schools, memory played a part in the present research. For example, there were annual examinations at the secondary school in which memory of facts and historical connections were tested (Appendix K). Piaget analyses memory in two ways: in the narrow sense as shown in rote memory of an arbitrary character and in the wider sense seen in the understanding of logical connections. (Furth 1969, p.163) Piaget links the former type with figural aspects of memory seen in perception, imitation and images whereas the latter is connected with logical thinking. A normal adult in Western society does not, for example, "forget", as a young child might, that if $A > B$ and $B > C$ then $A > C$ because he has fully interiorised the particular structures for that problem. He "knows" the answers.

Piaget supports his contention that knowing is always present in operative memory by quoting empirical research. The majority of a group of Genevan children aged 6 and 7 years could reproduce accurately one hour later the horizontal line of the top of wine in a tilted decanter. After the lapse of a week, however, while the children could still remember the drawing, they drew the level of the liquid incorrectly, a result which could be expected from children of that age. Their figurative memory had become weaker and could not compensate for their lack of operativity in this experiment. (op.cit, pp.152-153) Teachers are well aware of this occurrence when children "swot" formulae, causes of wars, figures of speech - and promptly "forget" them after an examination. Another experiment of Piaget's showed that children, evidently at the transitional stage between having and not having the structure of seriation improved over a period of six months in their remembering of a picture of a number of lines presented in series. (ibid, p.153) As their operative knowledge increased, so also did their memory performance.

What is the relationship of the two types of memory? For Piaget, some

system of operative schemes subsumes and controls all figurative knowledge. Even rote memory works within an operative scheme. A striking example of this was given in the present research when a girl aged 13 : 9 years in the "A" stream of a grammar school failed consistently to make the different weights reach equilibrium on a simple type of balance experiment (pp.29-30) This is how she tried to get 5g on one side balance, 2g on the other.

The girl's remarks:

2g at hole 20R (right)

5g at hole 6 L (left)

"What do you think?"

"It is too heavy"

"Can you do anything to make the bar stay level?"

"5g at hole 8 L (= 40) It still seems heavy on the right

2g to 19 R (= 38) That is better"

Yet she could repeat the rule perfectly. "The load times the load's distance equals the effort times the effort's distance. That's the rule we've been taught".

The girl had some understanding of the principle of moments; this was shown in her trial and error procedure. Within this rudimentary scheme, the rote learning had taken place. With increasing age, practice, and possibly a more simple explanation such as 'multiply the weight by the hole' she should have proceeded towards an operative memory of the principle of movements. But one year later she still did not completely understand metric proportion. This is her second answer to the question on the rule about the experiment. "If the weights are equal and (each) one is on either side, they have to be the same distance away from the fulcrum. But if one weight is heavier than the other it will be nearer the fulcrum than the smaller one". At least she was capable at 14 : 9 years of showing that she had some general knowledge of the balance experiment; this seems a more operative answer than her previous rote reproduction of the rule.

Such an example seems to provide support for Piaget's answer when he was asked whether exercising the memory would accelerate children's thinking skills (Ripple and Rockcastle 1964, p.20) "In exercising perception and memory, I feel that you will reinforce the figurative aspect without touching the operative aspect - not the analysis of states, but the understanding of transformations". One wonders, however, whether the exercise of figurative memory might provide additional data for children and might help to develop rudimentary structures into more sophisticated forms.

For example, it is necessary for young children to operate on number, as in discovering that four groups each of three objects yields the same total as three groups of four objects. (Lovell 1971, p.245) Does the rote-learning of tables also help in developing their grasp of the number system? If a teacher deems such repetition useful, then it would seem a more logical procedure to teach in succession those systems which more nearly relate to each other, such as 2×2 followed by 4×4 , and then 3×3 followed by 6×6 , rather than simply proceeding from 2×2 , 3×3 to 12×12 . As in so many other areas of educational research, however, the relationship of memory experience to operative knowledge still needs thorough investigation.

!!!!!!!

CHAPTER 2 : THE STAGES OF THOUGHT

Operations derive from sensory-motor actions through the progressive interiorisation and structuring of co-ordinating action schemes. As a result of development, operations eventually form a coherent system, the most characteristic attribute of which is reversibility. "Reversibility of thinking action thus becomes Piaget's observational criterion for differentiating operation in the strict sense from preoperational activity". (Furth 1969, p.63) Piaget usually employs the term 'preoperational' to cover the period from 1½ years to 6-7 years when thinking is no longer merely sensory-motor yet not fully operational. The period of operational thought is normally divided into concrete operations (7/8 years to 11/14 years) and formal operations (11/15 years onwards). The criteria for these three stages will be used to analyse answers in the present research, but it must be remembered that children's thinking on historical passages is likely to lag behind their thinking on more immediate concrete data.

1. The Preoperational stage

The child moves into this stage when he can differentiate a signifier such as the word for "dog" from the actual animal. This capacity is called the semiotic function by Piaget. Lovell (1971, p.243) explains that the ability to represent reality not present can be inferred from at least five behaviour patterns which emerge "at more or less the same time":

- (i) Imitation which takes place after the model has disappeared,
- (ii) Symbolic play
- (iii) Drawing
- (iv) The mental image
- (v) Oral language, which is "but one aspect of the semiotic function which in turn depends upon intellectual development". (ibid, p.243)

Preoperational thought can be characterised as "semi-logical or inconsistent". (Op. cit., p.214) The preoperational child is unable to focus on another's point of view in order to contrast or co-ordinate it with his own. He will also centre on one aspect of a situation and not take into account features which balance and compensate. Transductive thinking is often involved, this is, the child proceeds from one element to another without there being any necessarily logical relationships between the elements. He thus tends to make associative "and connections" rather than true implicative and causal relations in a chain of reasoning. In the earlier research (Hallam 1966, p.104) the following answer was judged to be showing signs of transductive thought. For the last question of a series the pupils were asked if they had any comments about Mary Tudor after they had read a short passage about her. A boy aged 13 : 3 years with an IQ of 113 gave the following reply.

"(she) liked having fancy clothes and ... she thought all English people were sinners for going after Henry VIII's religion which was a rebellion against the Holy Catholic Church".

"Why do you say 'she liked having fancy clothes'?"

"With being a member of the Catholic Church the priest had very expensive vestments and she liked very expensive clothes and also to have jewels and various other decorations on her."

The preoperational child is also syncretic in his thought, that is, everything in a whole can be related but there need not be any logical reasoning behind such relations. He is also likely to focus attention upon successive states rather than on transformations between states. As was noted earlier, the aspects of knowing which deal essentially with such fixed states is the figurative function (imitation, mental imagery) whereas the aspects of knowing which focus on transformations between states is known as the operative function. Piaget demonstrates how children at the preoperational stage are limited to the figurative function in the following experiment. (Ripple and Rockcastle 1964, pp.25-26)

Glass
A

Glass
B

Glass
C

The child is asked to predict how much water there would be in glass B and then glass C if the water was poured from glass A into each of them in turn. Piaget states that between the ages of 5 and 8 years three types of reaction are found.

- (i) 4-6 years: Children tend to say there would be the same amount to drink but they predict that the height of the water would be the same in B and C as it is in A. Piaget calls this a pseudo-conservation; the children have conserved the level as if the level on its own were the criterion for quantity.
- (ii) 6-7 years: Children will usually predict that the water in B will go higher because that glass is thinner but they will say that there will be more water in B and less in C. Here the image is simply a result of previous experience through drinking, say, milk in different tumblers. The child, however, cannot imagine a system of compensations involving two dimensions.
- (iii) 7+ years: The child should have reached the operative function where he can predict that the level in B will be higher and that B will also contain the same quantity of water as in C. He can contract two features, height and width, and also reverse his thinking so that he realises quantity in A = quantity in B = quantity in C, provided none is spilled.

2. The concrete operational stage

The typical Piagetian conservation problem mentioned above shows that the child from 7 to 8 years of age can envisage complete and reversible compensations. Thought has become systemised, logically or internally consistent. (Lovell 1968, p109)

"By concrete operations we mean actions which are not only internalised but are also integrated with other actions to form general reversible systems". (Inhelder and Piaget 1958, p.6) In Piaget's original conservation experiments such reversible, integrated mental actions are limited to intuitable data, that is, imageable or perceptible data. Concrete operations "function only with reference to observations, or representations of observations, reckoned as true, and not with data that is merely hypothetical" (Lovell 1972, p.75) Lunzer (1965) has argued that the essential achievement of concrete operativity lies in the definability of its concepts. "Operational = operationally definable", for example, to define number we place objects in a one - one correspondence, to define length we put things end to end. More recently (1973) Lunzer has decided that while this characterisation is correct, it is not explanatory. His new definition is that the child is aware of the criteria of his own actions in relation to alternative opposing criteria, seen, for example, in the classification experiments. He considers that this is a more powerful analysis than that offered earlier (1965) because only a single model is suggested and the use of stable criteria precedes their recognition, that is, a child may use different types of classification before he realises that others are existing while he is using just one type of classification.

The more recent experiments devised by Inhelder and Piaget (1958), two of which are used in the present research, demand that children reason in respect of scientific and mathematical problems. In relation to the pendulum experiment (ibid, pp. 67-79) Lovell (1972, p.75) explains that when asked to discover which factor affects the swing of the pendulum, the concrete operational child can only introduce or eliminate a variable to see what role it is playing. He pushes or does not push to see if the variable of "push" is causally effective. But the child at the concrete level cannot consider withholding a push each time he changes the length of the wire in order to determine the effect of the variable of, say, length. The crucial turning point for the beginning of concrete operations shows

itself in a sudden mobility, a feeling of coherence; the child does not fall into contradictions and perplexity as happens at the preoperational level.

Piaget believes that certain logico-mathematical structures make very good models of the actual organisation of concrete operations but he does emphasise that "logical axiomatics schematize the real work of the mind after it has occurred". (Piaget 1950, p.31) These structures, therefore, are merely intended to model processes of thought. He maintains that the mother structures of the Bourbaki group correspond to the natural, spontaneous development of children's thinking. (Ripple and Rockcastle 1964, p.33) The Bourbaki came to the conclusion that there are three fundamental, irreducible structures.

- (i) algebraic structures: combining a direct operation with an inverse operation, thus negating it; this is, reversibility by inversion or negation will result in a null product. This can be seen in classification, for example, brown beads (A) and white beads (A^1) = beads (B); beads (B) minus white beads (A^1) = brown beads^(A); white beads (A^1) = beads (B) minus brown (A) beads.
- (ii) ordering structures: based on relations such as $A > B > C$ and $C < B < A$.
- (iii) topological structures: based on the concepts of proximity, continuity, limits and so on.

These logico-mathematical structures of classes and relations have been used by Piaget on the basis for the nine groupings which are said to describe cognitive structure in the concrete operational subperiod: one minor, preliminary grouping and eight major ones. The preliminary grouping is one of the addition of pure equivalence: if $A = B$ and $B = C$, then $A = C$. Groupings I to IV concern operations performed on logical classes; Groupings V - VIII involve operations performed on the relations existing between two or more individuals or two or more classes. The following table is composed from Shayer (1973) and Flavell (1963, pp.175-195).

TABLE I

An explanation of the eight groupings of the concrete operational level

The Groupings Operations performed upon logical classes	Comments taken from Shayer (1973)		Examples of questions used in the history text
	Account given in "Traité de Logique"	Aspects investigated in "The Early Growth of Logic"	
<p>I <u>Primary addition of classes</u></p> <p>The operation performed on simple hierarchies of classes as, for example, trout included in fish, included in animals, included in living beings</p> <p>From Passage 1 (p.3 App.A)</p> <p>(D)^m People living in Greece</p> <pre> graph TD D["(D)^m People living in Greece"] --- C["In Athens (C)"] D --- B["In Sparta (B)"] D --- A["In Corinth (A)"] B --- B1["slaves (B₁)"] B --- B2["not slaves (B₁)"] </pre>	<p>Setting up and decomposing from a set such as "The Sciences" a classificatory system of the form:</p> <p>Maths Pure (A) and Apples (A¹) equals Maths (B)</p>	<p>Mostly involved with all aspects of the reversible relation and the inclusion principle.</p> <p>Concrete examples only of animals and flowers</p>	<p>Passage 1 (p.3 App.A)</p> <p>Q.1(a) Can you tell me some people who lived in Ancient Greece?</p> $D = C + (B_1 + \bar{B}_1) + A$
<p>II <u>The secondary addition of classes</u></p> <p>(D) People living in Greece</p> <pre> graph TD D["(D) People living in Greece"] --- C["In Athens (C)"] D --- Cbar["Not in Athens (C̄)"] C --- C1["Sons of rich parents (C₁)"] C --- C2["Not sons of rich parents (C̄₁)"] Cbar --- B["In Sparta (B)"] Cbar --- Bbar["Not in Sparta (B̄)"] B --- B1["Slaves (B₁)"] B --- B2["Not Slaves (B̄₁)"] B2 --- A["In Corinth (A)"] B2 --- Abar["Not in Corinth (Ā)"] </pre>	<p>Setting up and decomposing a set of alternatives</p>	<p>Tested with fruits and flowers only with the intention of setting up the notion of "the complementary class"</p>	<p>Passage 1</p> <p>Q.1(b) Were all the people who lived in Sparta Greeks?</p> $D = B + \bar{B}$ $B = B_1 + \bar{B}_1$ $D = (B_1 + \bar{B}_1) + \bar{B}$ <p>∴ B₁ lived in Greece and in Sparta but it all depends whether they were Greeks.</p>

* NOTE: The use of C, B etc. seemed helpful here but this type of notation is not used by Piaget.

The complementary classes \overline{C} , \overline{B} etc. refer to an unspecified number of classes of the same rank as the corresponding primary class C, B, etc.

That is, \overline{C} refers to everyone living in Greece except people in Athens. Therefore, one can write:

$$C + \overline{C} = D \text{ and also}$$

$$B + \overline{B} = D$$

Piaget refers to such equations as vicariences (Flavell 1963, p.177) because of the invariant rule that given $C + \overline{C}$ and $B + \overline{B}$ one can always substitute C for B provided that one also substitutes \overline{C} for \overline{B} in the same equation.

Note also that one of the classes in \overline{C} is B and one of the classes in \overline{B} is C (that is, the non-Athenians include Spartans and the non-Spartans include Athenians)

1(c) Were there more Spartans than anyone else in Ancient Greece?

$$D = B + \overline{B}$$

\overline{B} includes $A + C$ and $B = B_1 + \overline{B}_1$

∴ it all depends if \overline{B}_1 were Spartan

Greeks and if

$$B > (A + C)$$

III Bi-univocal multiplication of classes

Flavell gives this example:

Grouping IV in "Traite de Logique"

This grouping is seen by Piaget as the bridge to propositional thinking for the intersection ($A_1 A_2$ etc) is already part of the way to removing the classified elements of their contiguities

No abstractions used in the test material

Passage 1

Q.1(b) Were all the people living in Sparta Greeks?

D_2 (same class of people as D_1)

		A_2 Urban	B_2 Sub-urban	C_2 Rural
D_1	A_1 white	$A_1 A_2$	$A_1 B_2$	$A_1 C_2$
	B_1 black	$B_1 A_2$	$B_1 B_2$	$B_1 C_2$
	C_1 yellow	$C_1 A_2$	$C_1 B_2$	$C_1 C_2$

Piaget calls this bi-univocal multiplication to indicate that each component class of the first series is placed in multiplicative correspondence with each component class of the second series. One can include a third series such as A_3 = short people, B_3 = medium, C_3 = tall and reach 27 combinations.

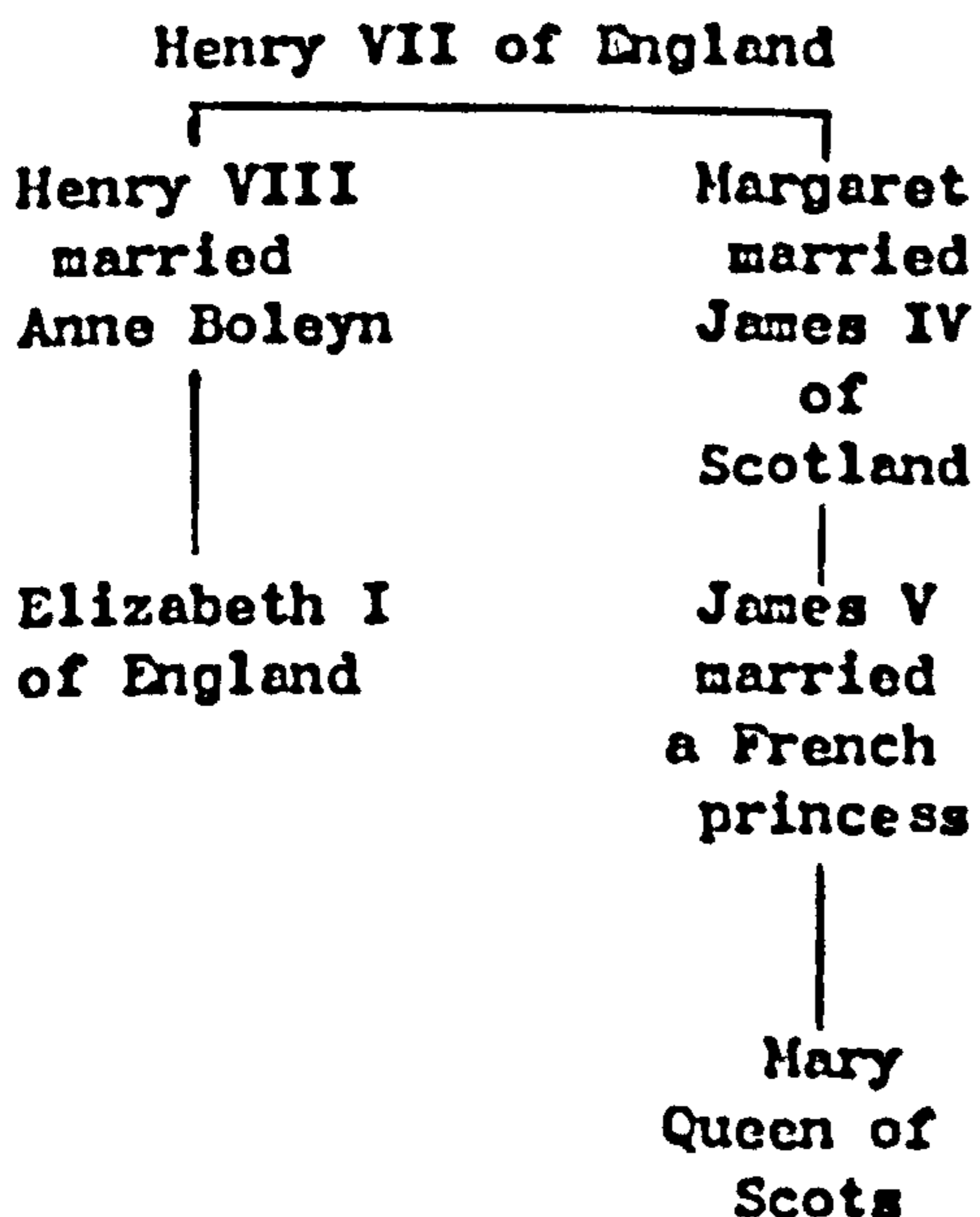
Living in Sparta
(B)

		Greeks D	Not Greeks \bar{D}
Not Living slaves in Sparta (B)	\bar{D}_1	$\bar{D}_1 D$	$\bar{D}_1 \bar{D}$
slaves	D_1	$D_1 D$	$D_1 \bar{D}$

This cannot be answered unless the children know whether $D_1 D$ and $\bar{D}_1 \bar{D}$ are correct (for example, there might be foreign traders who were not slaves but who lived in Sparta).

IV Co-univocal multiplication of classes

Passage 2 (p.)



Classification is structured so that each member is 'placed' in relation to the others.

Not investigated at all.

Passage 3 (p.)
Q.2(c),(d),(e)

"Looking at the family tree (the lines and implications of which were explained to the children), can you tell me the relationships of the following people?"

(c) Henry VIII to Margaret

(d) James V to Elizabeth I

(e) Mary, Queen of Scots, to Elizabeth I.

This is a type of relationship which is called co-univocal (one to many) in which one member of a series (eg. Henry VIII) is set in correspondence with members of one or more additional series. Hence, Henry VIII is a brother of Margaret, uncle of James V and great uncle of Mary.

Operations performed upon the relations which may exist between two or more individuals or between two or more classes
(following Flavell 1963, pp.180-187)

V Addition of asymmetrical relations
(A "is smaller than" B or "A" is the father of B" etc.)

Called seriation, the qualitative setting up of a series without equality of 'steps' being implied.

Parallels TL in the setting up of a seriation but none of the abstract algebraic relationships investigated

Passage 2 (p.)
Q.1(a) "Who died when Mary was a week old?"
"Can you find his name for me?"
Q.2(a) The relationship of Elizabeth I to Henry VIII.
Q.2(b) The relationship of Elizabeth I to Henry VII.

VI Addition of symmetrical relations
seen, for example, within a genealogical hierarchy as in the passage on "Mary Queen of Scots".

This is Grouping VII in Shayer's table. This is very much the same as Grouping IV except that the vertical relations are of equal, one generation steps.

Not investigated at all.

Passage 2. (p.)
Q.2

<p>VII <u>Bi-univocal multiplication of relations</u> which involves the one-to-one multiplication of two or more series.</p> <p style="text-align: center;"><u>Leaves</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Colour</th> <th colspan="4">Size</th> </tr> <tr> <th>small</th> <th>quite large</th> <th>large</th> <th>very large</th> </tr> </thead> <tbody> <tr> <td>pale green</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>medium green</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>green</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>dark green</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Colour	Size				small	quite large	large	very large	pale green					medium green					green					dark green					<p>Grouping VIII in Shayer's table:</p> <p>The matrix of two seriations. A hint towards proportionality and a step towards reciprocity.</p>	<p>Only the colour and size of leaves tested. No testing on the significance of equivalence or reciprocities, such as "Which could you get the same amount of green out of?"</p>	<p>Not tested</p>
Colour		Size																														
	small	quite large	large	very large																												
pale green																																
medium green																																
green																																
dark green																																
<p>VIII <u>Co-univocal multiplication of relations:</u></p> <p>the multiplication of the various symmetrical and asymmetrical relations which define the classes in hierarchies as in Grouping IV - relations like "father of", "first cousin of"</p>			<p>Passage 2 (p5A77A) Q.2</p>																													

Each of these groupings must satisfy certain conditions which make for logical consistency and completeness. (Peel, 1967, pp.94-95) These are the well-known conditions defining a mathematical group: composition, associativity, identity operation, inversion with the added restriction of tautology. "These five conditions ensure that the concrete operations are

consistent and that no operation is unco-ordinated with the system to which it belongs". (op.cit, pp.101-102) In the example which follows, the properties of Grouping I are described using illustrative material from the passage on Ancient Greece.

1. Composition Two elements of the system have as their result a new element of the system.

People living in Corinth (A) + People living in Sparta (B)
+ People living in Athens (C) = People living in Greece (D).

Similarly $A + (B_1 + \bar{B}_1) + C = D$

2. Associativity The sum of the elements is independent of the way they are grouped.

$$A + B + C = C + A + B$$

3. Identity The result of an element and its inverse yields the identity operator (0).

$$\text{Greeks} - \text{Greeks} = 0$$

When this identity operator (0) is applied to any element, that element does not change.

$$\text{Greeks} \overset{+}{-} 0 = \text{Greeks}$$

4. Inversion Every element of the system can be annulled by an inverse element. Thus

$$\text{Greeks} - \text{Greeks} = 0$$

When Class B (living in Sparta) is separated into two sub classes B_1 and \bar{B}_1 and one of them taken out, one class remains. Thus

$$B - B_1 = \bar{B}_1$$

5. Tautology Combining people living in Corinth with people living in Corinth results in people living in Corinth

$$A + A = A$$

As A is a sub class of D (people living in Greece), adding more people living in Corinth does not extend class D, namely, $A + D = D$.

Flavell (1963) is not satisfied in general that the nine groupings are a thorough explanation of children's thinking at the concrete operational stage. He comments: "a Piaget nearer to one's heart desire would no doubt have gone far beyond a simple assertion that the logico-mathematical structures are intended to model thought structures. He would have indicated clearly and unambiguously how each model component is translated isomorphically into a specific behaviour component". (ibid, p.188) But Piaget seems to have examined the nature of logical class and relation operations on their own; "the approach is distinctly logical rather than empirical"; "the groupings were not wholly derived from watching children think". (ibid, p.188)

Piaget comments in the foreword to Flavell's book that research on group structures is far from being complete "and its course so far does not support his (Flavell's) criticism". (ibid, p.viii) Parsons (1960, p.75), however, states that the only sense in which the groupings "are a complete description of concrete logic is that a number of further operations and principles are shown to appear only at the formal level". He explains that the groupings of relations cover only those which satisfy certain equivalence or ordering relations but relations which do not fit into these structures occur constantly in ordinary life. If Piaget is claiming that the groupings offer a complete model of thought at the concrete level, "the claim is obscure and doubtful".

The grouping structure also seems to be used to help to describe values at the concrete operational level. "As the child grows older his goals and values, initially unstable and momentary, begin to become organised into more or less stable hierarchies". (Flavell, 1963, pp.200-201) Understanding moral concepts and the notion of moral obligation supposedly develop in parallel with logical thought. It is also postulated that there is a liaison between the logical groupings structure and interpersonal relations. Frequent encounters and discussions with peers lead to a movement from static egocentrism to multi-perspective reversibility. But, organised interchanges

among people require in turn something like grouping structures in the individuals concerned. This is the classic dilemma of "which comes first"? Piaget's answer to this will be examined later. (see Part II, pp 78-86)

3. Some differences between the concrete and the formal operational stages

The child at the stage of concrete operations can merely postulate a result from the evidence available; he cannot begin with an hypothesis and then discover if the evidence supports that hypothesis. Lovell explains that the child at this stage structures only the reality on which he acts.

(Green et al 1971, p.82) The following answers to a question on the passage "Mary Tudor" (Hallam 1966, 1972) possibly exemplify the distinction between concrete and formal thinking in history. The children were asked whether the people of England would have preferred not to have had any more queens after having lived through Mary's reign.

A boy aged 15 : 10 years, IQ 110, used the data in the passage in a sensible fashion but he did not go beyond that data. "Yes, I think they would. Not many of them really wanted to become Catholics and she burnt some of those that wouldn't. Through giving in to her husband they lost the last British possession in France and that was a blow to Britain".

On the other hand, a girl aged 14 : 10 years, IQ 120, put forward elementary hypotheses during the course of her answer (ibid 1966, p.81) ... the common people probably wouldn't even think about it (the Salic Law), they wouldn't know about it. Mary was not a good queen, but it wasn't necessarily so that all women should make a mess. Yet - was she the first one? They would then accept her as the example of what would follow".

A contrast between concrete and formal thinking for Inhelder and Piaget is that concrete operational children can use reversibility either by inversion (N) or by reciprocity (R) but they cannot synthesise the two forms of reversibility. The characteristic of inversion or negation "is that the inverse operation combined with the corresponding direct operation

cancels the whole thing out: $+A - A = 0$ ". (Inhelder and Piaget 1969, p.136)
 Reciprocity is the form of reversibility which characterises relational groupings. (op. cit., p.137) "Both kinds of reversibility exist at the level of concrete operations. Lengthening can be negated by shortening or compensated for by thinning". (ibid, p.137) At the formal level these two forms of reversibility become integrated into a single system. Thus, in the balance experiment, if $+W$ is regarded as the basic operation of increasing the weight, the formal operational pupil can co-ordinate $-W$ (the inverse N) with $-L$ (decrease the length, which is the reciprocal R of $+W$). The two forms of reversibility become synthesised in the INRC group (pp.29-30)

The concrete operational child can deal only with first order operations derived from the co-ordinations of action on reality seen in number, length and temperature. (Lovell 1972, p.78) A child at the formal level, however, can structure relations between relations as in metric proportion which involves recognition of the equivalence of two ratios. (ibid, p.78) "In this sense proportions presuppose second degree operations, and the same may be said of propositional logic itself, since interpropositional operations are performed on statements whose intrapropositional content consists of class and relational operations". (Inhelder and Piaget 1958, p.254) Thus the typical 11 plus verbal comprehension item ("toe is to foot as finger is to - ") is only pre-proportionality for Piaget since there is no equivalence between crossed products as there is in, for example, $3 : 7 :: 9 : ?$ (Lovell 1972, p.82) Lovell (op. cit., pp.82-83) quotes an experiment by Piaget (1968) which seems to show the development of children's understanding of proportion. Three "eels" A, B and C, respectively 5cm, 10cm and 15cm long, are to be fed "balls of meat" (discontinuous units) on the assumption that the strength of each eel's appetite will correspond to its length. The "eels" also have to be fed with "biscuits" or little lengths of cardboard on the same principle of appetite (continuous units). The children were asked various questions such as: "If eel C gets 9 balls of meat, how many should A and B be given? It is said that the children's responses fell into four broad stages:

(a) Just "more" or "less", any number sufficing provided $B > A$ and $C > B$.

(b) Numerical quantification in an elementary form. For example:

B^1 (food) for Eel B should equal

A^1 (food) for Eel A plus one more

and C^1 (food) = $B^1 + 1$

This stage came rather earlier in the case of the discontinuous compared with the continuous units.

(c) Pre-proportions when the children compare the intervals between A and B as "more" or "less" than the difference between B and C; the equality of cross-products is missing.

(d) True metric proportionality.

4. The formal operational stage

Formal thinking constitutes "the realm of pure thought", the crucial aspect being an ability to construct and test hypotheses; a readiness to go outside the limits of the subject matter. "Rigorous testing of hypotheses entails an awareness of alternative hypotheses and their implications. The subject must be aware not only of the relations between the hypotheses and their consequences, but also of the second-order relations between the various hypotheses. Therefore a first characteristic of formal reasoning is the construction of second order relations". (Lunzer 1968, p.267)

Since verbal statements - propositions - are substituted for objects, the adolescent has available a much greater number of operational possibilities than the simple groupings of classes and relations. "Formal operations ... consist entirely of 'implications' ... and 'contradictions' established between propositions which themselves express classification, seriation etc." (Piaget 1950, p.149) Propositional logic is a "logic of all possible combinations" where the propositions are regarded as hypotheses, some of which will be confirmed and some denied by subsequent investigation.

This hypothetico-deductive nature of formal thought means that "reality ... is now secondary to possibility." (Inhelder and Piaget 1958, p.251) Instead of being dependent upon the empirical evidence available, the child is able to postulate an hypothesis and then rigorously deduce the consequence. The premises of this hypothetical reasoning need not necessarily be consistent with common-sense experience. This reversal of direction between reality and possibility "is a turning point in the development of intelligence, at least in so far as intelligence may be thought of as an organisation that is both stable and mobile". (q. ut, p.258)

Inhelder and Piaget declare that these features of formal thinking can be seen in all types of problems; "we see concepts of proportions and especially combinatory considerations appearing at the same level in the most diverse areas. It is as if the system of possible operations were an internal network along which a given thought content, once it had engaged the network, spread out immediately in all directions at the same time". (q. ut, p.265) Lunzer (1965, pp.23-45) and Lovell (Green et al 1971, Chapter 5) point out that the Piagetian experiments described in "The Growth of Logical Thinking" (1958) seem to fall into two broad groups. One group, including the pendulum and combination of colourless liquids experiments, requires pupils to provide proofs of hypotheses by the experimental manipulation of variables. The second group asks the children to solve problems necessitating the understanding of reciprocity in physical systems and to discover relationships involving direct and inverse proportion. Lovell (ibid, p.83) remarks that "the difficulty has been to see the relationships that exist between the thinking skills involved in these two groups of problems". He gives empirical evidence to show that the test scores obtained on the two groups of tasks do show some tendency to cluster together, referring to work by himself (1961), Hughes (1965) and Shields and Lovell (1967). Lunzer (1965, pp.23-45) at first decided that the two groups of problems are related in the sense that they require second order relations

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or relations between relations. More recently (1973) he finds this definition "woefully inadequate", (ibid, p.4) and considers that the "complex of interpretations" contained in "The Growth of Logical Thinking" cannot be assimilated as an adequate theory of more advanced thinking since "it is neither sufficiently precise to function as a model, nor is it consistent with all the facts". (op.cit. p.9) He does not attempt to put forward a new interpretative model which he thinks would be "speculative" in the present state of knowledge. Rather, he suggests two key features which appear to be entailed in thinking at the formal level.

Acceptance of lack of closure (A.L.C.) seems to be a necessary but not a sufficient condition for most forms of advanced reasoning. This refers to the realisation that the initial information offered does not permit of an unambiguous inference about a relevant variable, "but instead permits a reduction of alternatives so that the final determination can only be made at a subsequent stage, when more information has been obtained". (op.cit., p.5) The following comment by a girl of 13 : 6 years on whether William of Normandy was cruel or not seems to show A.L.C.

"In the last one (the devastation of the North) he seemed to have no mercy, but in the first one (the battle of Hastings) he seemed to have a lot of mercy - by reports, of course".

Any child who took part in this present research and who commented that there was not enough information in the passages by which one could make a sound judgment would presumably also be accepting a lack of closure. On the other hand, the child who decides William was cruel "because he killed the English" has not shown that he possesses A.L.C. A more developed answer would have to reveal that he possesses not only A.L.C. but also the presence of multiple interacting systems (M.I.S.).

Lunzer defines M.I.S. (op.cit., p.10) as the presence of multiple, interacting

systems. In the combination of colourless liquids experiment the action of any one factor is a system "and the task of the subject is precisely to disentangle the actions of the several systems involved". (q.c.t., p.12)

Possibly the answer quoted on p.31 demonstrates both A.L.C. and M.I.S. in a verbal context. Lunzer warns that one cannot deduce that the subject who possesses A.L.C. and M.I.S. is thereby a "formal reasoner". Other important factors are familiarity with the content of the task and the credibility of the experiment. In the experiment involving sliding bodies on an inclined plane, for instance, logical necessity and initial belief go together, whereas in the pendulum experiment they do not since initial belief suggests that weight must be a relevant factor. Lovell (Green et al 1971, p.88) considers that it is not possible to say for certain whether operational schemata are just not available in certain situations or whether it is necessary to posit some kind of analytic set (Bellin) which activates the individual's cognitive apparatus and allows him to analyse the data inherent in the situation.

The recent work of Inhelder and Piaget has been concerned with trying to find a "psycho-logic" which will mediate between psychology and pure logic as mathematical physics relates physics, concerned with the real world, and mathematics, where the criterion of truth is the internal consistency appropriate to a rigorous deductive system. (Piaget 1953, p.25) Piaget argues that the system of 16 binary propositions can be used to describe the underlying structure of adolescent thought. He does not expect that the child of twelve to fifteen will establish the relevant laws of logic. "But it is remarkable that at the level at which he becomes capable of combining elements by an exhaustive and systematic method he is also capable of combining ideas or hypotheses in affirmative or negative statements, and thus of utilising propositional operations hitherto unknown to him: implication (if - then), disjunction (either - or, or both); exclusion (either - or) or incompatibility (either - or, or neither - neither), reciprocal implication,

etc". (Inhelder and Piaget 1969, pp.135-136)

Following "modern symbolic or algorithmic logic, which is much closer to the real working of thought than the syllogistic logic of Aristotle" (op.cit, p.134), Inhelder and Piaget use 'p' and 'q' to express two propositions so that "the p's and q's with their negations \bar{p} and \bar{q} stand for the observation that a given variable and its result is or is not found in the experimental situation". (Inhelder and Piaget 1958, p. XVIII) Here are 16 types of combinations which Inhelder and Piaget claim were revealed in one subject's answer. (op.cit, pp.102-104)

1. Disjunction $p \vee q$ ($p \cdot \bar{q}$) \vee ($\bar{p} \cdot q$) \vee ($p \cdot q$)
2. Its inverse, conjunctive negation ($\bar{p} \cdot \bar{q}$)
3. Conjunction ($p \cdot q$)
4. Its inverse, incompatibility (p/q) = ($p \cdot \bar{q}$) \vee ($\bar{p} \cdot q$) \vee ($\bar{p} \cdot \bar{q}$)
5. Implication ($p \supset q$)
6. Its inverse, non-implication ($p \cdot \bar{q}$)
7. Converse implication ($q \supset p$)
8. Its inverse ($\bar{p} \cdot q$)
9. Equivalence ($p = q$)
10. Its inverse, reciprocal exclusion ($p \vee \vee q$) = ($p \cdot \bar{q}$) \vee ($\bar{p} \cdot q$)
11. Independence of p in relation to q $p [q]$
12. Its inverse $\bar{p} [q]$
13.)
14.) Independence of q and q in relation to p is $q [p]$ and $\bar{q} [\bar{p}]$
15. Complete affirmation ($p \cdot q$)
16. Its inverse, complete negation (o)

The formation of propositional logic depends on the establishment of a combinatorial system "which is manifested in the subjects' potential ability to link a set of base associations or correspondences with each other in all possible ways". (op.cit, p.107) The experiment used to examine this contention in the present thesis is the combination of colourless liquids (ibid, pp.107-122 and the present study pp.26-28) In this experiment children have to

combine liquids from five bottles labelled 1, 2, 3, 4 and G in order to discover the relationships existing among them. A mixture of 1 + 3 + G produces a yellow solution, 2 contains water, 4 thiosulphate, a bleaching agent. Inhelder and Piaget state that at the same time as the subjects combine the liquids, they form their judgments according to a combinatorial system having the same form, "that of the sixteen binary propositions (combinations one-by-one, two-by-two, three-by-three, four, or zero of the four base possibilities $p.q. \vee p.\bar{q} \vee \bar{p}.q \vee \bar{p}.\bar{q}$ ". (ibid, p.118) These are the actual combinations available.

<u>Combinations</u>	<u>Labelled liquids</u>
4	1 + G, 2 + G, 3 + G, 4 + G
6	1 + 2 + G, 1 + 3 + G, 1 + 4 + G, 2 + 3 + G, 2 + 4 + G, 3 + 4 + G
4	1 + 2 + 3 + G, 1 + 2 + 4 + G, 1 + 3 + 4 + G 2 + 3 + 4 + G
1	1 + 2 + 3 + 4 + G
1	zero

Such combinations do not seem to need to be expressed in terms of four base possibilities; in the experimental situation the use of propositional logic seems to complicate the experimental findings in an unnecessary manner. But Inhelder and Piaget contend that when these subjects combine factors in the experiment, by the same token they generate a combinatorial system which corresponds to the observed facts. (ibid, p.118) "This is how they (the subjects) determine the links of conjunction, implication, exclusion, etc., by means of which they interpret the experimentally established observations. Moreover, this fact explains the progress ... which is noted ... in the formulation of verbal statements". (ibid, p.118) In particular, they argue that this reasoning bears on bottle 2 and bottle 4. For the possible influence of liquid 2 on the combination, let p = the presence of colour and q = the presence of liquid 2. The subject at the formal levels works out that 2 has no effect on the colour (complete affirmation) for one

can have $(p.q) \vee (p.\bar{q}) \vee (\bar{p}.q) \vee (\bar{p}.\bar{q}) = (p * q)$ all possible combinations, thus absence of particular links.

On the other hand, between colour (p) and liquid 4(q) there is incompatibility: $(p.\bar{q}) \vee (\bar{p}.q) \vee (\bar{p}.\bar{q}) = p/q$ (op.cit., p.119)

After having seen over 200 children attempt to solve this problem, each child on two different occasions, it seems that the successful subjects obviously need the ability to envisage all possible combinations but they are not always able to discover the effects of 2 and 4 once they have worked through the 16 possible combinations. The simplest and neatest way of discovering the effects of these bottles seemed to be for the children to produce the yellow solution (1 + 3 + G) and then to add liquid from either bottle 2 or bottle 4. With 'p' as the presence of colour, the adding of 2(q) appears to demonstrate independence ($p \text{ [} q \text{]}$) rather than complete affirmation ($p * q$), whereas adding 4(q) to another combination of 1 + 3 + G shows incompatibility, as Piaget states (p/q). Looking at the experimental results as a whole, it is not immediately obvious that the successful children's answers contained the 16 binary propositions. According to Bynum, Thomas and Weitz (1972), however, the one protocol analysed in detail by Inhelder and Piaget (1958, pp.103-104 and ^{see} earlier, p.26) does not show evidence of the 16 binary operations. They found evidence of only 8 of the 16 operations and claim that the other 8 analyses were faulty. (1972, p.129) Bynum et al, therefore, query whether a fully developed formal operational thinker uses all 16 binary operations of truth-functional logic. (, p.132) What the answers of the present subjects did seem to reveal at the formal level was the ability to achieve multiplicative correspondence.

The difficulty one has in relating the combinational system with propositional logic is increased when one tries to examine in logical terms how far this system is coterminous with that other great achievement of the formal operational stage, the fusion of the two forms of reversibility, inversion and reciprocity, into the I.N.R.C. group. Inhelder and Piaget do

this by asserting that the integrated structure for adolescent thought has both lattice and group structures. They suggest that while the combinatorial operations express some of the laws of totality found in the lattice, in contrast "the proportional scheme effects the transition between the schemata originating in the lattice and those which are integral with the (I.N.R.C.) group structure". (1961, p.314)

The I.N.R.C. group can be explained by reference to a balance experiment devised by Inhelder. (1961, pp.173-181) To balance different weights on two arms of a balance, adolescents have to use both reciprocity and negation at the same time, this ability to combine two types of reversibility being impossible before the formal operational level.

p = a statement of a fixed increase in weight

q = a statement of a fixed increase in distance

\bar{p} = a statement of a corresponding diminution in weight

\bar{q} = a statement of a corresponding diminution in distance on the same arm.

Propositions p^1 q^1 \bar{p}^1 \bar{q}^1 correspond to statements that the same actions are occurring on the other arm.

Formal level subjects are said to understand the following relations of inversion and reciprocity, the I.N.R.C. group, but with p q chosen as the identical operation I .

$I (p.q)$ = to increase simultaneously weight and distance on one arm

$N (\bar{p} \vee \bar{q})$ = to reduce distance while increasing the weight, or to reduce weight while increasing the distance or to diminish both

$R = (p^1, q^1)$ = compensates I by increasing both weight and distance on the other arm

$C = (\bar{p}^1 \vee \bar{q}^1)$ = cancels R in the same way that N cancels I

Parsons (1960, p.80) comments that the I.N.R.C. group is too simple to describe the balance problem fully but it describes the situation where two of the variables are fixed. In a more recent work (1969, pp.142 Note 5)

Inhelder and Piaget explain the I.N.R.C. group in this manner,

increasing weight on one arm ($\div W$) = I

decreasing weight on one arm ($- W$) = N

compensating $\div W$ by decreasing the length ($- L$) = R

increasing the length to the original position ($\div L$) = C

Therefore, $I : R = C : N$ (or by crossed products $IN = RC$). In actual practice, this equation does not seem to work unless the weight (W) can be placed on the fulcrum. Farson's (1960, p.81) criticism that the connection between the logical group I.N.R.C. and the isomorphic group connected with the physical system "is not very clear and seems rather tenuous" would still seem pertinent.

Inhelder and Piaget extend their use of the I.N.R.C. group by stating that through the lattice and group structures the adolescent is able to reason formally in many different fields such as the following: proportions, notion of probability, notion of correlations, multiplicative compensatives and forms of conservation which go beyond direct empirical verification. For proof of the last, for example, they use the following propositional calculus in an experiment with a ball:

p = the statement that the ball loses motion

$q, r, s \dots$ = statements that give any reason such as friction, distance, etc. for the ball stopping

The adolescent can use these: $p \supset q \vee r \vee s \dots$

but can also invert the propositions, thus: $\bar{q} \vee \bar{r} \vee \bar{s} \dots \supset \bar{p}$ and reach the notion of inertia. (Inhelder and Piaget 1958, pp.328-329)

Inhelder and Piaget expect that the achievement of the combinational system and double reversibility will affect also the verbal manipulation of propositions and hypotheses. (1969, p.145) One wonders whether it is possible to see some representation of the I.N.R.C. group in the following answer to Question 7, Passage 5 (Appendix A, pp.10-11). There certainly

seems evidence of what Feigl has described as the ability to "think in terms of opposing and balanced forces and in terms of cancellation of forces and their compensation by other forces". (1967, p.162)

"Do you think William of Normandy was a cruel man?"

"It depends what you call cruel. If the definition of cruel is to kill and ravish and burn for any purpose whatever, William was cruel. On the other hand, if one is prepared to accept political necessity, William's cruelty was justified. Compared with many other feudatories, (knights et cetera) he was essentially a kind man. They ravaged generally for their own advantage and without care for the common folk or their land. Duke William, if the common people went with him, he seems to have been prepared to protect the common people from ravages. If, however, they went against him he seems to have treated it as a deliberate breaking of faith and acted accordingly. So, by the standards of his own day, for we cannot really judge him by our standards, he was probably not a cruel man."

This answer also illustrates the formal thinker's use of conditional conjunctions: "if", "on the other hand", "compared with". Inhelder and Piaget refer to these (1969, p.136): "(the formal thinker) is also capable of combing ideas or hypotheses in affirmative or negative statements, and thus of utilising propositional operations hitherto unknown to him: implication (if - then), disjunction (either - or, or both), exclusion

(either - or)" and so on. When children start answering questions on verbal passages it is often striking how the more advanced thinkers begin to use conditional conjunctions early in their answers.

There has been serious and continued criticisms of Piaget's use of propositional logic since the days when Isaacs (1951, p.187) stated that the use of a logic which recognises only truth and non-truth leaves out "all the vast field of uncertainty and probability, problematic truth and speculation" and "all the world of degrees and intermediate states and cases". These remarks are undoubtedly appropriate for any research into historical thinking. Parsons (1960) comments that Piaget "vacillates" in his use of the standard notation of propositional calculus, his use of it obscuring some features of inferences made by the subjects which logicians call logical. "This vitiates the claim that propositional logic provides the essential structure of the final stages of logical development". (ibid, p.75) Furthermore, "Piaget's methods would make hash out of any attempt to give a formal criterion of logical implication, equivalence or validity". (q.ct, p.78) Flavell (1963, p.428) warns of "Piaget's bent towards theoretical over-elaboration often bordering on the pretentious" and of the lack of co-ordination between the "imposing system of logical propositions ... (and) Piaget's body of empirical data on cognition". Wallace (1965, p.208) also thinks that "Piaget's theories stretch particularly far beyond his observations".

Lunzer (1973) considers that most of the Piagetian experiments in the experimental control of variables do not feature the I.N.R.C. group. Furthermore "there is little warrant for (Piaget's) a priori assertion that advances in thinking are a function of advances in logic". (ibid, p.17) Lunzer would regard "logical and mathematical proof as an activity sui generis, fairly removed from the business of everyday reasoning and even from most scientific reasoning". (q.ct, p.22) Problems of logical inference constitute a special class and should not be taken as a touchstone for the

quality of thinking in general. "At the very least, we have to recognise that the principle of material (logical) implication plays only a very limited part in everyday thinking or in scientific thinking, yet it is crucial ... to most logics". (op.cit., p.29) Within logic, though not outside it, a proposition is meaningful if it is either true or false. (op.cit., p.30) Logical or material implication is meaningful because it corresponds to a precise set of rules. Hence, within a logical calculus one could have this workable assumption: "That Piaget is a psychologist implies wine is intoxicating". Wason and Johnson-Laird (1972,) also point out that subjects will be affected by the degree of reality in statements. "The ordinary mortal passes into a looking glass world when confronted by a problem which is abstract, or symbolic, in nature". (ibid, p.83) Lovell (1973, p.2) also thinks that the following contention by Inhelder and Piaget is "plainly not the case in practice": "In contrast with the preceding (concrete) level, the operational form is entirely dissociated from thought content." (1958, p.265) Lovell comments that many studies have shown that the difficulty of reasoning problems is increased when the content is abstract or clearly false, for example, reasoning involving the premise "trout are larger than sharks". (1973, p.2) Wason and Johnson-Laird (1972) are disenchanted with propositional calculus as a criterion for logical ability. "Much of the individual's thinking lies outside the realm of the calculus, indeed outside any branch of formal logic, since it concerns questions of causality." (ibid, p.86) They ask how is the logic of the ordinary conditional statement to be represented within the propositional calculus since the conditional takes on the colouring of its surroundings; "its meaning is determined to some extent by the very propositions it connects". (op.cit., p.92) They give the following as an example for their contention that "it is clear that no conventional notion of logical form is viable for the analysis of ordinary deduction". (op.cit.,p.93)

Statement 1: "If I keep animals^(a) in my flat, then I'm liable to eviction".

Statement 2: "I keep an alligator^(b) in my bath, therefore I'm liable to eviction"

The native speaker appreciates that (b) is a special case of (a) and it is therefore unnecessary to have separate premises to establish this point. They are convinced that "the only viable notion of logical form, for the analysis of everyday inference, is one which takes the meaning of the statements as fundamental rather than the purely superficial disposition of words within the premises". (q. ut, p.94)

Empirical research seems to show that even intelligent adults cannot handle abstract propositions in purely logical terms. Wason presented university students with four cards, showing the following symbols:

E	K	4	7
(p)	(\bar{p})	(q)	(\bar{q})

Each card has a letter on one of its sides and a number on its other side. The students were then given the following rule which refers only to the four cards. (q. ut, p.173)

"If a card has a vowel on one side, then it has an even number on the other side.

Your task is to name those cards, and only those cards, which need to be turned over in order to determine whether the rule is true or false".

Wason and Johnson-Laird state that even professional logicians have been known to err on this problem "and only the rare individual takes us by surprise and gets it right". (ibid, p.173) One wonders if "only those cards" is an explicit enough instruction in that it does not necessarily specify the minimum number of cards. The difficulty seems to be in the subjects' wanting to verify the rule of "if p then q" instead of falsifying it by selecting cards E and 7 (p and \bar{q}). These are the results for 148 subjects. (q. ut, p.182)

p and q	59
p	42
p, q, \bar{q}	9
p and \bar{q}	5
others	13
	<hr/>
	128
	<hr/>

They comment that the theory of formal thought assumes that adolescents are capable of thinking in terms of propositions which take account of the possible and the hypothetical. They should be able to isolate the variables in a problem and subject them to a combinatorial analysis which nicely exhausts the possibilities. "But this, of course, is exactly what most of our subjects conspicuously fail to do." (op.cit., p.189) Piaget claims (1966) that the adolescent will ask whether fact x implies fact y, and frequently do this by formulating a proposition in the form of 'if p then q'. In order to test this proposition; he will search for a counter-example such as 'p and not q'. "Such a description reads like an account of what our subjects do not do." (op.cit., p.190) One answer to the divergence between their results and Piaget's is that formal operations may be elicited only by familiar tasks and are not cognitive skills which can be applied to an problem whatsoever. Some support for this solution was provided when the card experiment was presented in a familiar guise. The condition rule was, "Every time I go to Manchester I travel by train". The four cards showed respectively, 'Manchester' (p), 'Leeds' (\bar{p}), 'Train' (q) and 'Car' (\bar{q}). Far more subjects were successful with this problem than the other card problem. This result, together with the results on an 'envelope experiment' (op.cit., p.182), leads Wason and Johnson-Laird to conclude that, "The conditional rule, which proved so recalcitrant when its terms and conditions were arbitrary, has become almost trivially easy when it is embodied in a real task". (op.cit., p.193) Their final decision is that "content is crucial, and this suggests that any general theory of human reasoning must include an important semantic component". (op.cit., p.245)

The provocative and stimulating nature of Piaget's theories continues to exercise men's minds and it would be hazardous to ignore completely Piaget's account of propositional logic as a model of formal thinking. Although realising its limitations, the evidence at present, however, would seem to weigh against any thorough-going acceptance of that model, especially for a basically verbal subject such as history. For this research, as in the earlier (Hallam, 1966), the verbal criteria for formal thinking devised by Piaget as early as 1924 will be used: "reasoning from premises that are merely assumed"; "a sort of detachment from one's own point of view" (1928 English translation, p.71 and *passim*). Possibly the most useful "short-hand" description of formal thinking for this purpose is that given by the translator of "The Growth of Logical Thinking" (1958): the adolescent's thinking might be impressionistically characterized as a sort of mental scaffolding so that the agile subject can move vertically and horizontally from one point to another without reaching impasse. (*ibid*, p.xx)

Inhelder and Piaget do state that "psychology is not logic" (*op.cit.*, pp.332-333) and that symbolic logic must always be regarded merely as a tool, a means of analysis: "the empirical reality behind the symbolic translation is the field of co-ordinated behaviour". They extend their investigation of adolescents' thinking into a discussion whether "logical transformations fit the general modifications of thinking which are generally agreed - sometimes explicitly but often implicitly - to typify adolescence". (*op.cit.*, p.335) Adolescence is considered as synonymous with the assumption of adult roles. This development "varies considerably among societies and even among social milieus". (*op.cit.*, p.336) Therefore, the age at which formal thinking begins "must be extremely relative, since the logic of the so-called primitive societies appears to be without such structures". (*op.cit.*, p.337) They point out (1969, p.151, Note 10) that the attitude of adult society is an essential factor in the progress towards formal thought: "Negligible in conservative societies, the adolescent is the man of tomorrow in countries in the throes of change".

Thus, while the development of formal structures is linked to maturation of cerebral structures, their realisation depends "on social as much as and more than on neurological factors". (1958, p.337)

While psychoanalysts like A. Freud and E. Erikson have stressed "Successive identifications" with elders who serve as models, Inhelder and Piaget affirm that these investigators have neglected the role of cognitive constructions that pave the way for an anticipation of the future. (1969, p.150)

"The essential difference between formal thought and concrete operations is that the latter are centred on reality, whereas the former grasps the possible transformations and assimilates reality only in terms of imagined ... events". (q.ub., p.149) They consider that while the adolescent's theories may be awkward and stereotyped, they are his bases for the assumption of adult roles and are vital for the assimilation of social values.

Adolescents begin to consider themselves the equal of adults and think of ways of changing society, whether in some limited way or completely. The egocentric aspects of thought are recapitulated in adolescence as the youths try to adjust the environment to their ^{eyes} eyes: "the adolescent's egocentrism comes out in a sort of Messianic form". (1958, p.344)

As the adolescent increases in knowledge, so he is able to "cure himself of his idealistic crisis" and this leads to the true beginning of adulthood". The adolescent, they continue, "becomes an adult when he undertakes a real job. It is then that he is transformed from an idealistic reformer into an achiever". (1958, p.345) It would seem that Inhelder and Piaget are thinking of a particular type of adolescent since they mention in "The Psychology of the Child" (1969, p.151) that the adolescent wishes to choose a career "that will permit him to satisfy his need for social reform and for new ideas". A great many of the average children in English schools do not show overtly that their desire for a career is based on any altruistic motives. Inhelder and Piaget seem to expect that adolescents become adults when they learn to conform with the prevailing mores of their society; then

idealism is "cured". This would be an interesting area for further study. How far are pupils who leave school at 16 years more realistic in their aims and ambitions and more ready to adapt to society than those who remain into the sixth form? Do university students show more desire to change society than students learning to become teachers in the Colleges of Education? And if this is so, how far is that difference caused through the latter having to adapt during their training to a fairly conservative school society in which they expect some respect to be shown to them as teachers?

CHAPTER 3 : DEVELOPMENT THROUGH THE STAGES OF THINKING

Inhelder's criteria (Inhelder and Tenner 1956, Vol. I and Kessen and Kuhlman, 1962) for the different stages postulated by Piaget as an aid to the analysis of cognitive development remains a good basis from which to approach this controversial area, although a great deal of recent research work casts some doubt on the neatness of this framework and the boldness of the early claims. Beilin (Green et al, 1971, Chap. 9), for example, begins his recent, very thorough account of developmental stages by citing some of the main criticisms: the stage construct is a false issue incapable of being empirically tested; it is only a reflection of a methodological problem that results from the way developmental data are treated; and it diverts energies from more important problems which are both solvable and meaningful. Inhelder and Piaget, however, still affirm that the theory of different stages has psychological meaning: ^{for Beilin} "its persisting importance lies in the implication that it pertains to real entities". (ibid, p.173)

1. Each stage involves a period of formation (genesis) and a period of attainment

The period of formation in each stage is characterised by instability. Attainment reveals the progressive organisation of a composite structure of mental operations - a "structure d'ensemble". One can then interpret a broad and diverse range of behaviour in terms of each structural whole relevant to each particular stage. According to Piaget the typical operations of a given level are not simply juxtaposed but are organically interconnected by ties of implication and reciprocal dependence that group them into total structures. For instance, at the concrete operational stage "for a given concept, the (eight) possible groupings appear to be constituted at about the same time". (Piaget 1941, quoted in Pinard and Laurendeau^v 1969, p.138)

This seems somewhat of an extreme claim since the type of concept is not specified. Furthermore, Flavell argues that empirical evidence has not been discovered for all eight groupings. Dodwell (Sigel and Hooper 1968,

pp.104-112), found with a group of 60 children aged between 5 : 2 and 8 : 8 years that the understanding of the nature of hierarchical classification appeared to develop to a large extent independently of the concept of cardinal number as measured in tests of correspondence.(ibid, p.112)

This is contrary to Piaget's expectation that the child must develop basic operations on classes and serial relations before he is able to develop correct operations on number. This type of asynchronisation at the concrete level has been found by a number of research workers (Uzgiris (1964) in Flavell and ^{Elkind} ~~Elland~~ 1968, p.53, Tuddenham in Green et al, 1971, Chap. 4; Smedslund 1964; Kofsky and Shantz in Sigel and Hooper, 1968) Lovell and Ogilvie (1961) even found that children employed different approaches to the same conceptual area. Sigel and Hooper (1968, p.443) consider that the question of the inter-relationship between responses to different tasks involving the same operations "may well turn out to be something of an Achilles heel in Piaget's system".

The inconsistencies noted in children's responses at the concrete level foreshadow similar differences at the formal level. Hughes'(1965) thesis using five Piagetian experiments showed that cognitive development in 40 boys studied from the age of 11 years to 15 years varied according to both its field of application and the individual concerned. Performance in a Series and Numerical Analogies test, for example, was not closely related to performance in the five Piagetian experiments, one of which was the problem of equilibrium in the balance. Bart (1971) tested 90 adolescents from Chicago schools on four Piagetian experiments. He also gave them three formal operational reasoning tests based on a set of logic items which required for their solution the choosing of a correct solution from six alternatives. Factor analysis revealed that there was a large general formal reasoning factor and a factor that distinguished the Piagetian experiments from the formal reasoning tests. Davies (1965) examined 25 boys and 25 girls aged between 14 : 8 and 15 : 10 years on verbal reasoning,

verbal comprehension and non-verbal tests such as the balance experiment. An analysis of variance showed that individuals had marked preferences for non-verbal or verbal tests and also preferences for particular tests. Davies' criteria for formal reasoning on the verbal passages might cast some doubt on this conclusion, though (see later, pp.193-194). Lodwick (1972) gave three short, simple passages on popular history and four traditional Piagetian experiments like the pendulum problem to four groups of children aged 9, 11, 13 and 15 years on average (64 children altogether). His results indicate that the ability to reason at a particular level in one area of thinking does not imply the ability to reason at that level in other areas. While the verbal comprehension questions belong to one group of tests and the scientific and mathematical experiments belong to another, there was, however, a significant degree of agreement between the responses to the verbal comprehension questions and the scientific and mathematical Piagetian tests.

There have been a number of explanations for this "rather inconsistent inventory" (Pinard and Laurendeau^v 1969, p.141). Possibly factors foreign to the very nature of structures d'ensemble are playing a part. How far does perception have an effect on the understanding of, say, melted and solid butter compared with the conservation of plasticine rolled into different shapes? Would people answer these problems at different levels? Do verbal answers hinder children's thinking compared with their non-verbal manipulation of material? How far does the novelty of the situation determine the type of answer? Wohlwill (Sigel and Hooper 1968, p.481) comments that "even in the thinking of adults we meet frequent instances of failure to apply or generalise a concept or principle which is presented in unfamiliar ways or extended to novel situations". This was shown clearly in Wason's four-card experiment quoted earlier. Wallace (1967, p.119) thinks that concrete reasoning has a very limited generality during the period of acquisition, seeming to be acquired in one restricted situation at a time. This may account for some of the inconsistencies; should not

children be tested at, say, the ages of 10 or 11 years when the structure d'ensemble should have reached some consistency. Testing them at this later age may account for one of Lovell's findings (Sigel and Hooper 1968) that the children ^{he} examined demonstrated a stage type performance on four tasks of the addition and multiplication of classes, visual seriation, and the multiplication of asymmetrical transitive relations. While adolescents seem to prefer one group of tests to another if verbal and non-verbal are presented at the same time (Davies 1965; Lodwick 1972), they do tend to reason consistently across tasks. (Lovell in Green et al 1971, p.79) Lovell points out that with bright children, once the operational schema is available in some areas, it goes rapidly across the field "whereas in the dull child, it sort of pokes in this area, and then occasionally here, and there's literally no transfer". (op.cit., p.80) Inhelder states that in Geneva they had found relationships and ordering much more stable among some sets of tasks than among others. (ibid, p.80) M.V. Hunt thinks that Piaget is probably correct in asserting that concrete operations become "Gestalt-like operational structures" but he suspects that Piaget is wrong in asserting that these emerge quickly and all at once. Rather, they appear to emerge tentatively from coping with a given kind of problem in one situation, then again with that kind of problem in another situation, in another ... and so on, then from coping with related kinds of problems in a variety of situations until the rules for the situation become generalised. (Elkind and Flavell 1969, p.54)

2. Each structure constitutes at the same time the attainment of one stage and the starting point of the next stage. Thus, each stage has only a momentary stability

Inhelder states that this characteristic means that Piaget's is the only theory which links the most basic biological mechanisms to the most superior achievements of human thought. Mischel (1971, pp.323-325) is very doubtful about any such claim. He thinks that crucial differences

between physiological and cognitive "structures" are blurred. Biological equilibria are maintained by the causal interaction of specifiable physical forces such as chewing and digesting foodstuffs. But Piaget (1967, p.101) defines psychological equilibrium "very broadly as the compensation resulting from the activities of the subject in response to external intrusion", characterising this process in ways which make any analogy to the physical process extremely thin. (ibid, p.324) In support of this contention Mischel argues that the "external intrusion" is not a physical stimulus. What the subject responds to depends on the cognitive schemas to which the stimulus must be assimilated. What the subject responds to is his construal of the external intrusion.

Another criticism of the constantly evolving nature of the stages is posited by Wohlwill who considers that this characteristic serves only to confuse the lines of demarcation which separate the different stages. Pinard and Laurondeau (1969, p.148) ask how finely does an investigator examine a child to discover how many intermediary steps there are between two stages. In the research on historical thinking, and also when grading the Piagetian experiments, there are some answers assessed at the transitional level between pre-operational and concrete, concrete and formal levels. Having three sub-stages at both the concrete (2A, 2AB, 2B) and formal levels (3A, 3AB, 3B), as well as intermediate stages (1/2A and 2B/3A), means that the assessors have to examine with some exactness the criteria for each of those sub-stages. This should mean that an answer designated in a global manner as "concrete" reflects reasonably well the characteristics of that general period of thought. Such an approach to assessing children's answers should measure up to Bertalanffy's concept of equifinality which specifies phases of relative stability studding the evolution of the system. (op.cit, p.149)

3. An earlier stage is integrated into a later stage; preceding structures become a part of later structures

There seems little criticism of this characteristic; concrete operations, for instance, serve as a base for the formal operations of which they are a part. Shayer (1973) at present is investigating how Grouping III at the concrete level might become the "bridge" to propositional thinking at the formal level.

4. The order of succession of stages is constant

Concrete operations must precede formal operations. Sigel (1968, pp. 503-523) in his "Reflections" on the previously described experimental work states that "the papers presented in this volume offer greater support for the invariant order of stages than they do for the integrative and hierarchical nature of cognitive structures". (ibid, p.505) The invariant succession does not, however, mean that 'stage' is synonymous with a particular age. Sigel (ibid, p.518) ^{op. cit.} explains that, "In effect, chronological age is a quantitative descriptive, control variable with little explanatory power". Of the great number of influences which determine when a child reaches a particular stage these seem to be the most important.

(a) Heredity, manifested in physical growth, especially in the maturing of the nervous system. A number of commentators think that this might be the most important factor for Piaget: "his biological orientation and interest in structure leads him to take external factors for granted and to regard the form which this interaction takes as largely predetermined from the start". (Wohlwill, ^{op. cit.} ibid, p.489) A fuller discussion on this characteristic in development is given later (pp. 68-71 and pp 78-79)

(b) The physical environment seen in nutrition and experience in handling objects. Sigel, for example, asks whether play might be not a major factor in leading towards conservation. "Can it not be that children who ... demonstrate conservation relatively early are

children who have approached materials in ways which have consistently enabled them to test certain physical principles"?

(^{op. cit.} ~~ibid~~, p.514)

- (c) Personality where such traits as extraversion - introversion, attention - distractibility, rigidity - flexibility, determine how the child will interact with the environment.
- (d) The social environment when, for instance, rational, democratic discussion might encourage the growth of logical thinking. This environment can be considered at different degrees of generality. Sigel points out (^{op. cit.} ~~ibid~~, p.510) that "The Piagetian system is an expression of a logical, mathematical system integral to the scientific thought patterns of Western culture". Work by people like Price Williams (1962) and Vernon (1965) seems to indicate that children from non-European environments do reach the stage of concrete operations but at later chronological ages than European children. Lovell (Green et al 1971, pp.89-90) explains that Inhelder and Piaget consider that beyond some minimum age due to neuro-physiological development it is social attitudes and exchanges, cultural conditions, and the effects of schooling which determine the age of the onset of formal thought. He cites work by Peluffo in Italy and Kimball in Malawi as evidence that combinatorial and anticipatory thinking are strongly interfered with by an underdeveloped milieu. Within a country, the specifics of an environment may also affect the development of logical thinking, Sigel considering that "The rural environment, for example, offers a far different array of experiences than does the urban area". (Sigel and Hooper 1968, p.510) In a fairly small country such as Britain with the ubiquity of mass media and a general similarity of schooling, one wonders whether ^{the} rural - urban dichotomy would have such an effect. Social class, instanced in

such things as the quality of parent-child intercourse, availability of cognitively demanding toys and so on, might have more effect but even here the situation is far from clear or consistent. (Goldschmid in Green et al 1971, p.100)

- (e) Language presents peculiar difficulties which will be considered in the next section (Chapter 4)
- (f) The content to be structured, certain fields of knowledge being easier to understand than others. Feigenbaum (Sigel and Hooper 1968, p.521), for example, found a difference even within a conservation problem. Children found it easier to conserve quantity with seven pairs of beads than fourteen pairs of beads. Piaget has always maintained that thinking on abstract material shows features noted earlier when children dealt with concrete material. For example, "Residues of infantile thinking (are) found throughout adolescence; they result from a sort of overflow of concrete level problems onto a more abstract plane". (1958, p.334) Inhelder explains (Inhelder and Tanner 1960, Vol.IV, p.126) that "both the adolescent and the adult are far from reasoning formally all the time. The attainment of a cognitive stage merely means that an individual under optimal conditions becomes capable of behaving in a certain way which was impossible to him before".

As a combination of earlier reasoning and hypothetico-deductive thinking is not really consistent with a pattern of qualitative stages, each characterised by a structure d'ensemble, Piaget introduces the concept of *décalage* to explain such inconsistencies. Flavell (1963, p.21) states that this means that similar cognitive developments occur at different stages across the ontogenetic span. Vertical *décalage* involves repetition at a different level of functioning, for instance, a young child can find his way home from school without errors but it is much later before he is able to

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make an accurate plan of his route. Similarly, children may understand relationships in a family, especially if it is a close-unit one, before they will do so in historical genealogy. Horizontal décalage refers to a repetition which takes place within a single stage such as the concrete operational period. There are two types of horizontal décalage. One kind refers to the different rates of the formation of the structures themselves, for instance, transitivity lags behind conservation. The second kind is concerned with the differential difficulty of the informational processing requirements of structurally equivalent tasks. (Lovell 1973, p.1)

For example, Elkind's experiment with 4-7 year old children on the conservation of number, both of continuous and discontinuous quantities showed that the former type of conservation is more difficult than that of discontinuous quantity. (Flavell 1963, p.384) Piaget found that Genevan children tackled the problem of class inclusion more easily with flowers than with birds. (Green et al 1971, pp.10-11) His only suggestion for such a discrepancy is that the children are able to make a bunch of flowers but they are not able to do this with birds.

A recent study by Hamel and Van der Veer (1972) found a significantly positive relationship for 67 children from a middle class junior school in Holland, aged from 78.0 months to 87.6 months of mean average ability, between their achievements on multiple classification and multiple seriation tasks. They do point out that the high correlation could be attributed to a single intelligence factor, namely "matrix-solving ability. (ibid, p.324)

Yet even when the influence of general intelligence was partialled out, a positive correlation still remained. Hamel and de Veer conclude, however, that "it remains uncertain whether the subject may solve these problems by other ways than by using operational schemes". (ibid, p.324) Piaget considers that the "time-lag" are one of the more difficult aspects of his developmental theory. He thinks that they are probably due to the interaction between a person's structures and the resistance of the objects, some objects

being manipulated more readily than others. Pinard and Laurendeau (1969, pp.144-145) argue that if experimental analysis fails to confirm that there are structures d'ensemble, it will be necessary to find out whether there is a regular order of succession for different concepts. They think that "any empirically established asynchronism among the constituent groupings of a given concept would seriously jeopardise Piaget's conception of stage". They conclude that in any case, if a form of décalage is defined by the successive application of the same groupings to different conceptual concepts, that this is not an example of horizontal décalage but rather a particular form of vertical décalage. (ibid, p.145)

When considering the onset of formal operations Lovell (1973, p.1) explains that, "we are in the same or in even greater difficulty". The 1958 text by Inhelder and Piaget indicates two broad groups of problems. In one group the subjects have to provide proofs of hypotheses by the experimental manipulation of variables; in the second they have to discover relationships involving direct and inverse proportion. (ibid, p.1) Research indicates that the test scores obtained on the two groups of tasks do tend to cluster together. The coefficient of concordance is fairly low at about 13 years and increases with chronological age. "Again, there is less structure than the I.N.R.C. group would suggest. (ibid, p.1) Bellin is particularly unhappy about the concept of horizontal décalage. "Inferring both structural invariance and response variability from the same body of data, ... places the Genevan group in the position of offering either a paradox or a contradiction. It undoubtedly accounts for the ambiguity of an important aspect of their theory". (1965, p.318)

Flavell and Wohlwill (Elkind and Flavell, 1969, pp.94-106) consider that horizontal décalage is an ad hoc construct in the context of Piaget's system and try to present a more systematic model for the concrete operational period. Their hypothesis is that there appears no reason why structures d'ensemble could not be looked at as a family of separate structures since

Piaget has placed a "quite unnecessarily heavy burden of proof upon himself by stipulating that all of the ... several groupings develop in unison". (ibid, p.95) Each separate structure such as class multiplication or seriation would follow its own developmental timetable. Even if an investigation was restricted to such a single grouping, one would still expect to find departure from intertask consistency during the transition period as this is the period of maximum oscillation caused through the effects of task related variables such as the number of stimuli, the content and so on. Starting from this hypothetical basis, Flavell and Wohlwill then present the following model of three parameters which jointly determine a child's performance. (ibid, p.98)^{op.cit.} Note that this model deals only with the second kind of horizontal décalage which is concerned with the differential difficulty of structurally equivalent tasks.

P_a = the degree to which a given operation has been established in a particular child, ranging from 0 in the preoperational period to 1.0 when the operation has become established.

P_b = an attribute of the task. The value of this factor also ranges between 0 and 1 depending on a host of influences such as the familiarity of the stimulus materials and the magnitude of the information load placed on the child. Presumably, "this factor is responsible for the horizontal décalages that we find ... in much Piagetian research". (ibid, p.99)^{op.cit.}

$1-k$ = the power to which P_b is to be raised. This factor corresponds to the difficulty that a particular task carries for a given child, the ability to abstract the information that is relevant to a particular operation. (ibid, p.104) k varies from 0 at a relatively early phase of the establishment of an operation to 1.0 when the stage has become fully consolidated. Flavell and Wohlwill admit that "the psychological meaning of this parameter is not specified in very simple terms". (ibid, p.104) They give one example where

having to deal with a larger number of stimuli such as 10 objects rather than 6 may affect the likelihood of success. It seems easier to understand this parameter by stating that it consists of factors which will affect P_b and hence the final result seen in the equation: (ibid, p.100)

$$P(+)=P_a \times P_b^{1-k}$$

This equation shows the probability of a given child, characterized by particular values P_a and k , solving a task with some particular value of P_b .

For example, say

$P_a = 0.5$ (the middle of the development of the operation)

$P_b = 0.5$ (a task of medium difficulty)

$1-k = 0.6$ (some degree of difficulty in the contents of the task)

then $P(+)=0.5 \times 0.5^{0.6}$

$$= 0.5 \times 0.30 = 0.15$$

Hence the child is still in the preoperational level for this grouping and this task.

Flavell and Wohlwill then suggest that the course of the formation of a new cognitive structure may be described in terms of a four phase process.

Phase 1: $P_a = 0$, the child, lacking a given operation, must fail all of the problems demanding that operation.

Phase 2: P_a changes from 0 to 1.0 during this transitional phase while k remains equal to 0, or close to it (the role of task-related variables are expected to be maximal during the period in which the operation is still in process of becoming established). Thus $P(+)=P_a \times P_b$ and the child will fail most tasks based on the operation. He should manifest the intermediary forms of reasoning characteristic of this period.

Phase 3: The operation has now become functional, $P_a = 1.0$.

But success will vary according to the demands of the particular task.

Phase 4: The terminal phase in which $P_a = 1.0$ and $k = 1.0$, success

is achieved regardless of the task variables involved unless P_b is very low such as in a task of ordering a series of tones.

This model by Flavell and Wohlwill shows the interest generated by Piaget's theory of developmental stages but even they admit that P_b is an intractable variable. (^{of it} *ibid*, p.104) A model such as this takes us further into the region where attempts are made to give a mathematical exactness to Piaget's developmental stages but at present it seems impossible to specify the variables for even one grouping at the concrete operational period, let alone for a whole period of development. An investigation of children's responses to historical passages contains so many task-related factors including such aspects as the content of the passages, concepts used, the underlying logical structure behind each passage and the amount of historical knowledge available to each child, that one still has to rely for the analysis on the verbal criteria devised by Piaget and used in other related researches. (Goldman¹⁹⁶², Hallam 1966, Stones 1967, Peel 1971)

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CHAPTER 4 : LANGUAGE AND THOUGHT

1. Language at the concrete operational level

One of the more potent variables mentioned above (p.47), as far as this research is concerned, is the relationship of language and logical thought. It could be argued that this investigation into children's historical thinking is merely testing children's understanding of words. A similar criticism has often been made of Piaget's work. Berko and Brown suggest that Piaget is not necessarily deducing children's conception of quantity from their use of words such as "more" and "less". They think that it is at least as accurate to say that his studies are concerned with subjects' understanding of the vocabulary of quantity (in Wallace 1967, p.6) Children's errors in the water jars experiment might be caused through their earlier vocabulary training by adults. Parents might have talked about liquid in similarly-shaped glasses being "more", "less" or "equal", that is, where the variable of the containers was constant. Once children are confronted with jars of different shapes, they begin by making an inappropriate extension of the semantic rule. (op.cit., p.7) When testing young children of 7 to 8 years on the conservation experiments it is, however, often noteworthy to see how they manage to explain themselves without having recourse to an adult vocabulary.

The argument that words and not thoughts are being assessed seems supported by the Russian school's contention that language may enrich thought (for example, Gal'perin reported in Wallace 1972, pp.40-43), and by Bruner's emphasis that as language becomes more internalised, it assumes greater importance as a set of abstract rules for organising events. (Ripple and Rockcastle 1964, p.53) Such lines of thought have made the Genevan school pay more attention to the relationship of thought and language. Piaget stresses that babies develop schemes such as the concept of the permanent object: "Therefore, before the operations formulated

by language, there is a kind of logic of action co-ordination". (Piaget in Furth 1969, p.125) The operations resulting from the interiorisation of actions remain for a long while relatively independent of language. In normal children language appears at about the same time as other forms of the semiotic function, that is, the ability to represent something by means of a 'signifier'. Language thus has the same roots and, in the beginning, the same function as symbolic play, deferred imitation and mental images. (Sinclair in Elkind and Flavell 1969, p.320) Language obviously increases the range of thought, as do other aspects of the semiotic function, since this function "detaches thought from action and is the source of representation". (Piaget and Inhelder 1969, p.87) Piaget argues, however, that language is not a sufficient condition by itself for the constitution of intellectual operations. It is only when and because the child's intelligence has reached the stage of concrete operations that logical definitions are forthcoming on a typical conservation problem. Piaget adduces examples such as the following in support of this contention.

- (a) In the conservation test with clay a child is likely to conserve substance at 7 to 8 years, weight at 9 to 10 years and volume at 11 to 12 years. Yet the child justifies his successive conservations with exactly the same verbal expressions: "I have not taken away anything or added anything" or "this is longer but it is thinner".
- (b) The responses of normally-hearing children have been compared with those of deaf-mutes. Vincent and Oléron have shown that both types of children understand seriation at approximately the same time, with a slight delay in the deaf, but there is a delay of one to two years in the emergence of logical operations in respect of conservation. The deaf mutes, however, do reach the stage of conservation. Furth (1969, pp.118-120) tested children born deaf on Piagetian tests not couched in verbal terms.

He did not find the deaf uniformly equal to the hearing but "the number of tasks which showed no difference was impressive ... Failure seemed to be due to such types of behaviour as lack of intellectual initiative, grasping of instructions, or familiarity with similar problems". (ibid, p.119) Furth hypothesises that these factors may be more a direct result of inadequate social experience rather than language deprivation. He suggests that it is easy to observe that deaf children can grow up in an environment that neither readily accepts their handicap nor challenges their intellectual capacity. He tried out similar tests on a number of culturally deprived children and observed that they too, in spite of their lack of linguistic performance, showed a similar pattern of failure and success.

- (c) Linguistic progress and the development of logical operations can be compared in normal children. Sinclair (Elkind and Flavell 1969, pp.315-336) divided her subjects into three groups (total absence of conservation, intermediary stage and conservation present) on the basis of their responses on two Piagetian tasks of conservation of liquids and seriation. She then compared their answers on verbal tasks which did not touch upon conservation or seriation problems such as asking them to describe the difference between a short, thick pencil and a long, thin one. She discovered that children with conservation used comparatives far more often than those without conservation. (ibid, p.323) In a second series of experiments Sinclair tried to teach children without conservation the expressions used by the conserving group ("more", "longer", "thinner"). After the verbal training, their operational level was again tested in the conservation tasks. The children found it difficult to learn a co-ordinated structure such as "this pencil is longer but thinner, the other is short but thick". Even for

children who succeeded in learning to use such expressions, operational progress was rare. (ibid, p.324) "On the other hand, more than half the children who made no clear operational progress, changed their answers in the post-test". (ibid, p.324) They noticed and described the covarying dimensions but this improvement did not lead them to the compensation argument and conservation. Sinclair draws the following conclusions from her experiments:

- (i) A distinction must be made between lexical acquisition and the acquisition of syntactical structures, the latter being the more closely linked to operational level.
- (ii) Verbal training leads subjects without conservation to direct their attention to pertinent aspects of the problem (covariance of the dimensions), but it does not by itself bring about the acquisition of operations. (ibid, p.325) Inhelder and Sinclair, when reporting on these experiments in Mussen et al (1969, p.18), conclude that the "acquisition of appropriate verbal patterns does not per se bring about the acquisition of concepts and operations". Progress from one substage to another is helped if verbal training is combined with operational exercise but, while understanding is facilitated by using a system of symbolisation such as language, "language ... is but an instrument ... (The) learning capacity is not provided by the instrument, but by the subject". (ibid, p.21)

There appear to be two general conclusions on the language of children at the preoperational and concrete levels as far as the Genevan school is concerned. Such children can imitate verbally but often with an imperfect understanding of what is involved. Secondly, they will confer meaning on a verbal situation by transforming the meaning of the words so that they make some sort of sense to them. This has been shown so often in childish

"howlers" such as "Harold be Thy name". It was also strikingly revealed when one hundred pupils aged 11 to 16 years were asked what they understood from the following remark supposedly made by a Norman soldier after the battle of Hastings: (Hallam 1966)

"It would have been just (fair, correct, proper) if wolves and vultures had devoured (eaten) the flesh of these English".

Nearly half of the population, ranging from the oldest to the youngest, altered the meaning so that the passage made the following "sense".

"It looks just as if wolves and vultures had eaten the bodies because the battle-field was covered with bones".

Language at the formal operational level

Piaget (Furth 1969, p.122) accepts that, "It is quite possible that language is a necessary condition for the achievement of logical structures, in any case at the level of propositional structures". Later he comments that, "It is hard to conceive how propositional operations would reach an advanced stage of development without the use of language". (ibid, p.127)^{q. ut.} He reserves his judgement on the question whether language constitutes logical structures at this level or whether it has merely an indirect and supportive role. But he envisages the influence of language as being less the transmission of ready made structures than a kind of education of thinking. He also argues that logical operations at the formal level go beyond language because they constitute complex structures that are not part of language. These are the combinatorial system and the group of four transformations that co-ordinate inversions and reciprocals (the I.N.R.C. group) which are shown in the adolescent's behaviour by a series of new operational schemes such as proportion and combinatorial probabilities. One could possibly argue here that these logical systems were initiated and developed in action and have been developed through language, thus representing the abbreviated end-product of a lengthy process. Piaget

concludes that the influence of language on formal thinking, however, is a psychological question that can be answered only through experimentation. Morf and Furth with Youniss have investigated this relationship in two separate experiments.

(a) Morf analysed the spontaneous solutions of subjects at an intermediate level between concrete and formal operations on problems concerned with implication ("if ... then"), disjunctions ("either ... or") and other areas of propositional logic. Then he gave them a certain amount of verbal information by repeating questions with supplementary detail or by providing them with examples which illustrated the logical operations. "The result of this additional help has been systematically negative except with subjects who had spontaneously succeeded in solving one or another of the questions by hypothetico-deductive methods. Only these subjects were able to assimilate the meaning of the supplementary information for the successful solution of problems they had initially failed".
^{op.cit.}
(ibid, pp.128-129)

(b) Furth and Youniss (1971, pp.49-64) investigated whether deaf adolescents are limited in formal operatory functioning even though deaf children do not seem seriously handicapped at the concrete operational level on Piagetian tasks. They had three groups of students as is shown in Table II.

TABLE II

<u>Group A</u>	<u>Subjects</u>	<u>Chronological Age</u>	<u>Academics</u>
	40 students from a residential school for the deaf	14 - 20 years	Half academically quite poor
<u>Group B</u>	40 students in a rural high school	16 - 17 years	Half above and half below the mean for intelligence scores for the age group
<u>Group C</u>	40 students in a middle class suburban region	16 - 17 years	Half above and half below the mean for intelligence scores for the age group

The subjects were given three tasks:

- (a) After 5 weeks of training, problems in symbolic logic using conjunction etc. The number of deaf students reaching Stage IV (formal) was significantly smaller than the number of hearing subjects.
- (b) Probability (pulling coloured balls out of a box and assessing the probable colour of the next one). Comparable proportions of A, B and C passed this problem.
- (c) Combinations Linguistically deficient deaf adolescents used similar strategies, produced similar results and predicted combinations in the same way as Groups B and C.

Furth and Youniss accept that the special interests and the professional activity of an individual can lead to formal operations in a particular field because of the individual's exposure to a logical symbolic environment in that field, and that verbal language is apparently the most common and important symbol system. Therefore, it could be assumed that language is a pre-requisite for formal operations and that the deaf are not likely to reach that level. They argue, however, that the three tasks assessed formal operational thinking. It is not clear from the article which aspect of formal thinking was being tested. Their results show numerous

cases of success on one task accompanied by failure on another task for subjects in all three groups. They suggest, therefore, that the stage of formal operations should be likened to "a potential that requires personal interest and environmental occasions" - a finding that has been suggested also by Lunzer (above, p.25). Their second major finding was that there were only small differences between the three groups on the second and third experiments but rather large differences on the first experiment, the success rate on this being 28% for the deaf, 53% for the rural and 75% for the suburban subjects. They conclude from this result that a special environment, including its verbal aspect, is a powerful factor in motivating individuals towards selective operatory functioning. Their final comment is that the mere absence of a conventional language is not sufficient to terminate prematurely "the normal operative development that is species-specific to humans". (ibid, p.64)

3. Implications for the present research study

What is the relevance of this work for the present research? Children's answers are likely to be determined not by mere facility in using the words of the passage, from school books, the mass media and so on but by their having the appropriate schemes through which the passages become meaningful. Flavell (Mischel 1971, p.121) comments that, "Linguistic symbols ... provide meaningful inputs to a thinking process - they provide it with things to think of and about, without themselves constituting the thinking process itself", that is, linguistic processes serve fundamentally as cognitive carriers, in rather the same way that perceptual and memory processes do. The passage on "The Russian Revolution" (Appendix A) deals with events which are mentioned on television, sometimes distorted on the cinema screen and often read about in newspapers. Might not the secondary pupils' answers simply reflect their acquaintanceship with such data? The questions posed tried to demand from the pupils various forms of operations, not merely a

readiness to repeat information. In order to be successful in answering the questions as a whole, the subjects needed to have what Bruner (1959, pp. 364-365) considers are the two central forms of operation at the concrete operational stage:

- (a) class-inclusion where a city (Petrograd) is understood to be part of a country (Russia), and a country has relationships with other countries (Switzerland, Germany etc.),
or where people fighting in Russia include Bolsheviks, White Armies, armies from other countries,
- (b) Serial ordering seen in the progression: Tzar as ruler → first revolution → Tzar exiled → return of Bolsheviks → second revolution → murder ^{of Tzar} by a group of Bolsheviks.

They also, in order to gain a global grade at the formal level, needed to be able to show some general understanding of causation in human affairs (Q.2, Q.4); comprehension of metaphorical language (Q.3a); and generally an ability to go beyond the "observation of empirical correspondences". (Inhelder and Piaget 1958, p.279) (for example, Q.1(b), Q.2, Q.3(b), Q.4, Q.5, Q.7, Q.8) Lovell calls this ability a combinatorial power which makes it possible for pupils to feed reality, as it were, into a set of possible hypotheses which are compatible with the data. (Wall and Varma 1972, p.77) At a level somewhere transitional between concrete and formal thinking, this answer by a youth of 13 : 3 years, I.Q.141 seems to exemplify an ability to go beyond the "observation of empirical correspondences".

Q.8 Can you think of any effects or results that the Russian Revolution of 1917 has had in the world?

"The ideas of Communism have spread to China and the war in Vietnam - the Americans are trying to stop Communism taking over and all the troubles in Paris have been because Communists have been getting students to riot and people to go on strikes."

"Anything else to say about this?"

"If Communism spreads into Vietnam it will be nearer to America and

perhaps spread to America and then to Australia and the rest of the world if America was defeated because America is the chief source of power today".

A History teacher from the school attended this boy's interview and said afterwards that the boy had merely been repeating what he had heard on television. Wherever he had garnered these ideas, however, they had become meaningful to him, although not at a very sophisticated level - "America is the chief source of power today". He was able to use what he had seen or read in order to answer a stranger's question on a passage which he had not met previously. His answer contrasted greatly with many given by children in his class who could state only that, "Russia is now Communist". This can be considered to show an ability to forecast a result from the evidence available or merely to repeat a fairly well-known piece of knowledge - whatever the cause, such an answer is graded at the concrete level.

After having been taught for a term on the history of Russia, and one year after the first testing, this youth's answer to the same question on the same passage was considered not as advanced as on the first occasion. It was graded at 2AB to 2B (going towards advanced concrete) since he was merely forecasting a result from the evidence available and not handling as many variables.

"The - it's caused Communism to spread to China and Vietnam".

"Anything else to say on this one?"

"The Vietnam war"

"Yes - anything else?"

"No"

It is important to note on both occasions, that is, on the first and second testing, his global grade on the whole passage was 2B/3A (transitional between concrete and formal thinking). Lack of attention to one question out of a total of ten did not modify radically an over-all impression of his

thinking. Why was there such a discrepancy between the two answers? The boy might have been bored by the repeated question, it was the last one of thirty put on the three different passages; he might have been ready to go home; on the first occasion he might have seen or read something about Russia before the interview. This slight difference in answers to one question does indicate the force of Furth and Youniss' remark (1971, p.62) that the stage of operations reached should be likened to "a potential that requires personal interest and environmental occasions".

CHAPTER 5 : MOTIVATION

Occasionally, people have argued in connection with the earlier research (Hollan, 1966) that if the children taking part had been more motivated by the material, they might have answered at a higher level of thinking. Piaget would possibly approach this problem of motivation from another angle. For Piaget, the stimuli which affect a subject's behaviour are not "external factors" that can be identified apart from the subject's schemes. (Mischel 1971, p.329) The child's needs depend on his level of development; as he acquires new cognitive structures so he also acquires new interests which had not existed before he had those structures (Piaget 1959 in Mischel 1971, p.329). This begs the question for the moment of how these structures are acquired (see Part II, pp.78-96) but it seems in line with common-sense experience. As we acquire new levels of thought so "felt lacunae" are experienced urging us on to further discoveries. This "need to understand" (compare White's theory of competence) motivates behaviour from the sensori-motor period onwards. Therefore, it is "not necessary for us to have recourse to separate factors of motivation in order to explain learning (presumably general) because they are included from the start in the global conception of assimilation". (Piaget, op.cit., p.330) Such a functional need to explore and understand motivates intellectual behaviour through cognitive conflict. A child will surrender earlier, pseudo-solutions of a problem because his cognitive assimilations keep

running into difficulties since they conflict with the "facts" available to the child or with his other beliefs or with what other people say. (op.cit., p.331) And the child's recognition of this "disequilibrium" motivates him to resolve the conflict: "When the difficulty is not too great, does not seem insurmountable to him", the child is motivated to apply his schemes because "the obstacle itself creates a valuation in the form of a need to conquer", that is, there is "a zone of optimal interest for that which is neither too known nor too new". (op.cit., p.332) Whatever falls within that zone is found "interesting". Mischel comments that on this interpretation it is easy to see why one cannot divide into two the affective and cognitive aspects of behavior. "What we have ... is a form of cognitive consistency theory in which intellectual activities are motivated by the "need" to establish "the accord of thought with things" and the "accord of thought with itself". (op.cit., p.333)

Why is such inconsistency motivating? Mischel states that to say cognitive conflicts need to be reconciled (equilibrated) is to say that norms like consistency, coherence etc. govern directed thinking. Piaget discusses the "process" of equilibration as if he were presenting an empirical model about the workings of the mind. Mischel suggests that it is not so much a theory to be confirmed by facts but an analysis of how we think in accordance with the norms that govern directed thinking. (op.cit., p.343)

Ausubel interprets the need to cope intellectually with ideational problems as constituting an independent motivational factor in cognition (op.cit., p.357), as a cognitive drive which is the need to know, to understand, to obtain tenable solutions to problems. But he does not agree that this cognitive drive arises simply because "there is an intrinsic need for cognitive structures once generated by functioning to perpetuate themselves by more functioning". (op.cit., p.358) Ausubel thinks that cognitive drive is derived in a very general way from curiosity tendencies but is given direction both as a result of successful exercise and the anticipation of

future satisfying consequences from further exercise "Far from being largely endogenous in origin, therefore, specific cognitive drives or interests are primarily acquired and dependent upon particular experience". (ibid, p.359)^{of.ck.}

For Ausubel, then, motivation in studying history would be a result of satisfying and successful experiences at school and home. Ausubel seems here to be concentrating on particular knowledge. An attempt was made to assess the secondary pupils' attitude towards History in this research by the Osgood Semantic Differential (see pp. 292-296) and their general academic motivation by Entwistle's Aberdeen Academic Motivation Inventory. (1968, pp.181-188) This Inventory is claimed to cover "attitudes to school, aspirations, work habits and the determination to do well in school work". (ibid, p.186) These two means of assessment provide descriptive measures of the motivation of the secondary children. There was no attempt to assess the effect of other motivational factors on achievement and thinking skills such as differing types of ego needs (self respect), differing social needs (praise, achievement) and different anxieties: these obviously need a wide-ranging, empirical investigation of their own. (Mischel 1971, p.347) Piaget claims that he ignores such factors because they fall within the area of the "psychology of differences" which lies outside the "general psychology" of intellectual development which he has taken for his domain. Perhaps the present research might also be allowed to fall into the field of general psychology. The aim, taken broadly, was to follow Piaget's motivational model by posing problems which, it was hoped, would be far enough ahead of the children's general level of development to prove interesting and make appropriate intellectual demands on their cognitive schemes.

This major aim perhaps needs emphasising: the whole exercise was aimed at the children's understanding of historical material. Such aspects of history teaching as enriching the pupils' visual imaginations, using history in an expressive way through drama, painting, costumes, discovering history

in the immediate locality and so on, did not enter into the writer's plan. It was hoped that the children would find history presented as an intellectual challenge a worthwhile and rewarding exercise which would deepen their involvement in the subject, but all other aims were subsumed to the central one of asking them to think logically about the content of their lessons.

As well as following the syllabuses presented by the schools, the research had to be conducted within the schools' systems of incentives. For example, at the secondary school a "Merit" grade was given to any particularly worthy piece of work. The practice was resisted for half a term but eventually had to be followed since so many of the girls were disappointed that their hard work seemed unrewarded. The secondary school had annual examinations for form reports; the primary schools gave marks for written work; verbal commendation was often given in the course of a lesson at the two age levels. Both the experimental and traditional forms at each age level were treated in the same way as far as such incentives were concerned. It is questionable whether they affected the thinking levels of the children, although they might have had some influence on the amount of knowledge they acquired. Ausubel, indeed, considers that "no amount of motivation would suffice to effect the change (in intellectual skills) ... in the absence of the necessary genic potentialities and of the supportive cognitive growth and experience". (op.cit., p.361) And he concludes his examination of motivational factors with the comment that "on balance, it would appear that cognitive determinants of intellectual development are much more salient than motivational factors". (ibid, p.361)

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CHAPTER 6 : PIAGET'S THEORY IN RELATION TO OTHER THEORIES OF
COGNITION

1. Introduction

The equivocal borderline between Piaget's theory and those of other schools always had to be kept in mind during the series of lessons which lasted for a school year in both the primary and secondary sectors. Obviously, a research worker as a teacher in a classroom and faced with all the demands of that situation, is not able to control all the experimental variables as rigorously as would happen in a psychology laboratory. How far is a simple phrase such as, "Please get on with your work" an example of a stimulus which may result in the pupils merely putting symbols on to paper or how far will it cause them to interact positively with the historical data in front of them? Did the primary children in the experimental form understand in a meaningful way the relationships between members of a genealogical table or had they merely learnt the responses required to give the correct answers on questions about the Tudor royal family?

The whole research was full of such difficulties. Smedslund, in respect of Piagetian experiments, wishes to refine the methods used until all variations of the data due to extraneous factors such as previous experience have been removed. Wallace (1967, p.137) considers that those adopting this approach "seem doomed to narrower and narrower situations and a greater and greater degree of specificity ... in pursuit of the chimera of exact relations". The only hope, according to Wallace, of reaching such an objective would appear to lie in studying the course of the acquisition by a single individual of a single inference pattern as represented in a single object. Any conclusions reached "would be of such specificity as to be of little utility. In addition, the task of determining the extent to which these conclusions could be generalised to the myriad other possible solutions of this straitened type would take several millenia". (ibid, pp.137-138) No such charge of needle-point specificity could be laid against the present research. There was always an awareness that the type of teaching might be

encroaching on other fields of cognition. That Piaget's developmental theory has been confounded at various times with other conceptions of cognitive growth would seem to indicate that confusion is possible even on the theoretical level.

Ogilvie (1969, pp.1-5) explains that the phenomena of cognitive development are open to a variety of interpretations, many of which may be traced to the conflict between the classical schools of philosophy known as Empiricism and Rationalism. The Empiricists, Ogilvie states, argue that there is nothing in the mind that is not first in the senses; the Rationalists that the structures of the mind are imposed "by necessity" and develop independently of experience. He quotes Dugelski's (1959) equation that $B = I \times E$ or Behaviour is a multiplicative function of innate (I) x environmental (E) factors. Ogilvie asks what weight out to be attached to each of these two factors and instances different theories which have tried to resolve this equation. Each of the theories has been related to Piaget's work. (Sigel and Hooper 1968, pp.266-269)

2. Nativism

Nativism claims that differences in logical thinking are more apparent than real, that even very young children think like adults once they have sufficient knowledge. Piaget denies the nativist viewpoint, stating that nativists do not explain the details of the mechanisms at work in cognitive development; it is a "lazy" way out of solving important problems. (Mischel 1971, p.92, footnote) Sigel and Hooper comment that Piaget's findings seem to have excluded nativism as a serious rival to his theory since young children still show illogical behaviour even when they have all the facts (1968, p.268) - though a philosopher might like to examine what is meant by "have" and "facts" in this context.

3. Maturation

Maturation as a theory demands more significant consideration in relation to Piaget's work. Maturationists postulate that time and normal physiological

processes lead to cognitive development, Beilin, for example, arguing recently (eg. Mischel 1971, p.90-92) that Piaget is at least by implication a maturationist. His reason is that the course of cognitive development delineated by Piaget is that of a fixed sequence of stages. This invariant sequence is immune to environmental influences, although the onset of a stage varies with social and cultural conditions. "A fixed developmental sequence which is impervious to environmental influence must be in large measure under the control of some type of species - specific genetic programming ... The transaction with the environment that Piaget emphasises so strongly is, then, only facilitative. It provides the data from which knowledge is constructed, but the structuring is in accord with rules specified in the genetic programme that controls intellectual functioning". (ibid, p.90) Beilin thinks that it is perfectly reasonable to hold that experience merely furnishes suitable occasions for arousing an innate capacity and that Piaget's position can be incorporated within such a theory. (ibid, p.92) He continues that the process of equilibration itself is biologically determined, although Beilin gives no reference to support this assertion. Elsewhere, Beilin speaks of "... a pre-programmed rule system (that) controls the transactions with reality", "innate programming" and "prewired structures operative at birth". (Green et al, 1971, p.178) His general conclusion is that innate systems of rules regulate the manner in which ideas are generated by the mind. (Mischel 1971, p.92)

Beilin would seem to be over-stretching Piaget's acceptance of maturation as a force in cognitive development. Inhelder explains that Piaget's biological orientation makes him refuse to admit that a structure emerges ex nihilo. (Green et al 1971, p.150) "Every structure is based on an anterior structure, not only through logical derivation, but, far more profoundly, through biological growth". (ibid, pp.150-151) The specific cognitive structures, however, are not pre-programmed, as Beilin suggests. There must be interaction with the environment. "Maturation certainly makes certain transformations possible, but the further development of schemes

is understood almost entirely in terms of earlier schemes and experience ...
 Maturation is a necessary condition for development but does nothing to
 determine its direction". (Taylor in Mischel 1971, p.398) Indeed, Mc.V
 Hunt states that even noural maturation and the development of brain
 structure appear to be influenced appreciably by environmental encounters.
 (Elkind and Flavell 1969, p.34) Such a possibility is derived from Piaget's
 observation that reflexive systems decay without use. McV Hunt cites two
 pieces of empirical evidence to support this contention. Rabbits reared
 in the dark results in the anatomical apparatus of the visual system failing
 to develop. Conversely, there is repeated evidence of the central brain
 structures of rats increasing in size when they are placed in extra-complex
 circumstances. (ibid, p.34)

Flavell has an interesting comment on the controversy whether Piaget's
 is a maturationist theory or not. He wonders (Green et al 1971, pp.190-191)
 if, in the course of development, the constraining role of maturation decreases
 rather than increases. One tends to think of infancy as the critical period
 for cognitive development. But it is far more biologically guaranteed
 that a child is going to achieve sensori-motor acquisitions than it is that
 he will achieve formal operations. "The evidence suggests that whether or
 to what extent you get formal operations will depend much more upon the
 specific encounters the child has with his milieu than would be the case
 for sensori-motor operations or even concrete operations". (ibid, p.190)
 Flavell's image of development is thus that of a cone. "The circumference
 of the walls represents the constraints on what the child can develop into
 at each age period - thus, there are tighter constraints in infancy and looser
 ones towards adulthood". He suggests this image because of his impression
 that the major cognitive changes in childhood must have a biological growth
 process as their substate since they are largely inevitable, directional and
 uniform. (ibid, p.191) Adult cognitive changes appear to lack these
 properties. This interesting image might have implications for the results
 of the present research.

Piaget, however, firmly refutes any idea that he is a maturationist. How does one explain novelties? (^{of. ul.} *ibid*, p.192) "New structures, not preformed ... in genetic structure are constantly appearing". Biologically, a phenotype is the genotype's response to environmental pressure and this response is new. Psychologically, maturation simply determines the range of possibilities at a given age but does not cause the actualisation of those structures. Piaget, therefore, does not uphold maturation nor "physical preformation in the external world": "all my efforts are concentrated on going beyond both of them in order to explain the formation of novelties". (^{of. ul.} *ibid*, p.194)

4. Learning Theory

It can be argued that children acquire, say, the concept of conservation through repeated external reinforcements from physical experience and social experience seen in such instances as training in the rules of language. Gagné (quoted by Boilin in Green et al 1971, p.183) offers a learning theory explanation of cognitive development as an alternative to Piagetian theory. He posits a hierarchic organisation of development in terms of a series of stages derived from the additive combination of simpler processes. Stages of development in this theory are not age-related but specific experience-related and evolve from the operation of the basic behavioural processes of discrimination, memory and generalisation. Gagné assumes that two or more learned sequences add together to form a more complex thought unit. "The cumulation of elements involves no assumptions other than those of learning and addition". (*ibid*, p.183) Gagné argues, therefore, that conservation is acquired by the successive addition of constituent abilities. Langer comments (Mussen 1969, p.22) that such an approach assumes that there is no qualitative discontinuity - structural or functional - in development. Psycho-logical growth is therefore nothing but the increasing quantitative and continuous accumulation of behaviour.

Piaget refutes all such behavioural attempts to interpret the development of logical thinking. Even if a child demonstrates independent knowledge of the components of conservation, if he is a "non conserver" he will be unable to integrate these independent capacities into the appropriate reversible-compensatory operations that make conservation possible. (Greeh et al. 1971, p.183) For Piaget, in order to receive and understand information a child must have the appropriate structure which enables him to assimilate that information: "a stimulus is a stimulus only to the extent that it is significant, and it becomes significant only to the extent that there is a structure which permits its assimilation, a structure which can integrate the stimulus but which, at the same time, sets off the response", (Ripple and Rockcastle 1964, p.15) Boyle (1969, p.119) considers that Piaget here "misconceives the nature of contemporary learning theory". He continues that learning theorists do not ignore the question of what constitutes a stimulus; "much of the current research into operant learning is concerned less with responses than with discrimination", (ibid, p.119)

Piaget supports his standpoint by his comments on the apparent success of Smedslund (1959, 1961) in teaching the conservation of weight by means of external reinforcement, for example, by weighing the deformed substances. He argues that whereas Smedslund's experiments were successful in accelerating the development of the notion of conservation of weight, learning did not occur with regard to the transitivity operation (if $A = B$ and $B = C$ then $A = C$ or $A < B$ and $B < C$, then $A < C$). Learning by reinforcement was effective only in terms of "physical experience" and the mathematicological aspects remained untouched. Piaget, therefore, concludes that the fundamental relation involved in all development and all learning is not the relation of "association" but that of "assimilation". Assimilation is the integration of any sort of reality into a structure as a result of the learner's activity. (ogilvie 1969, p.10)

Piaget agrees that one type of stimulus response theory can be included within his explanatory system, that postulated by the neo-associationist

Derlyne. Derlyn (1965) has tried to show that the complex structures of internalised actions which constitute the heart of Piaget's account of intellectual development can be described in S - R terms. (Wallace 1967, p.158) Behaviour, for Derlyne, is not just an outcome of stimuli passively received but the sequel to an active process which selectively focuses on portions of the stimulation coming in from the environment. Derlyne introduces transformational thoughts (θ) which occur between the covert sensori-motor processes within the brain and which lead to a "system of balancing interchanges". (^{of. c. b.} *Ibid*, p.166) Although only one of a set of mutually exclusive responses can be evoked by a particular stimulus situation, all of the other sets of responses are instigated. Hence, through the transformational thoughts, immediate movement to any part of the particular thought structure is available. Piaget will accept this interpretation provided that two major modifications are introduced:

- (i) The classical responses or "copy" responses must be distinguished from the "transformation" responses, which are what Piaget calls operations.
- (ii) The notion of "internal" reinforcements has to be introduced. These arise in the elimination of contradictions, incompatibilities and conflicts and are what Piaget calls equilibration.

These modifications to Derlyne's interpretation seem to make it suspiciously similar to Piaget's own theory. In fact, Langer (Mussen et al 1969, p.22) considers that Derlyne's original exposition, insofar as it involves equilibration between habit structures "is nothing more than a reinterpretation into behaviouristic terminology of some of Piaget's organismic ideas on the equilibration process". Even after the partial acceptance, Piaget still does not seem happy about any reduction of his theory to the S - R standpoint: "I think the stimulus-response schema, while I won't say it is false, is ... entirely incapable of explaining cognitive learning". (Ripple and Rockcastle 1964, p.15) For Piaget learning

is a limited process, limited to a single problem or a single structure whereas an operation such as seriation is a reversible action and is never isolated. Such operational structures as seriation and classification are the basis of general knowledge. Elkind (Green et al. 1971, p.169) comments that all associative learning presupposes a cognitive organisation within which the associative elements are fixed. For example, learning a list of words presupposes an organised schema of the form $A > B > C$. All of Piaget's work has emphasised such mental organisations within which associative learning can take place. For Piaget learning is only possible when there is active assimilation: "All the emphasis is placed on the activity of the subject himself, and I think that without this activity there is no possible didactic or pedagogy which significantly transforms the subject", (Ripple and Rockcastle 1964, p.18)

Piaget's approach to the problem of the relationship between development and learning is crucial to the school situation. If, as he asserts, the development of general knowledge is a spontaneous process, "a total developmental process which we must re-situate in its general biological and psychological context", (op.cit., p.8) then the data which is presented in the classroom can be significant only insofar as the children have the rudimentary schemes which will enable them to assimilate that material. It might be considered, for example, that the primary children in the experimental group learnt in a rote manner the events surrounding the death of Rizzio (see Appendix A, Passage B and Appendix E, pp.114-119). According to the Piagetian stance, however, the children of 1E could not have used the information presented during the lessons in a meaningful way at the occasion of the second testing unless their cognitive schemes had been able to assimilate the content and the way in which it was presented. There had to be an appropriate interval between their existing schemes and the cognitive demands of the new information. This interval might or might not be bridged during the learning experiences. For Piaget, "S - R training will inevitably be unsuccessful because it provides only external reinforcement ... the rein-

forcement must itself be in the nature of a structure". (Boyle 1969, p.118)

This implies that there are possibly ways of presenting new information which might help to make it more readily available for the children's cognitive schemes; teachers should not wait for some almost mythical state of "readiness". "The fundamental difference between Piaget's approach and the S - R approach, as Piaget conceives it, is that the S - R model is of learning by association, whereas Piaget holds the fundamental relation, involved in both development and learning, to be one of assimilation, that is to say, the integration of experience of reality into an intellectual structure". (ibid, p.119) ^{op. cit.} For Piaget, therefore, the development of cognitive structures occurs both through embryogenesis (the development of the body, the nervous system and mental functions) and through learning. In essence, Piaget's is an interactionist theory.

5. Piaget's theory - an interactionist theory

Hamlyn (Mischel 1971, pp. 3-15) considers that Piaget's theory of genetic epistemology is a "kind of Kantian reconciliation" of empiricism (psychologically equivalent to associationism for Piaget) and rationalism (psychologically equivalent to "nativism"). This reconciliation is achieved only by the recognition of the active part played by the individual. "Piaget's reconciliation between empiricism and nativism comes through the idea that experience develops according to structures which are ... a function of the human mind in its relationship with the world ... what he (Piaget) seems to have in mind is the idea that at any stage, experience is determined by what and how the mind relates". (ibid, p.15)

The last sentence seems to have undertones, perhaps, of Beilin's argument that Piaget's theory is essentially a geneticist one: "The well-articulated, logically ordered, and invariant sequences argue more for a genetic, ie, a maturational, model than for either environmental determinism or interactionism". (Green et al 1971, p.181) Recent biological research,

however, seems to indicate that neural maturation itself is appreciably influenced by environmental encounters. Connolly (1971, p.99) considers that if a population actively changes its environment "then the selective value of the genes contained in the gene pool may be changed and therefore the population will undergo genetic changes. Genetic changes and cultural change thus appear to be in positive feedback relation to each other". That a characteristic is hereditary, therefore, does not mean that it cannot be affected by the environment. ^{of it.} (ibid, p.93)

This thesis of a close and continuing interaction between heredity and environment would certainly seem to be supported by Piaget. He states that he is neither a neobehaviourist nor a maturationist. (Green et al 1971, p.192) New structures, not preformed either in the external world or in genetic structure, are constantly appearing. His problem is to explain such novelties. Piaget does so by adducing both biological and psychological evidence, although he does not mention in Green (1971) the possibility that D.N.A. molecules can change their composition and thus affect heredity. He makes the following points:

- (i) A phenotype is the genotypes' response to environmental pressures. The response is new. Piaget says that he refers here to the important biological concept of the "reaction norms" of a given genotype which gives the range and distribution of all its possible variations. "These variations represent all the possible reactions which may be constructed through interaction with the environment". (ibid, p.192)
- (ii) A permanent function such as assimilation and accommodation does not contain an already formed structure. This structure has to be constructed, presumably through the surrounding environment.
- (iii) An early function seen, for example, when the baby realises there is a correspondence between his nose and his mother's, does not already contain all that may in the future be drawn from that early

and rudimentary understanding.

(iv) Maturation simply determines the range of possibilities at a specific stage: "the new reality still has to be constructed".

(ibid, p.193)

While Piaget here seems concerned with the effects of long-term and continued interaction between the organism and the environment, his discussion does indicate that the theory of genetic epistemology need not be considered pessimistically deterministic; change is possible through external means. Even though development is likely to subsume and direct learning, (Inhelder, ^{of ut.} ibid, p.153) the interesting question for education is whether relatively short term modifications of the learning environment can affect children's thinking processes.

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PART II

THE ACCELERATION OF CHILDREN'S THINKING

CHAPTER I : FACTORS CAUSING DEVELOPMENT

Piaget has referred to the desire for children to be helped to move more quickly through the various stages as "the American question", wondering if there is any advantage to be derived from such acceleration. "One must remember that the higher the zoological species, the longer is its period of infancy. There is a reason for this, and it may be that there is an optimal speed of development for each species". (Green et al 1971, p.7)

Educationally, however, it seems worthwhile to try to specify the possible causal agents in development, Kohlberg pointing out that "the prevention of ultimate adult cognitive retardation is a vital educational goal". (1970, p.47)

Dewey has also written that some see no alternative between "forcing the child from without, or leaving him entirely alone ... Both fail to see that development is a definite process having its own law which can be fulfilled only when adequate and normal conditions are provided". (Ripple and Rockcastle 1964, p.iv)

Piaget has suggested that the following four major factors are crucial in the course of such development.

1. Maturation

For Piaget, the development of general ways of knowing (Lovell 1971, p.239) is based on the whole process of embryogenesis, that is, the development of the body, the nervous system and mental functions. (Ripple and Rockcastle 1964, p.8)

This maturational process has a structure, but a structure plastic enough to be modified in the interaction with an environment. It is not a sequence of maturation in biological terms as in the hormonal regulation of physical growth patterns or of sexual maturation (Wartofsky in Mischel 1971, p.144), but rather a reciprocity of structure and environment. Piaget explains the inadequacies of

maturation as the key force in development in two ways. (Ripple and Rockcastle 1964, p.10)

(i) "We know practically nothing about the maturation of the nervous system beyond the first months of the child's existence".

That an area of knowledge is unresolved would not seem sufficient cause for dismissing it as the vital factor. The second of Piaget's arguments seems the stronger.

(ii) The average ages at which the stages appear vary a great deal from one society to another although the ordering of the stages is constant, having been found in all the societies studied.

Piaget explains, for instance, that in Teheran children reached the concrete operational stage at approximately the same age as in Geneva but there was a delay of two years for the children in the Persian countryside. Vernon (1965) has also shown the time lags evident in children of the same chronological age but different environments.

2. Social Factors

Social factors are obviously important causative agents in development. "In some social environments the stages are accelerated whereas in others they are more or less systematically retarded". (Piaget in Green et al 1971, p.7) Social experience cannot be the sole factor in development though, because a child can understand (make use of) valuable information only if he is in a cognitive state where he can accommodate to that information.

3. Experience

Piaget distinguishes between two types of experience which are psychologically very different. (Ripple and Rockcastle 1964, p.11) Children act upon objects, which is physical experience, but they also have logico-mathematical experience. This is not drawn from the objects themselves but through the actions effected upon the

objects. By placing, say, pebbles into many different orders a child will discover a property of the action of ordering. The pebbles had no order in themselves; it was the child's action which introduced the order. Similarly, a child will discover the action of summing objects, the sum being independent of order. So it is not the physical property of pebbles which this experience uncovered; it is the properties of the actions carried out on the pebbles. (op.citp.12) The subsequent deduction will consist of interiorising these actions and then of combining them without needing any pebbles, thus reaching the level of symbolisation. Despite the powerful effects of experience, Piaget considers that this factor is not omnipotent in development. Some of the concepts which appear at the beginning of the stage of concrete operations are such that Piaget cannot see how they are drawn simply from experience. For example, the conservation of substance appears before the conservation of weight. No experiment or evidence can show the child that there is the same amount of substance. "There ... is an example of a progress in knowledge, a logical necessity for something to be conserved even though no experience can have led to this notion". (op.citp.11) Ogilvie (1969, p.6) comments that the mere fact we cannot see how experience operates is hardly the best reason for postulating its ineffectiveness. Yet it seems difficult to explain why children reach an understanding of the conservation of substance before that of weight. Wallach (Elkind and Flavell 1969, pp.191-219) examines the bases of conservation, deciding that there must be factors other than sensory experience but that no viable alternative exists as the basis for conservation. (ibid, pp.194-195) He can only conclude that to recognise quantities do not alter under transformation "requires, clearly, the ability to think in certain ways and the absence of complete dependence on immediate stimuli." (ibid, p.214) Wohlwill

(Ripple and Rockcastle 1964, pp.95-100) considers that there is no specific answer to this problem of certain types of conservation preceding others. He thinks that there must be something in the normal course of development by which a new type of "set" emerges which has to do with the symbolic operations that relate to any particular concept. Wohlwill postulates "a tentative hypothesis ..., to the effect that the more generalised the experience that the child gets at an earlier point, the less specific teaching instruction will be necessary later".

Just as there is some difficulty in explaining why one type of conservation precedes another type, so there is a problem in reasoning how a child progresses from one stage of thinking to the next. Piaget considers that there is a "logical necessity" for a child to progress towards formal operations once he has reached equilibrium at the level of concrete operations.

McV. Hunt (Elkind and Flavell 1969, p.10) explains that concrete operations acquire an equilibrium because classifying etc. can be generalised to new circumstances indefinitely. "Yet, since they constitute thought processes directed entirely by encounters with circumstances, they are inadequate to provide a basis for an examination of those operations". Once the child begins to examine classifications and seriations in verbal contexts, a lack of equilibrium occurs. This "lack of equilibrium" would seem to be the crucial factor for Piaget in any explanation of the child's transmission from one stage to another.

(4) Equilibration

Piaget defines psychological equilibrium "very broadly as the compensation resulting from the activities of the subject in response to external intrusion". (quoted in Mischel 1971, p.323)
This intrusion need not be inevitably a physical stimulus. What the subject responds to is his construal of this external intrusion.

After early sensori-motor development, equilibration becomes a matter of compensating for "virtual" rather than "actual" intrusions. (op.citp.324) For example, the acquisition of conservation concepts "is enforced by logical structuring much more than by experience" so that equilibration here is a response to internal conflict between the subject's conceptual schemes. In such cases, equilibration is more a matter of achieving what Piaget calls the "accord of thought with itself" than it is a matter of establishing the "accord of thought with things". (op.citp.325)

Piaget warns against interpreting equilibration as the operation of a causal process and here refers to his series of four "strategies" which he says are adopted by the child. It is always the "failures or insufficiencies" of one strategy which lead to the adoption of a more equilibrated strategy. This series is presumably that described by Piaget in 1964 (Ripple and Rockcastle, pp.13-14): "In the act of knowing, the subject is active, and consequently, faced with an external disturbance, he will react in order to compensate and consequently he will tend towards equilibrium." In the conservation of plasticine, for instance, there will be four stages:

- (a) concentration on one dimension such as width.
- (b) concentration on the other dimension such as length.
- (c) oscillation between the two dimensions, thus discovering they are related. The child starts to think in terms of transformation and not only in terms of the final configuration.
- (d) compensation between the two dimensions which defines equilibrium.

"In other words, in the course of these developments you will always find a process of self-regulation which I call equilibration and which seems to me the fundamental factor in the acquisition of logico-mathematical knowledge". (ibid, p.14) Piaget explains further that "factors of subjective dissatisfaction with continually giving the

same response under changing perceptual conditions, and especially factors of perceptual contrast, particularly in extreme configurations ... increases the likelihood of centring the hitherto unnoticed property". (Flavell 1964, p.248) Flavell (ibid, p.248 footnote) criticises this explanation: "a simpler explanation ... might be that centring the second property necessarily becomes more probable as the number of trials increases". Hiles (1971, p.49) gives his own, helpful account of the possible development towards conservation:

- (i) there will be no dissatisfaction in giving the same responses if the child continually centres on one feature, for example, length, or if in alternating between length and breadth the child forgets the previous response.
- (ii) there will be subjective dissatisfaction when the child has made and remembers both perceptual responses and recognises the contradictions.
- (iii) the contradiction (as subjective dissatisfaction) together with repeated trials will lead to the search for the conservation of mass as the resolution of the problem.

Hiles considers that his explanation is in accord with Piaget's views on this problem since he has said that, "when the child is in a structural state of disequilibrium, his assimilatory and accommodatory functions act to establish greater equilibrium".

(quoted by Langer 1969, p.24)

These various formulations on the concept of equilibration indicate the difficulty in analysing its exact motive power. Almy (1966, p.21) thinks that Piaget's insistence on equilibration "is at once provocative and frustrating", some of the frustration arising from the difficulty involved in comprehending all that Piaget means by equilibration. Flavell (in Mischel 1971, p.125) also is unclear as to exactly what psychological phenomena "equilibration" is and is

not supposed to denote. He asks whether equilibration is interchangeable with cognitive conflict - which would seem to be so from the present accounts. If they are identical, how does such a process "explain" cognitive development? For Flavell the process of conflict resolution could not in itself be the single, necessary and sufficient vehicle for cognitive change. The child must be able to perceive that there are two potentially conflicting cognitive items and apprehend them as conflicting. "The capacity for this kind of apprehension may well have its own genesis". (ibid, p.125)

Furthermore, the child must be impelled to resolve the sensed conflict in a cognitively progressive fashion rather than, for instance, clinging even more rigidly to his prior interpretation. Flavell points out that to provoke a state of genuine cognitive conflict in children is surprisingly difficult, even in the laboratory.

As they develop, children come to "know" the invariance of substance but it seems unlikely that they acquire this knowledge by anything resembling Piaget's four-step equilibration process. Flavell then refers to Mischel's argument that Piaget's model is not an empirical theory of the developmental process but rather a "conceptual framework" within which to analyse empirical data on cognitive development. Flavell wonders, however, whether this "framework" will even prove a useful vehicle, especially if it is construed as the vehicle for developmental change. He concludes by declaring that he is "pretty sure" that there must be a number of mechanisms responsible for developmental change rather than a single one. (op.cit p.126)

Piaget would probably deal with Flavell's strictures by saying that the process of cognitive change is caused through any perturbing event, any event, that is, which puts a child's current structure into a condition of disequilibrium. (Kessen, op.cit. p.301)

Kessen gives a most useful account of the equilibration model (op.cit,

pp.300-307) but emphasises that he is explaining only the development of the early mind. His explanation seems relevant, however, to cognitive development at all levels. An event is construed as perturbing in relation to an available structure. There is an "optimal zone of interest for what is neither too well-known nor too new". (Piaget, *ibid*, p.303) And equilibrium is re-established through the process of equilibration. "So long as problems are posed to existing structures which do not permit easy assimilation but which are not beyond accommodation, change will occur and each successive structure will represent a cognitive gain". (Kessen, *ibid*, p.304)

When asked what are the rules of equilibration and how does the organism choose the appropriate solution, Piaget gives "his answer in several places in several ways, but the heart of that answer has two parts - a general strategy and some comments on tactics". (Kessen, *ibid*, p.305) The basic strategy is that of least effort; "That equilibrating change will occur which permits a maximum of activities and a maximum openness of exchange among structures" ... The tactical considerations that determine the selection of a particular problem resolution are frankly economic. When ... two possible schematic solutions are incompatible, an assessment is made of 'gain and loss'. The gain of new mobility and new simplicity must be measured against the cost of accommodatory change". (Kessen, *ibid*, p.305) Kessen then quotes this interesting passage from Piaget (1959):

"one of two schemata produces only a slight cost in accommodation but results in only a slight gain (from the point of view of an easy success or already acquired knowledge) while the other either produces a more difficult success that ... produces a gain in new knowledge; in this case the question is of knowing if these anticipated values sufficiently balance the effort (the cost) of accommodation".

Kessen comments that there is a remarkable assumption here. Is the pattern of accommodation to be determined by the baby's assessment of cost and gain? Or, if Piaget refers to the observer's assessment of anticipated values, how does assessment become relevant to the baby's problem solution? Kessen wryly concludes (ibid, p.306) that the quotation represents the great distance we must go before equilibration becomes sufficiently subtle and detailed an idea to guide specific research and generate specific predictions about the course of cognitive development. Such difficulties inherent in attempting to define equilibration (see also Pinard and Luarendeau 1969, pp.149-156) are, no doubt, among the potent causes for the contradictory findings revealed in the various acceleration studies in recent years.

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CHAPTER 2 : SOME OF THE PROBLEMS POSED BY ACCELERATION STUDIES

It is intimidating to realize how many different types of variables have been considered in previous attempts to accelerate children's thinking, some of which may obviously account for the discrepancies among a number of the studies. Strauss (1972, p.331), for example, contrasts structural transformations (development) with structural elaboration (learning), the latter being taken to mean that a child learns rules about how to apply the structure. Another set of variables is seen in Beilin's (1970) very extensive account of recent acceleration studies which poses the question of how specific should investigators be in isolating the operation which they wish to accelerate. Beilin examines research work concerned with single operations such as identity, class inclusion and reversibility. But even when such a neat division is made among the different operations, problems of definition continue to remain. Evidently the concept of reversibility, for example, is "fraught with confusion and a certain amount of vagueness". (Strauss 1972, p.341) Piaget sometimes uses the term "renversibilit  " to suggest the empirical return of a deformed object to its original configuration but elsewhere writes of "reversibilit  ", which can be interpreted in two ways:

- (a) a mental operation which allows one to cancel the effect of a transformation, thus implying inversion or reciprocity,
- (b) a reversible structure which is more embracing and implies the internal co-ordination of the system of operations which allows one mentally to transform the environment.

Despite the attempts to reach scientific exactness through isolating one particular operation it seems that training for the integration of mental operations is more successful than training for an isolated mental operation: "a research strategy which attempted to train for an isolated mental operation would not be thought to induce successfully either structural transformation or elaboration since the effect of such training might be either to segregate that operation or to exercise it". (Piaget, op.cit, p.344) Almy (1967) comments that experimentation which deals with the processes underlying the formation of specific concepts, "only begins to tackle the problems inherent in the transition from intuitive to operational thought ... (because) the possibilities for transfer to related problems in different contexts seems limited. If we understand Piaget correctly, the essence of the concrete operational level of thought is the child's ability to solve

a variety of problems in a systematic fashion. Consequently, if a child who has undergone a period of training responds correctly in a variety of conservation tasks, but ... fails to understand the class inclusion operation in a classification task, or can only order a series of objects by a manipulative trial and error process, he cannot be said to have completed the transition from intuitive to operational thinking". (ibid, p.129) It would appear from these comments that the studies concerned with one single operation, however successful they claim to be, are not following the correct path. They are not explaining how a child internalises information and co-ordinates his own mental operations.

Another vitally important aspect of acceleration studies is the type of criterion test used at the end of an experiment. Different criteria produce different interpretations of results and, therefore, different theoretical considerations. Strauss (1972, p.331) cites the most stringent of the various criteria accepted by different researchers - this, perhaps inevitably, being the ones devised by Inhelder and Sinclair. A subject should be assessed at the concrete operational level for conservation concepts if he can satisfy the following demands:

- (a) make a correct judgement of equivalence
- (b) logically justify that judgment
- (c) successfully resist a verbal counter-suggestion
- (d) produce a successful performance on a related behavioural task

Subjects at the transitional level should display at least two of these structural functions.

The ability to perform successfully on a related behavioural task would seem to be the vital criterion for Piaget before he will give any credibility to an acceleration study of conservation. At least one follow-up test must be made within a different content from that of the training study but the structure of the tests must be the same. Piaget also sets other standards for acceleration studies. Apart from mere behavioural responses in post-tests, what complex structures has the learning situation developed in the child? And how durable is that learning? There must be a reasonable interval between the training programme and the post-tests, Piaget seemingly wanting a period of about three months. Furthermore, the investigator must be as precise as possible in determining at what exact sub-stage the children were when the research programme began. Morf (Kohnstamm 1963, pp.323-324) reports

that 7 of 30 children aged from 4 to 7 years gave correct explanations on class inclusion questions such as, "Are there more animals or horses?" after having been trained to appreciate that objects can belong simultaneously to two or more classes. Worf is not ready to declare that this was a complete transition from one stage to another since he thinks the successful subjects probably had in principle at their disposal all the necessary operations and a nearly completed operatory system before the training began. Most studies, indeed, do indicate that it seems impossible to train children who are completely pre-operational in their approach; successful subjects have to be at least in the transitional period between pre-operations and concrete operations (see later pp.109-110). Smedslund's interesting experiment (Sigel and Hooper 1968, pp.277-280) in which he "cheated" both natural conservers and those who had been trained to conserve weight despite changes in the shape of the material, also direct one's attention to the problem of sub-stages. Smedslund wanted to test two predictions on the possible extinction of conservation. Learning theory would seem to expect that the notion of conservation can always be extinguished whether it is acquired in the laboratory or in normal life whereas equilibration theory states that a genuine understanding of conservation should be practically impossible to extinguish, since this reflects an inner 'logical' necessity. Smedslund, therefore, took a group of 5-7 year old children, eleven of whom always gave the correct response after the training. The control group was a set of 13 children who had always given the correct answer at the pre-test stage. Smedslund proceeded to "cheat" both groups on extinction trials by stealing part of the plasticine when he deformed one of the balls. The children answered that the "sausage" and the "ball" would weigh the same and Smedslund then placed the two objects on the scales. None of those "trained" showed any resistance to extinction, they simply switched to pre-operational answers, but 6 of the 13 'normal' conservers continued to reason logically, saying to Smedslund, for example, that, "You took a little piece away" or "You lost some". Smedslund concludes that the ability to resist extinction should render conservers "fairly independent of empirical

outcomes". (ibid, p.280) There have been two recent comments on this experiment and its support for the equilibration viewpoint. Hall and Kingley (Beilin 1970, p.16) have shown that it is possible to obtain extinction of conservation even among college students. Beilin thinks that such a finding places the extinction procedure as a strong test of operativity in doubt, though much would presumably depend on the type of conservation test. Secondly, Strauss (1972, p.349) asks the pertinent question: "What about the 54% of normal conservers who did not resist?" Were these only at a transitional stage on the pre-test but at that point had managed to give the correct answer to Smedslund? Debate about the criterion on relatively simple experimental procedures such as conservation makes one realise how complex is the assessment of children's answers on verbal passages. But conservation, perhaps, is not a relatively simple procedure, Beilin (1970) suggesting that there can be a strong and a weak definition of this concept. For example, "same" in relation to "number" involves the conceptual attributes of number which require cognitive capacities different in kind from those in which "same" is used in relation to the notion of same "object" such as water.

Gelman (ibid, p.16) has put forward the argument that failure to conserve may be due to inattention to relevant qualitative attributes, or to attention to irrelevant factors: "The theoretical basis for conservation ... is interpreted to be associated with the function of attentional phenomena". Possibly this contention was the basis for the investigation by Feigenbaum and Sulkin (1964) who blindfolded subjects before the children dropped equal numbers of beads into two jars. Feigenbaum and Sulkin interpret their successful results as supporting the equilibration theory since they think that the decisive effect might have been the active experience of manipulating the beads. (ibid, p.18) After surveying other experiments which aim at decreasing the influence of perceptual cues, Beilin concludes, however, that "attention is not a sufficient explanation of what occurs in conservation, even though it is a necessary ingredient to an

adequate explanation". (ibid, p.20)

Various other components of the learning situation have been suggested as the vital factors which might affect the development of conservation. Among these can be included the type of reinforcement used (see p.102), the number in the set of elements presented to the child (Iij-ima, ibid, p.35) the type of language used by the experimenter and, most important of all, the actual methods used during the training sessions. All experiments have to involve some of the components mentioned here; it is probably asking too much of any investigator that he isolate and examine just one crucial factor. Yet some type of order in an examination of the experimental evidence is necessary in order to try to clarify the relationships and similarities in the many acceleration studies recently undertaken. Possibly the clearest and simplest way of discussing these studies would be to consider them under the following rather global headings.

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CHAPTER 3 : DIFFERENT APPROACHES TO THE ACCELERATION OF
CHILDREN'S THINKING

(1) Disequilibrium

Strauss (1972, pp.332-339) considers disequilibrium as a concept of interaction both between a structure and the external environment (EXTERNAL) and also within the structure itself (INTERNAL). Thus, when a structure is equilibrated, it possesses stability relative to external information (adaptational equilibrium) and lack of actual, internal contradictions (organisational equilibrium). One wonders, however, whether Strauss is being a little too exacting in this distinction. How does one distinguish between a structure being adapted externally from one being adapted internally? If a child demonstrates understanding of conservation with reference to an external problem, can one say that the structure is equilibrated - at least, for that problem? Strauss (ibid, pp.337-338) indicates that he understands internal equilibration to refer to the structure d'ensemble and thus expects a child to have reached equilibrium in, say, the concept of classification, whatever the content of the problem. Research work seems to show that this almost chimerical internal equilibration can never be said to be all pervasive and perpetual. As mentioned earlier, college students have been deceived by the extinction technique. (Beilin 1970, p.43) Often students in further education find it very difficult to reason out this conservation problem:

"There are two glasses, one containing 10 ounces of water and the other 10 ounces of wine. A spoonful of water is taken from one glass and stirred into the wine. The same spoon is used to remove the equivalent amount of liquid from the wine glass to the water glass. Does the wine glass contain more water, the water glass contain more wine, or what?"

Strauss, indeed, does point out that people can revert to a subordinated level through stress or the novelty of the task but he contends that such regression is local and relatively short-term. He does not agree with Miller's (1971) conclusion that the extinction of conservation is ubiquitous, rather easy to obtain and that a majority of subjects seem susceptible to such training.

The whole question of the possible relationship between specific learning and structural organisation has been advertised recently in a series of articles in "Interchange" (1970). Bereiter began the debate by stating that

Kohlberg considers there are two kinds of behaviour change (ibid, p.26):

Type I (Structural Stages) : changes which are not situation specific, tend to be permanent and irreversible.

Type II (Reversible Situational): situation-specific changes which are thus limited in effect and are susceptible to extinction or reversal. Bereiter says that Kohlberg then argues that Type I change should take precedence over Type II change and that there "is no particular reason to expect that preschool teaching of a reversible situation-specific type can have any lasting effect upon the child". (ibid, p.26) Bereiter thinks that such a comparison presupposes that the two concepts are of the same category; "Basically, however, there is no way to compare stages with specific learnings".

The discussion whether Kohlberg has committed Ryle's "category error" seems to depend on whether Kohlberg inferred that "whatever doesn't qualify as Type I behaviour change is Type II and whatever is Type II isn't Type I". (Bereiter, ibid, p.49) Kohlberg in his reply to Bereiter (ibid, pp.40-48) points out that Ryle's category error occurs when similar observables are differently grouped and interpreted at different levels of abstraction, and are then treated as opposing concepts. Presumably, this could happen if a child's correct response to a conservation problem were treated as evidence of both adaptational and also organisational equilibrium. Possibly the concept of horizontal décalage is also a category error. As Beilin points out, "Inferring both structural invariance and response variability from the same body of data ... places the Geneva group in the position of offering either a paradox or a contradiction". (Sigel and Hooper 1968, p.361)

Kohlberg argues that the Geneva School claims that Type I structural re-organisation represents a different set of observable events than does Type II specific learning rather than representing a difference of perspective on the same events. To meet the criteria of being a Type I structural re-organisation "a given behaviour change must meet a set of criteria that are empirical, that is, for which there are clear observations to test whether or not the behaviour meets the criteria". (ibid, p.41) Kohlberg suggests that the following should be among these criteria:

- (i) The change is irreversible. Once it has occurred the change cannot be undone, forgotten, or replaced under normal conditions.
- (ii) The change is general over a field of responses and conditions.
- (iii) The change is in quality of response, not merely in its correctness according to an external criterion.
- (iv) The change is sequential, it occurs in an invariant series of steps.
- (v) The change is hierarchical, that is, later forms integrate the earlier forms of response.

In contrast, Type II behaviour change is reversible, specific and need not occur in a sequential pattern (for example, some studies suggest that randomly scrambling a programme yields as effective learning as does a 'rationally' sequenced programme). Kohlberg agrees that quality change as opposed to quantitative increase "may be legitimately argued to be a difference in perspective rather than a criterion differentiating two types of change". (ibid, p.42)

He does say later, however, that cognitive developmentalists hold that "experience functions in different ways ... when it causes structural change from when it causes content change". (ibid, p.43)

In particular, psychologists like Greco and Langer consider that certain types of learning experiences of cognitive conflict provided to children at a transitional stage will induce Type I structural change, whereas types of learning experiences (for example, verbal instruction and reinforcement) will be ineffective in inducing structural change. (ibid, p.43) Experimental literature suggests that creating such conditions of cognitive conflict is more likely to induce structural change than instruction which concentrates on modelling the "correct" response. "However, the cognitive developmentalist neither claims, nor has proven, that experiences of content learning have no effects at all upon structural re-organisation". (ibid, p.44) This is an area in need of empirical

research. Experiments on the training of conservation "do indicate that a given induced change in response content ... may represent either Type II reversible specific content learning or Type I structural re-organisation". (ibid, p.45) Which type of change has occurred is determined by tests of irreversibility and generalisation. Even with these criteria, however, one cannot be sure that the child is evincing signs of Type I or Type II learning since "change in an overt response like 'conservation' ... may be composed of various mixtures of Type I structural re-organisation and Type II content learning". (ibid, p.45) Furthermore, the criteria of Type I structural re-organisation may be not in a stronger form in some response areas than in others, "content" and "structure" being more intermixed in morality than they are in pure logico-mathematical thought. And "it is just these areas of content-structure mixture that are probably the most fruitful areas for educational intervention". (ibid, p.45)

Kohlberg seems to have led himself towards Bereiter's contention that all "Type I changes can, at a more detailed level of description, be treated in terms of specific responses and thus as Type II changes". (ibid, p.49) Bereiter also argues that "the level of description represented in Piagetian theory is too global to be useful in planning educational strategies". One cannot "teach" Type I changes; "the question is whether this type of behaviour change depends upon some other processes than those involved in specific learning or whether it is a higher level description of the same process of cumulative learning". (ibid, p.50) From an educational and a research viewpoint this distinction will obviously have a vital effect on training and teaching strategies.

Kamii entered the debate between Kohlberg and Bereiter by declaring that Piaget has delineated three areas of knowledge according to their respective sources: physical, logico-mathematical and social.

(ibid, p.34) The child can acquire social knowledge only from people. Two of her examples of this type of knowledge are that December 25th is Christmas Day and that Washington, D.C. is the capital of the U.S.A. It is clear that this type of social knowledge at a Type I level depends upon logico-mathematical support as much as information from people and Kamii does comment that a child cannot learn facts without a logical structure. (ibid, p.35) Even so, one wonders whether this distinction into three areas is sound on epistemological grounds. Bereiter comments that it would be "nice if ... the nature of a priori knowledge, could be disposed of so casually". (ibid, p.50) Later in her article, Kamii argues against Bereiter's view that specific learning and cognitive stage development are the same phenomena described at different levels of generality. She thinks that the issue is one of whether the operation in question, such as conservation, is part of a larger whole or the isolated result of specific training. We are again in the area where Lovell (1971) has distinguished between general and particular knowledge. For Bereiter the essence of learning seems to be a change in the child's behaviour, for example, if a child can give conserving answers without being shaken by trick questions, Bereiter would conclude that conservation has been learned. "Piaget is more concerned with how the internal processes become structures because rules that are not rooted in a total structure are not likely to lead to the construction of later structures". (1970 p.38)

This whole debate in "Interchange" (1970) seems to demonstrate the difficulty in formulating at an empirical level the criteria which could be used to distinguish between Strauss's two processes of adaptation to the external environment (adaptational equilibrium) and lack of internal contradictions within the structure itself (organisational equilibrium). Kohlberg's criteria for Type I

structural re-organisation should prove of help to research workers in the future but at present it seems safer to examine recent research in the area which Strauss has typified as that of external, adaptational equilibrium (1972, p.333)

Essentially, the adaptational model places a child in a situation where a discrepancy occurs between the structures already at his disposal and his own actions and/or the environmental data presented to him. This "lack of fit" should perturb the mental structure. In a fairly recent experiment, Inhelder and Sinclair (1969) studied preoperational, intermediate and operational children in a conservation of continuous quantity (liquid) task. The child had to predict the outcome of a transformation, for example, "what height do you think the water will be when it is poured into this differently shaped container?" The child could then observe what happened. The probable negative feedback, in that he made the wrong prediction, could provide the conditions for restructuring and progress. These are Inhelder and Sinclair's results.

		Percentage showing progress	
	Initial Assessment	Transitional	Concrete
Ss	Pre-operational	12.5	0
Ss	Transitional	38.5	36.5

Inhelder and Sinclair explain that 38.5% were placed at the transitional level because they had extended their previous structure. 36.5% showed a "true elaboration of their reasoning to true conservation" while 25% made no progress. Inhelder and Sinclair comment that in the training condition "there were many explanations with appeals to identity and compensation, but few to reversibility by inversion (annulment) that is common with natural conservers". (Beilin 1970, p.28) "Annulment" was possibly given as an explanation by natural conservers because they had achieved conservation of liquid through the experience of pouring liquid from one glass to

another.

Frank (1966) induced conflict in a prediction-outcome situation by screening the jars from the child's view when water was poured from one to the other. Bruner has argued on the basis of this experiment that when children "fail" the water experiment, they may have attained the conservation concept in their verbal, symbolic representation of non-perceived events but are misled in the experiment by irrelevant perceptual cues (ikonic). The screening, so continues Bruner, forces the child to base his judgments on the identity of water, which then helps him to "resist" the effect of changes in the appearance. Considerable improvement in conservation was reported for 5-6 and 7 year old groups in a transfer post-test but the 4 year old children made no progress at all. Strauss (1972, p.337) points out that there is a significant difference in the rationale behind this experiment and behind that conducted by Inhelder and Sinclair. Frank's experiment presupposes the existence of a mental structure, the conflict being between the ikonic and symbolic modes of representation of that structure, not between the structure and the retroactive feedback as the Genevans would have it. But the structure is affected by the conflict since the conflict resolution is theoretically followed by a relatively consistent dominance of the symbolic mode. Piaget (Bellin 1970, p.8) will not accept that Frank's experiment did demonstrate such dominance. He considers that the subjects reached pseudo-conservation, Bruner failing to distinguish functional covariation from operational compensation, and "reversibility" (which is logical and operative) from "empirical return" (which is a "physical notion"). Frank's subjects, therefore, achieved a preoperational type of identity which can lead only to pseudo-conservation. Wallace (1972, pp.126-127) explains that such a contrast between performance founded on an empirical basis and on

a reversible system of operations is paralleled in the distinction which Piaget makes within the cognitive function between the figurative and the operative aspects. The former deals with static configurations and comprises such activities as perception, imitation and mental imagery while the latter includes operations and the transformations which lead from one configuration to another. (ibid, p.126) There is constant interaction between these two facets "but the operative component constitutes the basic aspect of intelligent knowing and, as development proceeds, it increasingly dominates and determines the figurative aspect". (ibid, p.126) The pre-operational child puts the emphasis on the static quality of states, for example, he concentrates on Jar A or Jar B. Piaget contends that a training which concentrates on the perceptual aspect will reinforce the figurative component without touching the operative component and will thus be unlikely to accelerate the development of cognitive structures. "To achieve the latter objective the focus should be on the operative aspect, on the understanding of transformations not the analysis of states". (ibid, p.126)

Another experiment by Inhelder and Sinclair (Boilin 1970, p.29) investigated the relationship between misleading visual cues and the child's activity, although the principal aim of the investigation was to discover whether the acquisition of elementary spatial measurements of length can be facilitated by the child's application of numerical operations. The subjects had to construct a straight line equal in length to a zig-zag line already laid out for them, in one case with materials equal in length to the standard and in another case with matches smaller than the standard. There was extensive discussion between the experimenter and the child. 35% made no progress at all but 28% gave correct answers with full justification. Inhelder and Sinclair conclude that "it is possible

to use already acquired numerical operations to lead to spatial operations of measurement; however, progress is very slow if one wishes to reach full acquisition ... It is feedback from their actions and not from the visual results of the experiment that leads to structures of a higher order". (ibid, p.29)

Smedslund's well-known series of experiments set children in conflict situations where the deformation of a substance is contrasted with an addition and subtraction procedure on the same substance. (Sigel and Hooper 1968, pp.281-295) In one experiment Smedslund presented two objects which the child agreed were of equal weight. One was then deformed and a piece was taken out of the other object which remained in the original shape: the state of ensuing inner conflict, according to Smedslund, may well induce cognitive changes. After three practice sessions on three successive days, he gained the following results for 13 children aged between 5 : 6 and 6 : 6 years: 8 were consistently dominated by their perceptual schema but 5 adhered to the addition-subtraction scheme. Of the latter, 4 changed from no trace of conservation to several correct answers. Smedslund considers that this transition occurred as a source of conflict but does not expect it to happen very frequently; on previous tests only 5 of 100 subjects made such an improvement. Beilin (1970, pp.22-13) notes a series of follow-up experiments based on Smedslund's findings. Winer (1968), for example, found that A/S training aided transition but that 'conflict trials' in which A/S was tied to a deformation procedure were more effective. In spite of this, Winer considers the effect of the conflict procedure to be minimal. Gruen (1965) considered that subjects given conflict training out-performed subjects given direct training on the apparatus in which there was no A/S procedure. He found, however, very little transfer from number training to length and substance conservation. Beilin concludes his survey by saying that

in spite of the few negative studies (Wohlwill and Lowe, 1962, Smith 1968, Mermelstein 1969) "the conflict procedure appears capable of leading to improved conservation performance". It is more effective with older children and does not transfer to types of conservation not trained in that way. Conservation of discontinuous quantities such as number is achieved before other types of conservation.

Another experiment which might be grouped with those of the adaptational equilibration model was that conducted by Morf. (1958, in Beilin 1970, pp.32-33 and Kohnstamm 1963, pp.317-325) Morf's subjects at the beginning of the experiment could isolate classes but could not cope with the class inclusion question: "Are there more flowers than roses?" Training by demonstration evinced little improvement but children's free exploration of the materials, when the exploration had something to do with the problem, showed a definite improvement; 7 of 30 children aged from four to seven years giving the correct explanation. Kohnstamm (ibid, p.321) considers that learning was interpreted here in a very narrow sense: "The possibility of first instructing the small child and then letting him try to apply that instruction to other problems is not even mentioned in a series of publications professing to study the connection between learning and logical operations". Morf thought that those children who were successful probably already had at their disposal all the necessary operations and a nearly completed operatory system.

Wallace's recent research (1972) into the possibility of accelerating children's ability to conserve a number of objects included the two different approaches of pictorial definition and conceptual conflict. He also included a reinforcement procedure, though this aspect of his experimental design did not figure largely in his discussion of the results. Generally reinforcement procedures in conservation

experiments have "been reported both as unsuccessful ... and as successful" (Doilin 1970, p.15) One of the difficulties is that different researchers conceive the same training techniques as relevant to different mechanisms and as supporting different interpretations.

Wallace (1972, p.35) decides that in view of the important function which it performs in both neo-associationist and Piagetian theory, an attempt to foster cognitive conflict appears to be an appropriate goal for any acceleration technique. Wallace goes further to consider the merits of direct training accompanied by external reinforcement as a feature of a treatment calculated to accelerate conceptual development; that is, there was a feedback for the child concerning the accuracy of his responses. Certainly the protagonists of neo-associationist theories would support such an experimental design. How far would it satisfy the Genevan school? Wallace thinks that Piaget would agree with the inclusion of direct training using external reinforcement in a treatment aimed at accelerating intellectual development on two conditions: "firstly, that it was not regarded as a sufficient feature, and secondly, that due attention was also given to features such as the encouragement of conceptual conflict, which would be likely to lead subjects to engage in structural re-organisation and which would thus be conducive to the operation of the process of equilibration". (op.cit, p.37)

For his experiment Wallace selected 90 subjects from an original sample of 227 Bristol nursery school children aged between 4 : 0 and 6 : 6 years on the basis that they represented certain types of non-conservation performance detected by pre-tests: for example, included among these were subjects who maintained conservation of two groups of objects through overtly counting the objects after they had been re-arranged. These subjects thus failed to realise

that in the absence of the addition or subtraction of an element the number of objects must remain the same. The 90 subjects were randomly assigned to one of three groups: Experimental I and II and Control, the Control group not being seen by Wallace for training purposes.

Experimental Group I had a non-verbal training procedure in which the children were trained individually for thirty minutes on eight successive school days. Among the training techniques was an attempt to make children conserve two groups of objects through contrasting an addition - subtraction approach when the objects were moved closer together (if an object was added) or farther apart (if an object was subtracted). "This procedure set the perceptual cues consistently at variance with the nature of the numerical change and was intended to maximise the degree of conceptual conflict involved". (op.cit p.70) Correct solutions on all the training techniques were rewarded by mini-titles to be found behind doors in the apparatus; those were used to complete a mini-mosaic which the child was given. Wallace does not say whether a completed mosaic could perhaps be exchanged for a possibly more positive reinforcement such as a bar of chocolate.

Experimental Group II had a treatment based on the work of Gal'perin (1961). From his examination of Gal'perin's research, Wallace decided that the process of concept formation is greatly shortened when a subject is provided from the outset with a precise and objective account of the essential features of a concept and is shown how to apply them in the clearest possible way. (op.cit p.73) As written, verbal definition was unsuitable for Wallace's age range, he used a largely pictorial method of presenting the basic features of the concept (op.cit, pp.73-78). The subject was guided to the solution of conservation problems with material objects by applying all of the aspects of the concept as delineated on the card. (ibid,

p.76) When he had thoroughly assimilated the contents of the card, it was withdrawn in stages. The subject then recited aloud how the components were applied to the features of each problem. Finally he spoke "to himself". If a subject gave an incorrect reply he was directed to return to the preceding level of the process. These verbal training methods proved more time consuming than the non-verbal.

Post-tests were given immediately after the training and three months later. Both non-verbal and verbal tests were given, the former proving the more difficult for all three groups. (op.cit. p.91)

TABLE III Wallace's (1972) results on the conservation of objects

(a) VERBAL TESTS (derived from Table 8, op.cit, pp.87-88)

Groups	Total Scores of post-tests		Experimental Group I		Experimental Group II		Control Group	
	First	Second	First	Second	First	Second	First	Second
Experimental Group I	9.22	11.19	-	-	S	N.S.	S	S
Experimental Group II	11.13	11.41	S	N.S.	-	-	S	S
Control Group	6.50	8.19	S	S	S	S	-	-

(b) NON-VERBAL TESTS

Groups	Total Scores of post-tests		Experimental Group I		Experimental Group II		Control Group	
	First	Second	First	Second	First	Second	First	Second
Experimental Group I	9.15	12.85	-	-	N.S.	S	S	S
Experimental Group II	7.60	7.38	N.S.	S	-	-	N.S. p = 0.067	S
Control Group	4.54	4.08	S	S	N.S. p = 0.067	S	-	-

S = significant at or beyond the 5 per cent level

Wallace points out (op.cit. p.91) that the proportion of subjects in Experimental Group I who attained the pass criterion in the second post-tests was significantly higher than in the first post-test on both the verbal test ($p < 0.01$) and the non-verbal test ($p < 0.025$). Such a result did not obtain for Experimental Group II. Why was there such a 'delayed action' effect ~~from~~^{for} Group I on both the verbal and non-verbal tests? Two of Wallace's three possible explanations are of interest for the present research.

- (a) The training procedures had brought some of the members of Group I to a point in development at which the additional varied experience supplied by the initial testing and everyday events thereafter, was sufficient to produce number conservation three months later.
- (b) A more speculative reply, according to Wallace, hinges on the distinction made by Piaget (1959) between the acquisition of content and structure in intellectual development. (op.cit, p.104) The former is the province of learning on the basis of external reinforcement but the latter consists of the active "reorganisation by the subject of the logical structures necessary to cope with the content derived from experience and is identified by Piaget as equilibration". (ibid, p.104)

Wallace argues that this was precisely the goal at which the addition-subtraction trials in the training series were directed; by encouraging conceptual conflict it was hoped that this would lead the subjects to
 {engage in structural reorganisation.

Was the effect of the "comparatively passive process of registering the physical facts of the situation" of shorter duration than the active process of structural reorganisation? If this was indeed so, then the acquisition of content outstripped the development of structure, hence necessitating retrospective structural

reorganisation (op.cit. p.105). Wallace reports that Inhelder and Sinclair (1969) were astonished in acceleration studies to note how several of their subjects who learned quickly and surely showed no sign of transfer of what they had acquired to a different field, whereas subjects who had seemed to be having difficulties "finally showed a true mastery of the learned concept as well as transfer to another field". (ibid, p.105)

Wallace also considers why children from Group I were better able to generalise their learning to new situations "in which the relevance of their training experiences was not signalled". (op.cit. p.121). He again warns that any answer to this question must be speculative. He used the distinction made by Schroder et al (1967) between unilateral and interdependent training environments as an approach to the problem. In the first type the agent provides the subject with ready made rules and controls his behaviour until he learns the required response. By over-structuring and simplifying the environment, the agent endangers the potent development of abstract structural properties. In an interdependent situation, "the learner is provided with an environment which affords information as feedback or as a consequence of his own questions or exploratory behaviour". (op.cit. p.122)

Hence, there develops a more complex perception of the environment and an increased potential for cognitive development. Wallace thinks that the verbal and non-verbal training sequences which he used "can clearly be identified as a unilateral and an interdependent method respectively". (op.cit. P.122)

In the former the subjects were from the outset provided with the entire structure to be internalised; in contrast, the latter method "left it to the children to derive the principle for themselves". (op.cit. p.123)

It can be hypothesised that structures founded on externally provided mediation are not assimilated in a meaningful

or generalisable way since they are not expressed in a child's characteristic mediational mode. Structures which are formulated by the child himself, on the other hand, are integrated into the child's conceptual structure as a whole and are thus rendered more flexible and adaptable. (ibid, p.123)

Wallace also advances "an alternative, or possibly complementary, explanation ... which ... focuses on conceptual conflict rather than mediation". In the non-verbal technique there was an attempt to foster such conflict by confronting subjects with trials in which the effects of perceptual change were juxtaposed with those of addition and subtraction. Any restructuring caused in this way would "have the result of placing the addition-subtraction schema in a dominant position in any position in which the perceptual mode of operation had, hitherto, been paramount". (ibid, p.123) The essence of the verbal technique, however, was "the guided application of the definition to the features of the problem situations. (op.cit. p.124) This probably meant that the child was never placed in a situation in which rival schemes were activated and that, "at best, the internalised definition would become a specialised structure of narrow applicability, divorced from the totality of (a child's) conceptual structures and, thus, from the possibility of generalisation". (ibid, p.124) Whether the explanation is that of different mediational modes or of cognitive conflict, the non-verbal training technique led the subjects on both the non-verbal post-tests to exhibit reasoning which indicated that they had formed conceptual structures allowing them a greater degree of flexibility and adaptability than was available to these subjects trained in the verbal technique or to those used as a Control Group. Whether the differences would fail to be statistically significant after a period of more than three months is a question which another research project might answer. But

Wallace's results offer little, if any, evidence in support of the contention that language learning by itself contributes to the integration and co-ordination of 'informational units' necessary for the achievement of conservation concepts. (op.cit. p.127) On the contrary, his results seem to favour the Geneva position. The relative failure of the verbal acceleration technique to produce generalisation of the conservation principle supports Piaget's contention that "a treatment, which depends for its effectiveness on inducing the child to abandon his dependence on misleading iconic forms of representation by providing him with alternative verbal and enactive mediators, will result in a purely empirical recognition of conservation based on experience and confined in its application to the situations in which this experience was gained". (op.cit. p.128)

(2) The use of language in acceleration studies

The artificiality in classifying these acceleration studies under one global heading is evident in Wallace's research. While he used reinforcement as a means of motivation, the major findings are concerned with differences between verbal and non-verbal techniques. The following studies also demonstrate a mixture of different techniques but each is concerned with some type of verbal training method. Beilin (1970, pp.21-22) suggests that there are three approaches by which one may study the effect of verbal elements in the process of conservation acquisition:

- (a) the role of lexical terms such as 'large - small' and 'wide - narrow' in their relation to conservation concepts,
- (b) the effectiveness of a verbal as contrasted with a non-verbal technique,
- (c) the efficacy of verbal rule instructional procedures.

Reference has already been made to the conclusions of Inhelder and Sinclair.(1969, p.21) After an attempt to train children to use comparatives they discovered that at the concrete level, "language

... is but an instrument ... (and) learning capacity is not provided by the instrument, but by the subject". Wallace's results seem to reveal that the non-verbal techniques had a more lasting effect than the verbal. A recent study by Hamel et al (1972) indicates that children must be partial conservers if they are to benefit from a relatively short period of verbal training. Eighty 6 year old children were divided into four groups:

Group I	20 conservers
Group II	20 partial conservers
Group III	20 non-conservers
Group IV	20 non-conservers (control group)

Within two weeks of a conservation pre-test, a pictorial pre-test was given to Groups I, II and III. This consisted of 4 items of discontinuous quantity (flowers, birds, etc) and 9 items of continuous quantity (water). Immediately after the pre-tests, the subjects in Groups II and III were asked the same questions as in the pre-tests, but now the experimenter correctly^{id} faulty answers by focusing the children's attention on the similarities and differences in height and breadth of the water and the glass beakers"(op.cit. p.188)

"This was done to teach the subject to abstract the relevant attributes of the concepts 'more', 'less' and 'same' from the stimulus field". (ibid, p.188) The Control Group IV received no training. After the relational terms training (the interval of time is not stated), groups II and III were post-tested with the relational terms pre-test. Then Groups II, III and IV were given the conservation post-tests" which were identical with the conservation pretests". (ibid,p.188)

The experimenters seem to have ignored Piaget's requirements that some time must elapse between training and testing, and that all of the post-tests should not be identical with the pre-tests. Hamel et al conclude that the use of relational terms is more difficult with continuous materials than with discontinuous ones. They also

state that the language-activation training promoted conservation reactions for only the partial conservers and not the non-conservers "who appeared not to benefit appreciably from the short training procedure". (op.cit, p.191) This study would seem to support the views of Inhelder and Sinclair: the children must have available some thinking skills through which the language becomes significant. Bellin, however, wonders whether the Genevans slight the importance of language in conservation acquisition. He thinks, for example, that Inhelder and Sinclair did not use a verbal rule instruction method which paralleled his own approach in 1965. This was a complex study involving number, length and area conservation tasks together with three procedures: equilibration, attentional orientation and verbal rule instruction. The most successful technique used was that which contained repeated verbal explanations of the conservation rule. The post-test results indicated that the V.R.I. treatment had significantly improved the subjects' performance in the areas in which they were trained (number and length conservation) but there was no improvement in the conservation of area in which they had not been trained. (Wallace 1972, p.121) Bellin also quotes (1970, p.22) a study by Smith (1968) which showed the efficacy of the V.R.I. approach when pitted against reinforced practice and a Smedslund type of addition-subtraction procedure. Simcox (1970, pp.69-77) tried to improve the logic of a group of children aged 8 years. The experimental set of 33 children were taught games based on logic while a numerically equivalent control set had lessons in fabric printing to avoid any "Hawthorne" effect. Each child in the experimental group had six ten minute lessons given individually, every child watching the "game" of the preceding child. The instructions for the "game" were given verbally. Before and after the series of training lessons the children answered Peel's Logic Tests, Visual (illustrated) and Verbal (not illustrated). The

results are not very easy to analyse as the two tests contained irrelevant items and these were both included and excluded in the final results. The lack of a decisive result is seen in this Table IV (op.cit. p.73):

TABLE IV Simcox's Experimental Work (1970)

<u>Analysis of Variance of Gains of Whole Sample</u>					
<u>Summary of Treatment Effects</u>					
	Training	Control	F	P	
Visual + Irrelevant	402	230	7.2	0.1	Highly significant
Visual - Irrelevant	229	135	2.7		Not significant
Verbal + Irrelevant	191	114	2.2		Not significant
Verbal - Irrelevant	172	82	4.4	.05	Significant

Thus, the highly significant gains on the visual test of the group which had received teaching by the bead and counter games compared to the control group disappeared when "irrelevant" items were extracted. On the other hand, when gains on the verbal test are compared, it is only when the irrelevant items are excluded that significant gains were made. (op.cit. p.74) Simcox contends that the fourth comparison in the above table is probably the most important, this entirely verbal test illustrating "that significant gains in the logical thought of children" aged eight years can be cultivated. (ibid, p.74) Yet this contention has doubt cast on it when one notes that: "At the conclusion of these 'lessons' the original VISUAL and VERBAL tests were repeated". (op.cit, p.73) It is not clear there whether there was an interval between training and post-testing. The experiment also points to the problem of isolating the crucial factors in an acceleration study: were the successes gained primarily through verbal experiences or through concrete experience? Simcox mentions in his conclusions (op.cit, pp.76-77) that the research shows there is a need for increased awareness of some children's limited understanding of such phrases as "only" and "any" but also concludes

that, "if thought is internalised action, concrete experience ... has aided thought". (op.cit. p.77) It is thus difficult to decide if the verbal activities took the predominant role in improving children's answers.

The research work outlined in this section would not seem to give powerful support to acceleration attempts at the concrete level based on verbal training techniques alone. Inhelder and Sinclair declare that "linguistic structures are not acquired uniquely according to their own laws. On the contrary, an operative component is necessary before linguistic structures can be generalised". (Bellin, 1970, p.30) Bellin, however, concludes his survey of research findings with an opposite viewpoint, that verbal rule instruction leads to improved conservation performance: "The mechanism that accounts for its effectiveness is the algorithmic function of language that enables it to serve in problem solving even in those instances in which an adequate operative structure is not available to the child". (op.cit,p.23) The trend of research evidence indicates that verbal instruction does not lead to transfer effects outside the area in which the children were trained; whether it is only or even mainly the verbal rule instruction technique which accelerates thinking within any particular area such as seriation or conservation of substance would seem to be yet another problem which awaits further research.

(9) Multiple training strategies

Bellin (op.cit, p.23) introduces his discussion of multiple strategies with the remark that, "the mere demonstration of conservation by training, in itself, does little to extend knowledge of the mechanisms of thought or the way they develop and function". Kohnstamm's provocative study (1963, pp.313-356) is selected by Bellin as one example of those types of research which contain "so many experimental manipulations as to make them of limited value as scientific instruments,

although they may be noteworthy as education polemics". (Deilin 1970, p.24) Later, Deilin comments somewhat more sympathetically that Kohnstamm's approach, while involving explanations why answers were wrong, using leading questions and verbal and non-verbal materials, had virtues of flexibility and most aptly approximates to what is done in educational settings. (ibid, p.33) ^{of cl.} In essence, Kohnstamm was concerned with the skill of class inclusion. Sixty nursery children aged on average 5 : 7 years were divided into three sets as comparable as possible in age, sex and intelligence. Great success is claimed for Group III where the training sessions consisted of the children initially working on problems involving lego building blocks of various colours and size, followed by a picture series of problems. Eighteen children answered correctly questions in a post-test on the blocks and sixteen on the pictorial problems. All the successful children also obtained high percentages of correct answers on verbal problems.

Kohnstamm considers that the training was not equivalent to mere conditioning since the learning result was too generally applicable and too durable. Eight children of Group III were retested with the same picture material six months after the learning experiment, 92% of their answers being correct. (1963, p.354) Kohnstamm argues that if the original learning had been a mere S - R connection, then extinction would have done its work during the long period in which no reinforcement was given. He suggests, on the basis of these results, that Piaget has not given any consideration to the possibility of other learning methods outside the scope of both passive empiricism and the equilibration theory.

There have been a number of rejoinders to Kohnstamm's experiment and its conclusions (reported Beilin 1970, pp.33-36). Pascual-Leone and Bovet (1966) think that Kohnstamm relies on what they interpret to be "figural structures" which do not necessarily correspond to the

underlying logical structures, the children's solutions reflecting the acquisition of "empirical schema" (that is, empirical generalisation) rather than operative structures. Lasry and Laurendeau (1969) replicated Kohnstamm's experiment but the post-tests were transfer tests on different materials. They also had a control group at the operative level to determine whether the experimental subjects' acquisitions were truly operative. Lasry and Laurendeau obtained a significant amount of learning, more success being obtained with the material class inclusion problems than with problems using verbal terms. Inhelder and Sinclair (1969) believe there is evidence that operativity is achieved, but this remark is qualified by the observation that in general the criteria for operativity ^{are} is too vaguely defined to make it possible to judge such achievement. (op.cit, p.34) For their part, Inhelder and Sinclair used Kohnstamm's criteria and also more stringent criteria for operativity. In this way they discovered two different results with a group of eleven children: using Kohnstamm's criteria nine succeeded, using the latter criteria only two succeeded. Inhelder and Sinclair, therefore, still query "whether an operative structure can be acquired by 'empirical-didactive' methods". (op.cit, p.35)

From some other studies on the class-inclusion problem reported by Beilin, that of Ahr and Youniss (1970) seems instructive in the present context. They developed a training sequence with children aged from 6 to 8 years in which there were two conditions:

(i) "expanded question training" in which subjects were asked questions such as, "Are there more pets or more dogs or more cats?" This was designed to overcome children's tendency to substitute a sub-class for the super-ordinate class.

(ii) feedback procedure with correction for incorrect responses.

Ahr and Youniss discovered that the latter training was the more effective, with older children benefitting more than younger. They consider that the correction procedure did not promote inclusion behaviour de novo but "seems to bridge a gap between not yet stable competence and performance". (op.cit. p.35)

Possibly the most extensive of the studies involving multiple training strategies is that reported by Almy and Associates (1970). Their primary aim was to try to assess the effects of three programmes of logical thinking in mathematics and science on children in the second grade (aged on average 7-8 years) in various areas of the U.S.A. Three programmes were studied in detail, each of them making efforts to help children move more completely into operational thinking. (op.cit, p.59)

(i) American Association for the Advancement of Science (A.A.A.S.)

In the foreword, the aim is stated as developing skills in "Observing, Recognising and Using Number Relations, Classifying, Communicating, Inferring and Predicting".

The stress is placed on developing these skills rather than upon a systematic presentation of information. (op.cit, p.61)

Nearly half of the cognitive responses required related to the logic of classes, about 15% to the logic of relations and about 20% to number.

(ii) Science Curriculum Improvement Study (S.C.I.S.)

In general, the teacher was asked to experiment with the presentation of various activities in the manner of a scientist, looking for evidence of "the children's growing ability and interest in dealing with objects and events in more analytical ways". (op.cit, p.64) An open-ended approach was to be adopted, the teacher being instructed to refrain from drawing conclusions from experiments. One wonders if this programme suffered from a lack of clear,

precise directions as possibly also occurred with The Nuffield Junior Science Project in Britain. (Hoyle 1972, pp.35-40) Indeed, Hardeman comments (Almy 1970, p.60) for all three American programmes that there is no way of knowing whether any given teacher actually carried out the activities in the "precise way prescribed by the manual". Approximately 70% of the cognitive responses required were concerned with the logic of classes, about 10% with the logic of relations and 20% asked the child to become aware of his thought processes. (op.cit, p.66)

(iii) Greater Cleveland Mathematics Programme (G.C.M.P.)

Through a discovery approach to learning children were to be led to an understanding of basic mathematical ideas such as the equivalence of two sets. (op.cit, p.67) About 70% of the cognitive processes required were connected with number and 20% with the logic of classes.

The control groups in the kindergartens and first grade classes of Garden City, New York, were given no proscribed lessons but the teachers were handed two mimeographed curriculum guides compiled by local educators, one for science and one for mathematics. The choice of activities and the sequence in which the concepts were provided were left to the teachers but they were encouraged to allow the children to find their own solutions to problems. The manuals also gave lists of concepts to be taught, with one or two examples of each such as, "The need to count on a one to one correspondence. Example: We need ten chairs, twelve napkins". (op.cit, p.69)

From the original number of 949 children, 634 remained for the completion of the study over the three years of testing, namely, at the beginning of the kindergarten, first and second grades.

TABLE V Almy et al (1970, p.21)

(a) Sex, Chronological Age and I.Q.^a at Initiation of Study of Children Remaining to Completion

Program	No. of Children	Sex		Chronological Age in months		PPVT mean	IQ S.D.
		Boys	Girls	mean	S.D.		
A.A.A.S. (G.C.M.P.)	94	50	44	64.28	3.61	105.41	17.62
S.C.I.S. (G.C.M.P.)	79	43	36	64.42	3.67	100.66	18.24
G.C.M.P. only	122	67	55	64.80	3.37	106.76	12.55
No prescribed lessons	137	63	74	64.92	3.31	109.20	14.73
TOTAL:	432	223	209	64.66	3.46	106.13	15.76

(b) Program Initiated in First Grade

S.C.I.S. (Math)	115	61	54	75.63	3.06	107.87	13.93
G.C.M.P. only	87	45	42	75.24	3.23	104.31	14.96
TOTAL:	202	106	96	75.46	3.13	106.34	14.45
GRAND TOTAL:	634	329	305			106.19	15.34

^aI.Q. is based upon Peabody Picture Vocabulary Test Form A

The "pretests" at the beginning of each school year consisted of two kinds of tasks, conservation involving number and a quantity of liquid and class inclusion questions. In the "post-test" interviews in the fall of each year once the programme had been completed, the same tests were repeated and were supplemented by tasks of serial ordering, transitivity, matrix tasks and conservation of weight. (op.cit, pp.27-51)

There were two sets of important results: (a) the overall performance of those children with I.Qs over 89 who had early instruction of any type is better than of those who did not have such instruction (op.cit, 12)

(b) children with no prescribed lessons in the kindergarten did about as well as those who had such lessons. "None of the differences in per cent of children who were clearly operational is large, although five of the seven comparisons (among the tasks) favor the group with no prescribed program". (op.cit p.126) Almy wonders whether "a relatively unstructured but active kindergarten experience provides the less mature children an opportunity to develop spontaneously the ability to conserve and some degree of operational thinking". (op.cit, p.126)

When a comparison was made of groups matched on the basis of sex, age and six points range in P.P.V.T. I.Q., these findings held: children in the programs where there were no prescriptions for mathematics and science lessons were as competent in the post-test tasks as their counterparts in prescribed programs". (op.cit, p.128)

Did the emphasis of the different prescribed programmes have different effects on the children's thinking? For instance, the S.C.I.S. and G.C.H.P. programmes emphasised the manipulation of objects somewhat more than did the A.A.A.S. programme, but observers in the classrooms raised the possibility that in the G.C.H.P. programme the children observed the manipulation of objects rather than actually handling them individually. On an overall basis, and in matched groups, the children following both science and maths programmes did somewhat better in conservation tasks than those who had only mathematics. More children on the A.A.A.S. programme were operational on the transitivity tasks. But, the fact that children on no prescribed programme performed neither better nor worse than the other groups "makes suspect any assertion of differences in specific tasks". (op.cit, p.131)

Almy suggests a number of reasons for the paradoxical results of the study, that early instruction benefitted children's thinking but

specific programmes had no more effect than simply attending a kindergarten.

- (a) The groups beginning the programmes in the first grade presented a wider range in socio-economic status than was the case for the group beginning the programme in the kindergarten.
- (b) The mean P.P.V.T. I.Q. of the group that had no prescribed lessons in kindergarten or first grade was significantly higher than that of the groups having the programmes.
"But in initial conservation status they gave no evidence of being advanced over the other groups". (op.cit, p.145)
- (c) The Garden City kindergartens gave specific attention to science and mathematics concepts, even though they followed no prescribed programme. These Garden City teachers were also more experienced than the others and knew that they were involved in a study comparing the effects of prescribed instruction with the child-centred, loosely-structured, informal activities customarily included in their curriculum. Furthermore, the children in the Garden City classes had somewhat better verbal ability, and were more homogeneous socio-economically. (op.cit, p.146)

Possibly, with all these factors seeming to work on their behalf, it is not surprising that the control group maintained progress with the other children. Almy proposes, on the basis of the results and relevant variables, that "the experience and education of the teachers is a primary factor in the outcome in the second grade". (op.cit, p.147)

Considering that only a small portion of the kindergarten - first grade curriculum was modified by the introduction of prescribed lessons, Almy also thinks that it is perhaps unrealistic to expect any major effects on the children's thinking. In contrast to the limited time available for the groups with specific programmes to follow, the

Garden City teachers had more freedom and time, if they chose, to follow the interests of the children.

The equivocal nature of the findings may have been caused through "the inability to control adequately in a field setting certain variables relative to the outcome". On the other hand, the results may be a true reflection of "the recalcitrance of the young child's thought structures to modifications from without". (op.citp.167)

In general, there is no evidence in this study that the prescribed lessons led to a new integration or a total re-organization of children's thinking as they began second grade.

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CHAPTER 4 : ATTEMPTS TO DEVELOP FORMAL OPERATIONS IN
CHILDREN AND ADOLESCENTS

(1) Some training studies

Beilin (1970, p.36) comments that there has been little research into trying to help children understand the relation between the real and the possible and the "reasoned determination of all logical possibilities". Ennis et al (1969) claimed that, while training children from the first to third grade on possible conditional relationships resulted in no differences between the experimental group and the control group, many subjects had already mastered the basic principles of conditional logic. Beilin considers that their study did not accurately represent Piaget's theoretical position. (op.cit. p.37) Furthermore, O'Brien and Shapiro (1968) came to a quite different conclusion when they assessed children's ability to deal with hypothetical reasoning, only 45% of students in the 12th grade being able to interpret correctly statements deductively derived from "if - then" propositions. (op.cit. p.38)

Anderson (1967) hoped to improve by instruction the logical quality of adolescent pupils' reasoning. Eight comprehension passages were prepared from a pilot study and given to 128 secondary modern girls, half aged 11 to 13 years and half 13 to 14 years. The instructed girls were given printed forms which contained information intended to provide them with the opportunity to form and test hypotheses. The teacher initiated discussion and helped to lead towards the "acceptance of sound judgments based on reasoned argument". (op.cit, p.17) Agreement was obtained, not imposed. Thus, the girls were helped to recognise inconsistencies, incompatibilities, irrelevances and partialities. (Peel 1971, p.118)

There were three grades given to the answers but these were dichotomised into less mature 'B' responses and mature 'C' responses for the purpose of statistical analysis. These were the three original grades:

A. Prelogical

B. Tied to the material of the passage and limited in the understanding of underlying relationships and possibilities.

C. Entailing exploration of elements beyond the passage:

"explanatory and abstract propositions are invoked, and imagined possibilities or hypotheses are considered". (Anderson 1967, p.32)

One wonders, however, whether the following answers really merit the 'C' grade which Anderson and his co-marker Best assign to them. (1967, p.36)

The children were given the passage concerning the pilot flying a plane over the Alps which collided with an aerial cable railway. (Peel 1971, p.32)

They were then asked:

1. Was the pilot a careful airman?
2. Why do you think so?

"Yes he was careful because it could have been foggy" (Anderson 1967, p.32 No.31 1A1) The passage gives such information as "This summer ...".

For a mature answer, surely one would expect some discussion of the possibility of weather conditions in summer?

"Yes, because accidents can happen" (No. 78, 3DN) - little more than a truism?

Even the more advanced answers (ibid, p.36) such as, "Can't say, because we don't know enough about the airman to say he was not careful" (No. 123, 3A1) do not explore a variety of possibilities.

Admittedly, Anderson was assessing whether the girls' responses had changed: there was an interval of five weeks between the first test and the second test. He may have kept the criteria steady for each individual girl over the intervening period, but he does seem to allow a range of answers within the 'C' category.

From his statistical analysis Anderson gives the following results:

- (a) The effect of a stream was more powerful than that of age, an A stream child being more likely to score higher than a D stream child and third year child more likely to score higher than a first year child.

(b) The effect of instruction was highly significant, being more marked with first year girls than with third year, and slightly more with A stream girls than with those in the D stream.

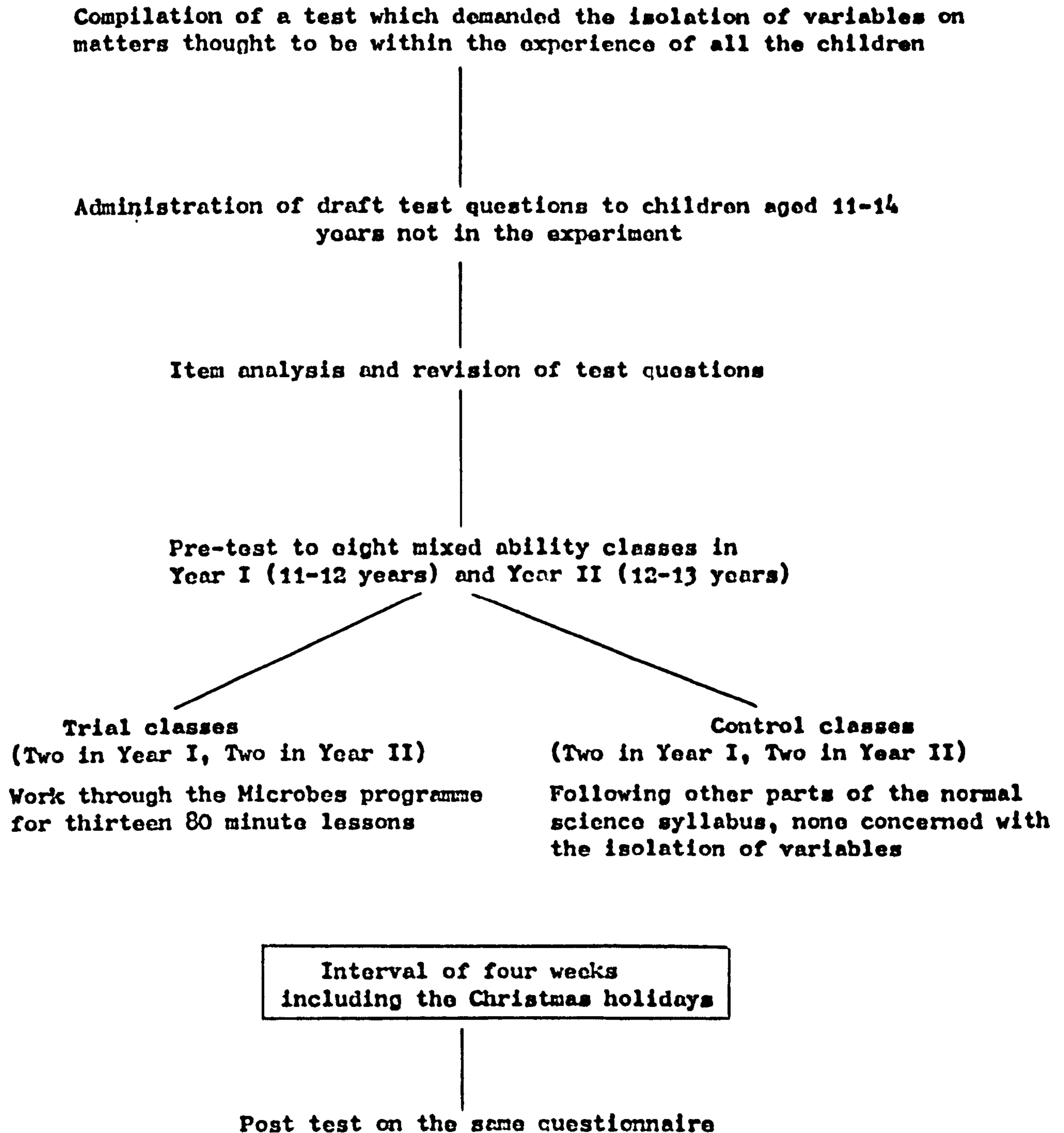
(2) Acceleration studies in science

Suchman (1961, 1964, reported in Peel 1971, pp.115-117) used a method of "inquiry training" to help children discover scientific principles. Films of simple phenomena in physics which were discrepant with the children's previous experience (a bimetal blade bent differently as it was turned over in a flame) were shown to children aged ten years. The pupils were allowed to ask questions which could be answered only by 'yes' and 'no'. Peel (op.cit, p.116) explains that on the basis of the answers the pupils "build better theories which they test themselves". Each session was tape recorded, being followed by a playback and discussion. The effects of such 'inquiry training' appears to transfer to other fields, as in biology and economics. (op.cit, p.117) Harlen (1968, p.8) in his discussion of Suchman's (1960) experiment, states that the children showed an improvement in their logical approach to problems and displayed characteristics of formal thought, nor normally achieved until adolescence.

A number of modern science courses stress the need for, and the use of, controls in experiments. Kamm (1971, pp.417-423) designed an experiment to determine whether working through the trial version of the programme 'Microbes Part I' (Nuffield Resources for Learning : Biology - Independent Learning) significantly improved the ability of children aged 11 - 13 years to isolate variables and hence appreciate the need for controls. This was the design of his scheme (op.cit, pp.418-420)

FIG. I

Kamm's (1971) Experimental Design



All the trial classes and two of the control classes were taught by the same person who added guidance and discussion to the usual method of teaching biology in Kamm's school. This consisted of following duplicated worksheets. Taking an arbitrary score of 14 out of a possible 22 correct answers as a sign that a child can satisfactorily isolate variables, the results suggest that a mean age of about 13 : 5 years is required before such a standard can be reached. This result seems to agree with the

findings of both Mealing (1963) and Inhelder and Piaget (1958). There was no difference between boys and girls in the ability to isolate variables. (op.cit, p.422) The children who followed the 'Microbes Part I' programme made no greater improvement in their ability to isolate variables after completing the course than did the children in the control classes. "This absence of any difference in ability (to isolate variables) applied to all groupings - by age, by sex, and by V.R.Q.". (op.cit, p.422) Kamm, therefore, concludes that the draft microbes programme appears not to have fulfilled its secondary aim of teaching children how to isolate variables. This could be due to a number of possible reasons including:

"(a) That transfer of reasoning from one particular problem to another similar one is only slight, as was found by Lovell and Ogilvie (1960), by Barker (1965) and by Harlen (1965)

(b) That children automatically and progressively attain the ability to isolate variables as their mental ages increase and that this is not a process which can be speeded up". (op.cit, p.422)

It may also be that a teacher cannot hope transfer will occur; he has to teach specifically for the type of transfer desired.

Ervin (1960) also tried to train children to isolate variables in a scientific context. Harlen (1968, p.10) explains that Ervin trained eight boys and eight girls from the third and fourth grades (8-10 years) on an apparatus consisting of a weighted trolley drawn up a slope by a string which had weights hung on the end of it. Three variables governed the behaviour of the trolley but in the training sessions only one variable at a time was altered. In the testing situation questions were posed which were designed to detect the child's ability to predict outcomes when two variables were changed at a time. Training, however, did not eradicate error in the test problem. Ervin concluded that her subjects were not able to make use of the training experience because they had not reached the appropriate stage of maturation.

Coombs' aim (1969) was to "ascertain whether, in the absence (sic) of the necessary mental structures as outlined by Piaget, it would be possible to teach children to arrive at the correct solutions to problems by the process of testing hypotheses and eliminating or rejecting those propositions which were found to be inadequate". (op.cit, p.26) The design of the experiment can be summarised diagrammatically:

TABLE VI Coombs' (1969) Experimental Design

Pre-testing

Boys given either Group I experiments (Combination of liquids, pendulum I, bending rods) or Group II experiments (pendulum II, bulb and switches, bending rods)

24 boys aged 7-8 years		24 boys aged 9-10 years		24 boys aged 11-12 years		24 boys aged 13-14 years	
12 _R	12 _C	12 _R	12 _C	12 _R	12 _C	12 _R	12 _C
Exp 6	Con 6	Exp 6	Con 6	Exp 6	Con 6	Exp 6	Con 6
Three in each cell of good average ability and three of average ability (headmasters' criteria)							

R = schools in residential areas C = schools in central urban areas

Training to experimental groups in school hours on the three scientific problems, the length of the training varying according to the problem and the age of the boys.

Interval of eight weeks

Post-testing on whichever group of experiments was not taken in the pre-test and also on the balance.

While the control group showed little change in its performance over the two attempts (op.cit p.114), training significantly improved the replies in the experimental group for the pendulum ($p < 0.001$), chemicals ($p < 0.025$) and balance ($p < 0.01$), and this group's answers were better on the bending rods problem. The difference in performance

on the balance experiment may be an indication of transfer of training, thinks Coombs. (op.cit, p.112) One presumes that the boys did not reach the level of formal operations on at least one of these experiments since Coombs comments thus on the combination of chemicals: "they were unable to arrive at a method which could be used to cover all possible combinations". (op.cit, p.110) The improvement in answers was more pronounced for 11 and 13 year old subjects than others, the best results coming generally from the 13 year old boys. (op.cit, p.114) Those classified as of good average ability by the headmasters on the whole did better on all the experiments than the groups of average ability. On the combinatorial and bending rods experiments the boys from the central urban schools obtained better results than those children being taught in residential areas, but this result was reversed for the pendulum experiment. In general, however, the subjects in the central area were found to produce better average results, Coombs suggesting that this could be caused through differences between the two samples. (op.cit, p.112) Possibly, the headmasters, working on teachers' comments, underestimated the abilities of the central boys; there was no external criterion for selection. (op.cit, p.28)

Coombs concludes that it would be reasonable to accept that "training has had some positive influence on the subjects, (and) this training has been of greatest benefit to those in the oldest age group". (op.cit, p.115) Furthermore, "the Balance experiment shows that there is a measure of transfer to problems which are of a related nature". (ibid, p.115)

(3) The use of programmed techniques

Peol (1971, pp.123-124) first suggested the possibility that the actual responses made by people in previous experiments could be used in a branching programme as a means of teaching individuals how to judge. Gray (1970) produced five such programmed texts for training different aspects of judging, each requiring up to 40 minutes for completion.

u The approach, through the medium of the verbal logic of a branching

programme was:

- (a) to indulge the child's current level of thinking on the particular topic long enough for him to become aware of his limitations;
- (b) to lead the child deliberately into the next higher level of thinking by challenge, argument, the production of further information, and so on;
- (c) to encourage, at the hypothetico-deductive stage, a consideration of all possibilities and the subsequent discarding of those unwanted;
- (d) to encourage divergent thinking - yet also to provide opportunities for the convergent thinking involved in carrying an argument to a conclusion". (op.cit, pp.124-125)

Randomly selected experimental and control groups of secondary school pupils were chosen, given a pretest of five problems, then the experimental groups went through the five branching programmes at a rate of one per day for five consecutive days. Both groups then took a post-test of six thinking problems; Peel does not say whether there was a longish interval between this post-test and the completion of the programmes. The adolescents in the experimental groups obtained significantly higher scores on judgment problems (seemingly of a similar type to those used in the programmes) but there was no significant difference between the performance of experimental and control groups on such problem solving situations as Duncker's ropes problem (1945) and a divergent thinking test of Unusual Uses. (op.cit, p.125) Peel considers that Gray's programmes appear to be effective in promoting mature judgment. Gray also concluded that analysis of judgment may exist independently alongside work on divergent thinking and problem solving.

Renhard (1971) attempted to increase non-verbal intelligence test scores (Raven's Standard Progressive Matrices) through children following

a programme on the principles of inductive reasoning. Renhard's definition of this type of reasoning was derived from Cohen and Nagel (1934): "dealing with those inferences which enable us to derive universal conclusions from particular ... premises". From a set of observations, then, the common character or property is sought and from this a universal proposition is suggested. Induction is, therefore, a generalisation from particular instances. (op.cit, p.10) After having written and validated a suitable programme, randomly selected children from the first three years of a secondary, non-selective school in a suburban residential area were divided into experimental and control groups.

TABLE VII

Renhard's (1971) Experimental Design

(a) Subjects

Year	Ages	Numbers	
		Experimental	Control
1st	11-12	29	33
2nd	12-13	34	30
3rd	13-14	34	31

(b) Research strategy

Time	Experimental Groups	Control Groups
One afternoon in the first week	Raven's S.P.M. followed by the linear programme	Raven's S.P.M. followed by normal school activities
One afternoon in the second week	Completion of the programme followed by the retesting on Raven's S.P.M.	Raven's S.P.M. followed by normal school activities

(c) Results (op.cit, p.32)

	Gain Scores (diffce. post- and pre-test scores		Level of Significance
	Exporimental	Control	
Year I	+ 2.45	+ 0.40	1%
Year II	+ 2.18	+ 0.60	N.S.
Year III	+ 0.12	+ 0.16	N.S.

The children in the experimental groups classified as being of lower intelligence than the others, made an average greater gain in the post-tests.

Renhard admits (op.cit, p.31) that by working through the matrices before tackling the programme, the experimental groups may have been influenced in their understanding of the programme. One wonders, also, how far the post-test scores were affected by there being no interval at all between completing the programme and taking the post-test. Renhard did not check for persistence over time by having a retest later. (op.cit, p.39) He suggests that the low gain in the third year might have been caused by a lack of motivation in the experimental group since the pupils were removed from practical lessons. He also wonders whether the scores were influenced by a growing rebellion against authority which seems to emerge rather more strongly in that age group. (ibid, p.39) It might also be considered that a programme covering such a short period of time is likely to have but little effect on minds which are possibly reaching a cognitive level in which they are less easily affected than are those of younger children.

Olton and Crutchfield (1969) used a sample of 280 children of about 12 years, with a mean group I.Q. of 115 for both Instruction and Control Groups. (Miles 1971, p.44) Within an eight week teaching period of one hour each school day the control group followed activities of "general educational value" while the other group used two types of self-instruction

material: "a set of 16 programmed lessons that provided direct instruction and a certain amount of guided practice in productive thinking and problem solving, and a set of supplementary exercises intended to strengthen the skills taught in the programmed lessons". (quoted *ibid*, p.44) Two pre-tests were given one week before the programme began; six post-tests were taken immediately after the completion of the eight week period and were followed six months later by five follow-up tests. Miles (*op.cit*, p.45) explains that these tests were highly diverse in content ranging from structured ones with a limited number of answers to an open-ended test such as the writing of an essay on poverty in the U.S.A.

The programme evidently "raised the level of thinking skill shown by an 'average' student to the level of a student with an I.Q. some 25 points higher". The attitude of the instruction group also improved, showing a 26 per cent increase in the 'favourable' index over the control group. Olton and Crutchfield contend that, "Considerable increments in thinking proficiency can be produced by showing the student how to make more effective use of the basic cognitive capacities he already possesses, rather than by attempting to accelerate the emergence of basic capacities that normally develop at a later age". (quoted *ibid*, p.46) Miles says, however, that this conclusion is hardly supported by the evidence cited as the test programme contained no assessment of operational levels of thinking. "Rather the results were quantitative and do not appear to distinguish between concrete or formal operational answers among these twelve year old children". (*ibid*, p.46) Miles also thinks that another conclusion by Olton and Crutchfield is speculative. They consider that "once the basic capacities for complex thinking have emerged, training may considerably enhance the child's ability and readiness to use complex cognitive processes efficiently and effectively". Miles, however, explains that the question simply required answers at a concrete operational level; thus, a quantitative review of factors at a concrete

operational level does not tell us whether a child can think at the formal level. (ibid, p.46)

Stones (1967) adapted Ausubel's theory that giving subjects a passage at a higher level of generality than the passage to be studied subsequently would improve both their immediate understanding of that passage and also help in long-term retention of the contents. (op.cit, pp.57-58) One hundred and four girls were selected at random from the fourth year of 4 schools (two grammar, one grammar-technical and one secondary modern). Within each school pupils were matched into pairs on the basis of A.H.4 scores and were then assigned randomly to two groups. They were thus paired on a quantitative measure but their answers on the criterion passages were assessed qualitatively though a six point scale derived from Piaget and Peel.(op.cit, pp.100-106) The experimental group followed a linear programme of instruction of sixty-two frames on concepts such as trade, transport, imports etc. which underlay the subsequent history material used in the criterion tests. (Peel 1971, p.126) The other group were given a set of definitions of the concepts; these were presented in a random and unconnected sequence. The definitions were simple and straightforward but they contained little or no material to indicate any relationships between them.(Stones 1967, p.70) Each member of each group worked at her own pace until everyone was ready. Then the girls answered a total of 9 questions on the three passages concerned with the history of American transport. The sum total for the nine questions was then used as the criterion score. This is how Peel explains Stone's results (1971, p.126): "The group receiving the programmed instruction achieved significantly higher scores on the judgment tests. The improvement was most marked among pupils of higher intelligence and lower verbal fluency". One notes, however, that the passages were answered immediately after the completion of the programme. Once again, Piaget's demand of some interval of time as proof of durable learning was not met.

(4) Comments

As with training programmes at the concrete operational level, the research described in this section does not give a consistent answer to the problem whether thinking can be accelerated at the formal level. As might be expected, it seems that the older and the more intelligent subjects gain greater benefit than do the less intelligent and younger subjects (Anderson 1967; Coombs 1969; Stones 1967 - but contrast Renhard 1971). One of the variables affecting these results might be the assessment of the children's responses. Stones (1967) for example, did not ascertain her subjects' initial level of thinking, which Inhelder declares is of vital importance. (Green et al 1971, p.113) And Stones seems to have found some difficulty (1967, p.107) in differentiating between answers at Grade 4 (causal links) and Grade 3 (circumstantial). This appears to have been the crucial area in the statistical analysis for distinguishing between the two levels of thinking, high and low. (op.cit, p.123)

Some researchers state that their training and teaching methods produced improved thinking skills (for instance, Anderson 1967, Suchman 1964, Coombs 1969): others declare that there was little effect (Kamm 1971, Ervin 1960). A similar discrepancy in results can be noted also for another of Piaget's imperatives - the ability of the subjects to show their improved thinking skills on a task which is similar in structure but different from the original test. Suchman (1964) and Coombs (1969) decide that their results indicate success on this criteria: Kamm (1971) and Gray (1970) decide otherwise. The temporarily, rather gloomy decision is that the general picture seems as inconclusive with regard to accelerating formal operations as it does with concrete operations.

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CHAPTER 5 : GENERAL CONCLUSIONS

From the various research studies cited in Part II it would seem that some acceleration of thinking based on Piagetian criteria is possible but that such training is subject to a number of limiting factors. Disagreement has occurred, for example, because of the criteria used to assess whether operativity was achieved or not. Gruen (Sigal and Hooper 1968, p.495) comments that the 1960s controversy between Braine and Smedslund on children's grasp of transitivity of length demonstrates "that Braine and Smedslund are using quite different criteria for diagnosing the presence or absence of transitivity". Smedslund always asked the children to explain the reasons for their answers while Braine deems a child a conserver if he simply gives a conserving response; Smedslund has called this type of answer a "symptom response". Inhelder et al follow Smedslund in demanding that the subjects give reasons for their answers: "The operational structure (as defined by Piaget) underlying the conservation concepts appear to us to be a complex, co-ordinated system that cannot be properly evaluated by rather summary investigation of answers to pre-selected questions with no exploration of the child's justification of those answers. Nor can such answers be induced by training the child to direct attention uniquely to those aspects of the situation that lead him to a limited (in terms of the criteria for the conservation concept) "correct answer". (quoted ibid, p.496) Gruen contrasted the responses of 45 subjects aged five years who were given verbal pre-training to help them discriminate between the concepts of "more" and "same" with the replies given by 45 control subjects who were not given V.P.T. but had the same experimental conditions. When Gruen used Smedslund's criteria which required a logical or semi-logical explanation (ibid, p.496) there were no significant differences between the two groups on post-tests. But using Bruner's criteria (which were similar to Braine's), the differences were significant. Gruen considers

that it is an open question which set of criteria is the appropriate one, Smedslund believing that logical operations such as reversibility and compensation underlie conservation while Bruner thinks that the state of conservation is reached when the symbolic mode of representation dominates the iconic mode. (op.cit, p.500) Gruen concludes with a warning to research workers to be very careful about specifying what they mean by "conservation" and the psychological processes which they assume underlie this concept. It is interesting here to note that Engelmann's claim (Green et al 1971, pp.118-126) that he had trained kindergarten children to reason correctly on problems involving specific gravity was demonstrated by Kamii and Derman (ibid, pp.127-143) to be no more than a claim that he had taught a verbal rule; the children did not have the requisite previous and necessary abilities such as class inclusion and the multiple seriation of weight and volume through which they could assimilate in a meaningful way the concept of specific gravity.

It is no easy task, however, to tease out the exact structures needed for success on any problem of logical thinking. Elkind (Sigel and Hooper 1968, pp.460-472), for example, thinks that Piaget's explanations of answers to a typical conservation question such as "Does the ball stay the same?" are really post hoc rationalisations rather than veridical reflections of the processes leading to conservation: (op.cit, p.464)

(i) "Nothing has been added or taken away so it is the same".

(identity)

(ii) "If you made it like it was before it will be the same".

(reversibility)

(iii) "What it lost in one way it gained in another". (compensation)

Inhelder and Sinclair contend, however, that it is possible to analyse children's answers so that such logical operations can be detected. For instance, they state that few of the subjects whom they trained to understand conservation of liquids used arguments of annulation by reversibility which are frequent among children who acquire the concept

by slower, more spontaneous means. (Mussen et al 1969, p.7)

The problem of which criteria should be used in assessing operational development is reflected in Kohlberg's distinction (1970, pp.40-48) between learning characterised as Type I (structural re-organisation) and that characterised as Type II (content learning). The Genevan school claims that Type I change represents a different set of observable events than does Type II, the former being able to meet an empirical set of criteria: (ibid, p.41)

- (i) Change is irreversible under normal conditions.
- (ii) Change is general over a field of responses and situations.
- (iii) There is a change in the quality of response.

Possibly this criterion is the "stability" seen in naturally acquired responses when compared with learnt responses. (Beilin 1970, p.41)

- (iv) Change occurs in an invariant series of steps.
- (v) Change is hierarchical, earlier forms being integrated into later forms of response.

Jensen (1972) also regards as vital a distinction between forms of associative learning, which he thinks are mainly a function of the time spent in the learning activity, and the development of more complex cognitive structures. (op.cit, p.184) He comments that some pre-school and compensatory programmes have demonstrated earlier than normal learning of certain skills but that "the evidence for accelerating cognitive development ... is practically nil". (op.cit, p.187) Usually a distinction is not made between sheer performance and the nature of the cognitive structures which support the gains in performance. For Jensen evidence of the latter is seen in a capacity for transfer of training resulting from some specific training.

In the present research at the secondary level possibly the gains made by some children in the examination results represent the 'performance' aspects of the training situation, while the manner in which they reasoned on the taught and non-taught passages is indicative of any structural

re-organisation. At the primary level the pupils were also tested on taught and non-taught passages. At both levels, primary and secondary, it was necessary to look for more than mere "symptom responses" to questions. Whenever it was thought to be necessary, supplementary questioning tried to discover the reasons for the children's answers (Appendix C, pp. 27-39). Examining all the replies on a passage usually indicates in a global manner at which level the subject is answering (see, for example, the contrasted series of answers on pp. 42-3). Whether certain defined logical structures underpin children's verbal reasoning is still a debatable area (Parsons 1960, Bynum et al 1972). Further research into thinking in history might use passages requiring answers which should show evidence of schemes such as classification and seriation at the concrete operational level and truth-functional logic at the formal operational level. In the present research certain questions were asked (see pp. 13-17) which specifically required the use of the groupings that Piaget considers lie at the basis of concrete thought, while the questions as a whole were attempting to assess whether children would view historical events from a present-day or a contemporary viewpoint, thus demonstrating the ability to use reversibility. Answers were judged at the formal operational level if they met the verbal criteria for hypothetico-deductive reasoning. (See pp. 257-258, Table xxiv) In view of the serious criticisms laid against their use of propositional logic (see pp. 33-37), it was not intended in this investigation to analyse answers for evidence of the sixteen binary operations of truth-functional logic which Inhelder and Piaget state are used by a fully developed formal operational thinker.

As well as this vitally important concern over the criteria used to assess answers, another important factor in acceleration studies is that cognitive learning depends very much on the child's initial level of thinking: "and this is what few researchers have studied in sufficient detail". (Inhelder in Green et al 1971, p. 113) From her own work

Inhelder claims that true progressive development takes place only when children are at an intermediate stage in their thinking. Not one of her subjects starting at a truly pre-operational level succeeded in learning the logical operations that underlie the elementary notion of conservation of physical quantities. (Mussen et al 1969, p.6) Bellin also states that where legitimately inferred change has been observed it is invariably in subjects who are already partially conserving. (Green et al 1971, p.179) Wallace (1972, pp.201-202) thinks that the Piagetian insistence on considering the initial level of children is consistent with Flavell and Wohlwill's (1969) account of the formation of cognitive structures in terms of a four phase process in which transitional and stabilisation phases intervene between the initial pre-operational and the final phase. Hence:

Children at the pre-operational level - little, if any, evidence of the acquisition of concrete operational concepts.

Children at the transitional level - variably receptive to influences aimed at speeding up the initial emergence of concrete operations and, for those that do learn, fairly limited transfer.

Children at stabilisation - show effects mainly of consolidation or generalisation in nature; an extension of previously established operations to new domains.

Final phase - cannot give evidence of any learning effects.

Wallace considers, therefore, that a more precise assessment of the subjects' initial levels is becoming increasingly important. In the present research a careful attempt was made to assess each subject's initial level of thinking before the teaching programme began. The results when the same subjects were tested a year later appear to throw an interesting light on this question of progress through sub-stages. It seemed easier for children to move from the lower levels of thinking (intermediate between pre-operational and concrete) to more developed

ones (concrete), than it was to move from the advanced concrete/Intermediate formal level to formal operational thought. Although one has to quantify the stages in order to make a statistical analysis of the results, it appears that the intervals are non-parametric, that is, development is a longer process in the upper reaches of the Piagetian scale of thought.

The next problem is concerned with the methods used by the experimenters to produce acceleration of thought. Beilin (1970, p.54) goes as far as to declare that "a wide variety of techniques and contextual conditions contribute to, or at the least, permit concept acquisition". He thinks that the Genevans appear to be on their weakest ground in this area. "Even if their thesis is correct that new structures are only constructed out of the confrontation of different or contradictory schemas, they make no effort to define, even vaguely, the parameters of experience that lead to this conflict, except to imply that the clinical method will accomplish it. Even so, a paradox exists because the clinical method is extensively verbal and the Genevans have been at great pains to insist that verbal (i.e. various linguistic methods) will not lead to operative achievement". (op.cit, pp.47-48) Beilin here does not seem to be taking into account some of the more recent training programmes. As far as the inducement of conservation responses is concerned, it is argued that experimenters should teach the logical prerequisites of an operation such as compensation and reversibility rather than conservation itself. Inhelder (Green et al 1971, pp.156-158) gives empirical evidence to support the value of the former type of training. Two groups were taken. All of the subjects could conserve numerical equivalences but none could not understand the conservation of substance and liquid nor class inclusion on the pre-test. One group was given training on class inclusion problems, the other on conservation. Almost all the subjects in both groups made progress in the concept exercised "no doubt because of the intensive and extended training (six

sessions) and the rather advanced initial level of the training group". (op.cit, p.158) Those in the conservation group who progressed clearly in conservation showed development in class inclusion tests in but a few cases and "even this progress was only partial". On the other hand, those in the second group showed clear progress in class inclusion problems and also remarkable progress in conservation tasks. (ibid, p.158) One wonders if this is the same experiment which is reported in Mussen et al (1969, pp.12-13) where the numerical differences would not seem striking enough to support Inhelder's contention. There she states that of the eight out of ten subjects in Group A who progressed in conservation, only two showed progress in the inclusion test, their progress being only partial. In Group B, eight of ten subjects improved in inclusion problems and of these four made remarkable progress on conservation. Inhelder concludes from this result (Green et al 1971, p.158) that "appropriate training in a mainly logical field influences the child's reasoning in more physical problems despite the fact that these have not been touched upon in the training sessions". The second interesting finding was that "the lower the child's initial level ... the more (that) progress tends to be limited to one specific field or even to one specific type of problem". (op.cit, p.159) Again, this type of research work on conservation possibly points the way for further investigations into the teaching of logical thinking. One should, perhaps, define the essential logical operations needed to solve the problems posed in a discipline such as history and teach those operations. This is easily written but it is a highly exacting task to decide which logical operations are needed for any one discipline. In the present research, for example, (see Part IV) it is argued that one aspect of historical thinking is the ability to evaluate evidence, to oppose one statement against another, and it was attempted to teach such skills to the experimental group at the secondary school.

Among many variables relating to acceleration studies which are

considered by Sigel (1968, pp.503-523) two important ones stand out for the present investigation. Firstly, to what extent is a child's personality effective in his understanding of the data of an acceleration experiment? Sigel declares that, "Personality characteristics play an influential role in determining how the child will interact with the environment, how susceptible he is to its variegated influences, and how capable he is in modifying them to his own ends. The outgoing, active child has greater opportunity for greater engagement with objects and people than the child who is withdrawn and prefers the observer role, minimising action". (op.cit, p.509). In an attempt to make some assessment of personality factors the children in the primary and secondary schools answered Eysenck's personality questionnaire and their form teachers completed the Terman-Merrill inventory for such personality characteristics as perseverance, originality and intelligence (see Appendix B and pp.224-229, 241-4). Sigel's second point is that chronological age and mental age may have different effects on children's progress. He explains that studies into children's understanding of volume show that chronological age is a significant control variable, yet there is an overlap between groups of different chronological age: "In effect, chronological age is a quantitative, descriptive control variable, with little explanatory power". (op.cit, p.518) The results which embody mental age and I.Q., on the other hand, are "equivocal". The effect of I.Q. and M.A. "varies as a function of the task involved. Since some Piagetian tasks have more counterparts in everyday experience than others, C.A. might be of greater significance in such areas, whereas M.A. might be more relevant for academic tasks. This may account for the Goodnow and Bethon (1966) finding that C.A. was more relevant for conservation tasks and M.A. for combinatorial problems". It is a neat question whether an understanding of the implications in the questions set on the passages in this research depends more on mental age than chronological age, however that mental age is assessed. Generally, research findings show that when

children's answers on verbal passages are judged by Piagetian criteria, then mental age is the more salient factor. Yet an awareness of the emotions and reasons behind people's actions often comes with advancing chronological maturity. Presumably, the oldest and the cleverest among the subjects should demonstrate better understanding than the others. But the following protocols show that two girls, one in a primary school with a mental age of 13 : 1 years, the other in a grammar school with a mental age of 14 : 6 years, gave answers at quite different levels. The younger girl seems able to show an understanding of the historical situation while the older is confined to a superficial appreciation of the data from a present-day standpoint. Both girls came ostensibly from a similar social background, the father of the younger being in engineering and the elder's father being manager of a large department store.

TABLE Contrasted answers from two girls

Questions from the passage "Ancient Greece"	Answers by primary school girl aged 10 : 3 years with I.Q. 128	Answers by Secondary grammar school girl aged 13 : 0 years with I.Q. 112
2. Why aren't the boys in your class trained like the Spartan boys?	Because they're not afraid of a lot of slaves rising up and fighting.	(It's) not necessary today - there are enough people in the army and navy to fight the people. Whom? Which people? Other countries
3(a) Why do you think the boys were whipped when they had done nothing wrong?	Because the people there wanted them to learn to steal and do things like that because if the slaves ever did rise up against them, they'd (the boys) be tough.	Don't know
3(b) Do you think that the Spartan boys would think that their masters were cruel?	No - because they'd never known anything different.	Yes - because they wouldn't like to be whipped.

<p>3(c) Do you think that whipping helps to make boys into better people? - to improve them?</p>	<p>No - it would make them cruel when they grew up. Why do you think that? Because if they were taught like that when they were little, they might grow up like that</p>	<p>Not really Why not? It would be better to make them waste their time. What do you mean? To give them lines Why do you think that things like "lines" are a better method? Don't know</p>
<p>4(a) Was it wrong of the Spartan boys to steal food?</p>	<p>In a way it was wrong but they daren't do anything else because they were taught to steal and get whipped if they didn't. You said, "in a way it was wrong" - what sort of way? You shouldn't steal Why shouldn't you Don't know</p>	<p>Yes, nobody should steal</p>

Such a contrast in answers seems to lend support to Beilin's contention that "the logical operational system is under the control of a genetically programmed mechanism that will permit the development of only certain types of cognitive structures through the interaction with environmental inputs". (1970, p.48) While Piaget will not accept an undue emphasis upon genetic factors, he also stresses internal as opposed to external influences on cognitive development. He states, for example, that Smedslund's subjects learnt only a physical experiance when they were trained to realise that two objects weighing the same amount did not lose that relationship if one object was deformed. The children did not achieve the construction of a logical structure which "cannot be obtained by external reinforcement. The logical structure is reached only through internal equilibration". (Ripple and Rockcastle 1964, pp.15-16) This is not to say that a particular act of learning cannot help towards

the eventual development of the logical structure, but the immediate learning is restricted to the specific case of training. (op.cit, pp.16-17)

"When you have brought about some learning you can always ask whether this is an isolated piece in the midst of the child's mental life, or if it is really a dynamic structure which can lead to generalisations". (op.cit, p.18)

This, of course, is the crux in any acceleration study. How far can the structure taught such as seriation or classification be shown by the child to be meaningful: (a) in contexts other than those in which the child was taught (TRANSFER), (b) in relation to other structures which theoretically form part of the same structure d'ensemble (GENERALISATION)?

Transfer does not seem too difficult to demonstrate: the experimenter has to present problems with different materials but which demand the use of same structure as the one trained. Thus, for example, if children are taught to put coloured rods of different heights into a correct sequence, then they should be able to use seriation in other contexts. While the comparison is not exact, in the present research the children at both age levels were taught one historical topic during the year on which they were tested both at the beginning and the end of the academic year ("Mary, Queen of Scots" with the younger; "The Russian Revolution" with the older). They also answered questions on historical passages, the contents of which did not form part of the year's syllabus.

(Appendix A) Could they show evidence of any transfer from having been taught in a particular way: (a) to a passage concerned with a topic which formed part of the year's syllabus, (b) to other historical passages.

The question of the generalisation of taught structures appears more complicated than that of the transfer and has led to a fair amount of controversy. First of all, one has to demonstrate that the schemes of the concrete operational level such as transitivity, classification and seriation are indeed related to form a general structure. "If they are

not, then these (schemes) involve independently learned skills". (Lovell in Green et al, 1971, p.111) Wallace (1972, p.204) explains that the generalisation criterion of the authenticity of cognitive acquisition is founded on Piaget's contention that all of the groupings underlying the stage of concrete operations "appear at the same time without our being able to seriate (them) into stages". (1941) One wonders whether Piaget still maintains that opinion today. Pinard and Laurendeau (1969) would evidently think so since they "adopt the view that any empirically established asynchronism among the constituent groupings of a given concept would seriously jeopardise Piaget's conception of stage because it would deny one of its most essential characteristics". (quoted *ibid*, p.204) Flavell and Elkind (1969), in contrast, assert that "Piaget has placed a quite unnecessarily heavy burden of proof upon himself, by stipulating that all of the various concrete operations (that is, all of the several groupings) develop in unison. There appears to be no reason that the structures d'ensemble could not be looked at as a family of separate structures, each following its own developmental timetable". (*ibid*, pp.204-205) Flavell has recently (1971) concluded that items from the same stage may often emerge in an invariant or near invariant sequence rather than concurrently, and that a stage theory such as Piaget's does not logically require anything but a very loose sort of item concurrence at the most. (*op.cit*, p.205)

This situation seems as complicated on the empirical as on the theoretical aspects of generalisation. Wallace, for example, cites Pinard and Laurendeau's (1969) review of the research aimed at evaluating Piaget's assertion that all of the groupings underlying the stage of concrete operations appear at the same time. This evidently provides "an inconsistent picture with some of the results supporting synchronisation while others reveal asynchronisms". (*op.cit*, p.205) Hamel and der Veer (1972) found a significant positive relationship for a group of middle

class children aged 6 : 6 to 7 : 3½ years on multiple classification and multiple seriation. This they interpret as support for the existence of a structure d'ensemble of operational schemes on highly similar tasks (ibid, p.324) "Nevertheless, it remains uncertain whether the subjects may solve these problems by other ways than by using operational schemes".(ibid, p.324) Lovell (Green et al 1971, p.111) explains that there is evidence that training can induce a cognitive scheme which has durability and at least limited transfer but that, "the evidence is still not at all clear as to whether there is a change in the operational structure in a strictly Piagetian sense". Beilin (1970, pp.55-56) states that, "it seems there is a great deal less transfer among Piagetian operations than one would expect". Inhelder and Sinclair (Mussen et al 1969, pp.19-20) give a few tentative conclusions on the question of the interaction between such different fields of knowledge as the numerical, logical, spatial and physical. The possession of an elementary invariant like the conservation of number is a pre-requisite of success in learning experiments in any field; logico-mathematical progress is more apt to cause progress in the physical field than vice-versa; a great deal depends on the initial level: "the lower his (a child's) level, the more a new acquisition tends to stay limited either to the particular problem or to the particular field". Lovell (Green et al 1971, p.80) adds a comment that once the operational scheme is available in some area with a bright child it goes rapidly across the field of learning, whereas, as Bruner said years ago, the mentally retarded child has to learn everything afresh, as it were. Obviously a great deal more research is needed on this whole question of generalisation, Wallace commenting that "until theoretical and experimental work produces a more coherent picture of the developmental relationship between concrete operational tasks any attempt to apply a generalisation criterion appears, at best, premature". (1972, p.205)

However desirable it might be from a scientific point of view, it

is obviously impracticable in schools to try to teach one particular structure and then discover whether children can generalise that structure. One has to teach in a fairly undifferentiated way within a classroom and a number of researchers, indeed, seem to consider that this is an appropriate procedure for future research. Smedslund (op.cit, p.207) comes out strongly against laboratory training methods. Smedslund asserts "that the fact that various training methods have been shown to lead to acquisitions does not prove that similar processes occur outside the laboratory. It is very hard to find, in children's daily life, any observations, conflicts and reinforcements directly relevant for the acquisition of concepts like conservation, transitivity, class inclusion and the multiplication of classes". Indeed, Smedslund suspects that Piaget's concrete operational tasks represent unique and highly atypical experiences for the children and that acceleration studies employing training items closely related to the criterion task are on the wrong tack. It seems that the difficulty in finding everyday parallels to these structures does not mean that they are not important in the development of logical thinking, but they may have been developed "through some kind of generalised changes in children's codes and strategies". (op.cit, p.208) Duckworth (Ripple and Rockcastle 1964, p.2) reports that Piaget himself sees little sense in intensive specific training on conservation. "Even if the child does manage to learn something about this situation, the learning is not likely to have a general effect on his level of understanding".

Modifying a child's effective set of mental operations depends on a much wider, longer lasting and more fundamental approach than the "rather trivial" type of specific attack prevalent in many training studies at the moment. While the present research has followed the broader type of approach (for example, Almy 1970, Suchman 1964, Kamm 1971), the problem then resides in determining which factors did or did not

cause a change in the children's thinking skills. Possibly the discovery of causal factors is an insoluble problem within the confines of a teaching experiment such as this. The development of knowledge, for Piaget, "is a total developmental process which we must re-situate in its general biological and psychological context". (op.cit, p.8) There is a significant difference between such development and learning, development being a spontaneous process, tied to the whole process of embryogenesis while learning is provoked by situations and is limited to a single problem or a single structure. "So I think development explains learning, and this opinion is contrary to the widely held opinion that development is the sum of discrete learning experiences". (ibid, p.8) Inhelder and Sinclair (Mussen et al 1969, p.21) echo this viewpoint by affirming that the "learning capacity is not provided by the instrument but by the subject" and that "learning is subordinate to the laws of development".

These comments would seem to support Beilin in his attempt to translate Piaget's developmental theory into a geneticist one. He considers that his comprehensive review of training studies gives "further support to the idea that the logical operational system is under the control of a genetically programmed mechanism that will permit the development of only certain types of cognitive structures through the interaction with environmental inputs". (1970, p.48) Elsewhere (Green et al, p.192) he argues that experience provides the content for thought (that is, the data for developing the concepts of mass etc) and also stimulates "timing genes" which act "to synchronise the activity of other genes in developmental programming". There also seem to exist "genetic switch mechanisms" which are activated by external or internal agents.(ibid, p.182) Such switch mechanisms, although responsive to external stimulation, are under genetic control "since, as the conservation learning studies suggest, specific training alone will not ensure the triggering of these functions". Switch mechanisms,

however, are well differentiated in their response to environmental stimuli, that is, first-grade children can profit from the teaching of qualitative length measurement but they will not benefit from area training until they reach the third grade (Beilin and Franklin, 1962). Beilin comments that "the differential effect of (this) training is attributable to a difference in internal programming, and training will not switch on a mechanism that is not primed for it." (op.cit, p.182) Beilin allows that some of the environmental "inputs" may be quite specific but widens the general environmental influences to include a society's whole attitude. For example, an urban, industrialised culture orients people, including children, to respond to their world with a disposition to analysis and idea construction. When one, therefore, attempts to break away from a narrowly specific training situation, then one is faced with a whole range of possible influences on children's thinking. In the present research an attempt was made to take account of certain factors which might influence the children's thought processes. For example, some aspects of intelligence, personality, attitudes and social class were investigated as well as the pupils' replies on the criterion passages. It has to be stressed, though, that the study was primarily concerned with certain teaching strategies in a school-based context. This involved accepting the general ethos of each school, including its aims, the history syllabuses and the pupils' expectations of rewards and incentives. As well as the developmental model devised by Inhelder and Piaget which can be used for the analysis of children's replies, Piaget's opinions on teaching methods were ^{therefore} also a vital part of the research plan. These can be usefully considered in relation to a simple model of the curriculum.

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PART III

THE CURRICULUM, INTELLECTUAL GROWTH
AND THE ROLE OF THE CHINESE HISTORY.

Some quite elaborate plans for analysing the curriculum have been devised recently (for example, Merritt 1972), but the present section rests on the relatively simple design known as the National Curriculum Plan (Pring 1972, p.87). This approach studies the curriculum under the headings of Aims and Objectives, Content, Methods and Evaluation.

CHAPTER I : AIMS AND OBJECTIVES

Pring (op.cit. p.75) describes aims as "general and abstract statements of goals that are largely evaluative rather than descriptive". One of Piaget's general concerns is with the type of citizen a country wants. Is it one who transmits knowledge or one who is a creator of knowledge, responding constructively to experience? For Piaget, the principal aim of education is "to create men who are capable of doing new things, not simply of repeating what other generations have done - men who are creators, inventors and discoverers" (Ripple and Lockcastle 1964, p.5). If schools want to produce "intellectual explorers rather than mere erudition" (Piaget 1971, p.51), then they owe it to themselves to develop and direct hypothetical types of thinking. Such an approach will lead to "the development of the experimental attitude of mind that will emphasise the importance of research and discovery rather than relying on mere repetition" (op.cit. p.53).

The second important goal of education for Piaget is to "form minds which can be critical, can verify, and not accept everything they are offered", (Ripple and Lockcastle 1964, p.5). He continues that the "great danger of today is of slogans, collective opinions, ready-made trends of thought. We have to be able to resist individually, to criticise, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly by their own spontaneous activity and partly through the material we

set up to them; who learn early to tell what is verifiable and what is simply the first idea to come to them" (ibid. p.5).

The second of Piaget's aims would seem peculiarly applicable to the "New History" or "Huffield History" (Jones 1973, p.48) which has been advocated recently. There the emphasis switches from content to methodology (see Part IV, Chapter 5), to the communication of the "mode of enquiry" peculiar to the discipline (see Part IV). The psychologist Hooper (1968, pp.426-429) has tried to build a model which would show correspondence between Piagetian constructs and social science concepts. This, for example, is an abbreviated version of the first of his proposed cross-relationships (ibid. p.426).

Probabilistic reasoning

The idea that combinations of insufficient causes can render an outcome more probable.

Social Science concept

The fundamental uncertainty of historical predictions of outcomes.

Hooper comments that it would "be a tremendous service to children if, as well as historical narrative, we could teach them the 'uncertainty structure' of great amounts of subject matter If we can reach them at this period of relative cognitive mobility (late childhood and adolescence), they may accommodate some substantial notions of probability and inference" (ibid. pp.426-427).

Burston (1972, p.6), however, sounds a warning note against too speedy a rush towards the Enquiry Method. He comments that, "It is now argued that pupils at school and quite young ones at that, should be given some training in historical method and, by the use of sources and other first hand evidence, establish or 'discover' the facts for themselves". Burston considers that, since sources need historical knowledge if they are to be interpreted, the 'discovery method' cannot be "the sole, or perhaps the main method of teaching history in schools" (ibid. p.6). Other, more traditional, claims have to be accepted, namely, "the benefits which accrue from an understanding not of historical methods but of historical facts and explanations".

Yet research work (Part V) seems to indicate that the traditional ways of teaching history are not stimulating the modes of thinking which Piaget desires and which have been expected in the upper age ranges of Secondary Schools. Booth (1967), for example, found that his sample of 147 pupils in the fourth year of five Grammar Schools "were unused to thinking and reasoning historically (ibid. p.157) Booth states that the evidence of his research points "strongly to the fact that what matters for the pupil is how the topics are taught rather than what is taught (op.cit. p.217). If his subjects were to be believed, most lessons were dull, the staple fare consisting of note-taking, note-making and lectures, techniques which rarely involve the pupils or illuminate their understanding (ibid. p.217).

In the light of such research evidence (see also Hallam 1966, Stones 1967), the primary goal of the present research was to try to put into practice some of the aims suggested by Piaget. It was hypothesised that methods whereby children were asked to be critical, to evaluate the evidence in front of them, to report accurately, to refuse to accept the immediate and the superficial, to become aware of possible bias, would lead to an acceleration of their thinking skills on passages concerned with history when compared with control groups taught by more traditional methods. As the empirical work was carried out within the three schools the project was necessarily affected by various aspects of each school's life; for example, by the need to give grades on written work, by the necessity to set homework and an annual examination in the secondary school, and so on. Such limits did not allow teaching programmes which would go as far as Piaget seemingly wishes, but it can be argued that within the context of English education in the late 1960s this research study was at the least realistic since the teaching took place within the normal, everyday school timetables.

A global aim such as "to accelerate children's general thinking in history" has to be translated into specific behavioural objectives. Thus, the lesson notes in Appendices E and K contain explicit statements of what the pupils were intended to do in each lesson, (cf Lager 1962). Interestingly, Coltham and Sines (1971), adapting the work of Bloom and others, have

given us a rigorous analysis of educational objectives in the study of history. Accordingly, an attempt has been made to relate some of the objectives and work with the secondary pupils of Class 3E to the criteria developed by Coltham and Fines (see Appendix L).

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CHAPTER 2 : CIVIL

Diaget quotes with approval (1971, pp.110-111) two recommendations of the International Conference of Public Education (1958, 1960). These emphasized the dangers of overloading the school programmes at both the primary and the secondary levels: "It is desirable to replace the encyclopedic contents of school programs with essential ideas" (ibid. p.110). In order to select these essential ideas the drafting and revision of school programmes should be entrusted to special bodies including teachers, specialists in the particular discipline, psychologists, and teachers from other fields who should be there "in order to provide liaisons" (op.cit. p.111). This is the type of organization that was set up in the U.S.A. when eminent physicists emphasized "the total discrepancy existing between the progressive spirit of science itself and the teaching of the sciences at all levels" (op.cit. p.53). The Academy of Sciences organized a conference at Woods Hall to which were invited mathematicians, physicists, biologists and psychologists. As well as Bruner's famous report (1960), this conference also resulted in professional scientists undertaking field experiments in teaching methods (ibid. p.53).

The International Conference made detailed recommendations for the planning of programmes in secondary schools. It stated that the following should be taken into account when planning the curriculum (op.cit. p.111):

- (i) the characteristics and rhythm of development in children.
- (ii) the most outstanding scientific advances achieved in the various fields constituting the subjects to be taught.
- (iii) the tendencies governing the cultural, social and economic development of the modern world.
- (iv) the result of the experiments carried out on similar programmes.

The present research was conducted in conditions quite removed from the ideal state envisaged by the International Conference. The major aim was to teach two groups of pupils, those who were transitional between preoperational and concrete, and those between concrete and formal thinking (as judged on their responses in respect of historical sequences). In a predominantly rural area two primary and one junior school agreed to take part in the teaching aspects of the experiment. And the content of the courses was determined in general by these schools. (See Part VI and Part VII).

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CHAPTER 3 : METHODS

Possibly the most provocative of Piaget's pronouncements on education have been concerned with teaching methods. He is an unashamed advocate of "Active methods". This is a theme which recurs throughout his writings, seen in such aphorisms as "a ready-made truth is only half a truth", and "verbal thinking seems to be marginal to real thinking". He refers (Piaget 1971, p.27) to an article by Hutchins where it is affirmed that the principal aim of education is to develop the intelligence itself. Piaget asks what is the precise meaning of this term and considers that, "the essential functions of intelligence consists in understanding and in inventing, in other words in building up structures by structuring reality" (ibid. p.27). Knowledge is not a copy of reality, despite the "knowledge - copy concept" continuing to provide the inspiration for many educational methods; "even, quite often, for those intuitive methods in which the image and audio-visual presentations play a role that certain people tend to look upon as the ultimate triumph of educational progress" (op.cit. p.28). Rather is knowledge derived from action: "not in the sense of simple associative responses, but in the much deeper sense of the assimilation of reality into the necessary and general co-ordinations of action. To know an object is to act upon it and to transform it To know is therefore to assimilate reality into structures of transformation, and these are the structures that intelligence constructs as a direct extension of our actions" (op.cit. p.29). In support of such a standpoint, Piaget quotes an experiment in the sphere of image-recall and memory. "If we compare the memories that distinct groups of children retain of a grouping of cubes, according to whether the grouping has been (a) simply looked at or perceived, (b) reconstructed by the child itself, or (c) constructed by an adult while the child watches, we find the memories produced by case (b) are clearly superior. The demonstration by an adult (c) produces no better results than simple perception (a), which shows once again that by carrying out experiments in the child's presence instead of making the child carry them out, one loses the entire informational and formative value offered by action proper as such" (op.cit. pp.35-36).

If one were to or one such a viewpoint, suggesting, perhaps that children cannot act on everything in a school's curriculum, Piaget would argue that active methods are always possible in thought. He says, for example, that with older pupils, "intelligence still consists in executing and co-ordinating actions, though in an interiorised and reflexive form" (op.cit. p.29). Intelligence, at all levels, "is an assimilation of the datum into structures of transformations (and) these structures consist in an organisation of reality, whether in act or thought, and not in simply making a copy of it". (ibid. p.29). Lovell supports this line of argument at the formal level, saying that "the greater the need to question and to find out about the environment and to commit oneself to possibilities, the greater chance there is it seems of formal thought developing" (1973).

Piaget is thus opposed to all methods which are merely "figurative". "Whenever it is believed that an idea has been derived from a perception, without any other process intervening, in every case the activity itself has been forgotten" (1971, p.35). Thus, methods which depend basically on passive imitation such as copying notes from the blackboard, from the textbook or the teacher, or merely watching and hearing audio-visual images, are utterly rejected by Piaget: "all assimilation is a restructuration or a reinvention" (op.cit. p.40). Intellectual development is essentially dependent upon the activities of the subject, being the product of successive constructions. "And the principal factor in this constructivism is an equilibration achieved by autoregulations that make it possible to remedy momentary incoherences, to resolve problems, and to surmount crises or periods of imbalance by a constant elaboration of fresh structures that the school can either ignore or encourage according to the methods it employs" (op.cit. p.41).

Piaget, apparently, does not think that his challenge applies to the teaching of history: "There are some subjects, such as French history or spelling, whose contents have been developed, or even invented, by adults, and the transmission of which raises no problems other than those related to recognising the better or worse information techniques" (op.cit. p.30). Piaget thus aligns himself with historians such as Elton and Pares (see Part IV) who consider that the study of 'pure' history is an adult pursuit.

But if we want children to realise that history is more than a monolithic slab of information determined by adults, then we need to have them acting in a logical way on that data. History in the classroom, as such as science, can depend on "a rational construction accessible to any healthy intelligence". Hapet's scornful analogy to types of science teaching can be applied just as forcibly to types of history teaching: "a sufficient experimental training was believed to have been provided as long as the student had been introduced to the results of past experiments or had been allowed to watch demonstration experiments conducted by his teacher, as though it were possible to sit in rows on a wharf and learn to swim merely by watching grown-up swimmers in the water" (op.cit. p.51).

As has been noted (see p.¹⁵² of this section) there is an impressive movement today in support of a "New" or "Ruffield History" where, as far as possible, the pupil confronts history at first hand (Hannam 1969, Jones 1973, Lamont 1972). There are obvious difficulties, compared with the teaching of science, in carrying out such an aim. Apart from the almost metaphysical problem of the nature of the history taught in schools (Part IV), there are more mundane problems of organisation. Steel and Taylor (1973) have recently proposed "Family History" as a means by which the pupil will be enabled "to handle and think about the main categories of evidence used by the professional historian" (ibid. p.7). They have the honesty to admit, though, that difficulties were met in the classroom situation. The work had to be structured more tightly than had been expected (op.cit. p.157 and p.165) and the children often produced little evidence for the specified lessons. Therefore, secondary material had to be used such as Lunnell's "History of the First World War" and "Knowledge", less able pupils finding the latter rather difficult (op.cit. p.159).

It is possibly worthwhile to reiterate here that the pupils in the present research were not being asked to "act as historians". In this context, the following rather tart comment by Smock (1970) is refreshing. "A number of psychologists and educators are proposing that a child can be taught anything if only the right gimmicks, the right teaching techniques, and the 'right' theory of learning are used (Bruner, et al, 1966). Such a position is embarrassing to me as a child psychologist and acceptance of it should be embarrassing to any educator. I anticipate little lasting good to come from uncritical acceptance of such a position".

(ibid. pp.28-29). History teachers have been cautioned by Burston that it is pretty well impossible to have a school child acting as an historian in any true sense of the term. For instance, he states that if a pupil is trying to establish the historical facts for himself, then all relevant sources must be used if it is to be a genuine historical exercise (1972, p.5). Depending on the pupils' age level, the present research was aimed basically at :

- (a) to handle the historical data presented to them in a coherent and logical manner (concrete or descriptive thinking; the chronicle level in history).
- (b) to analyse the implications of that data, to present reasoned possibilities and to handle a variety of factors which affect historical events (Formal or explanatory thinking; the analytic level in history).

And one of the crucial factors in trying to achieve these goals was the use of the "active" methods proposed by Piaget. (cf Coltham 1971, p.36).

Piaget's second forceful contention about teaching methods was also followed with the experimental groups in this research : children should work in co-operation. His 1932 book on the moral judgement of the child is permeated with requests for methods which allow co-operation among peers. For example, "It is only through contact with the judgements and evaluations of others that intellectual and affective ~~anomy~~ will gradually yield to the pressure of collective logical and moral laws" (1932, p.408). In 1964 he states that there is a danger in schools of "false accommodation" by children, false because it agrees with a verbal formula given by the teacher. "There is a false equilibrium which satisfies a child by accommodation to words - to authority..... A teacher would do better not to correct a child's schemes, but to provide situations so he will correct them himself" (1964, p.4). Again, in 1971, he stressed that if teachers want to concentrate on the constructive role of action, then they must place "an essential share of importance upon the activities of the student himself" (1971, p.67). And when he says "active" he means it in two senses. "One is acting on material things. But the other means doing things in social collaboration, in a group effort. This leads to a critical frame of mind, where children must communicate with each other.

Co-operation is indeed co operation" (quoted in Sigel and Hooper 1968, p.431). He recommends the wisdom of a Canadian school inspector who divided every class into two rooms, "in order, he said, that the children should have time "to work", and that the teacher would not talk to all of them together the whole day long!" (1971, p.67)

Piaget is possibly being deliberately provocative in these affirmations, although they do span a long period of his published work (English translations 1952 - 1971). Experimental research does not seem to give credence to the superiority of group methods over individual work. Sullivan, indeed, considers that "Piaget's prescription of a particular type of learning atmosphere seems a premature extrapolation from his equilibration model. Thus the educator who justifies his particular programme by scattered statements made by Piaget is deluding himself into a state of false security" (1967, p.33). Evans (1962, p.74) states that while most workers seem to agree that there is little difference in the amount learned by students under the two methods, children appear to enjoy their work more under group methods. In a more recent review of the effects of co-operation on pupil learning (the criterion seeming to be the amount learnt) Thompson (1972, pp.28-36) divides co-operative conditions into two sub-classes: joint co-operative efforts where the group is required to produce one outcome for the learning task, and associative co-operative conditions where pupils interact in task relevant ways but each pupil is required to produce his own outcome (ibid. p.29). Experimental investigations over a series of learning situations into both types of group interaction compared with individual work showed no significant difference in mean post-test scores. Thompson's general comment is that, "Experimental evidence would thus appear to show that co-operation between pupils, whether joint or associate, results in neither greater nor less learning than is the case when pupils are working individually" (ibid. p.29). Only one study investigated whether interaction was actually occurring among the pupils in the groups. As far as the amount learned was concerned, the result was the same: one of no difference (ibid. p.29). When the 'cohesiveness' of groups was investigated, the criterion often being derived from sociometric techniques, the conclusion is that, "There is some evidence that the learning of pupils is independent of the level of cohesion of the group in which the pupils conduct their learning" (ibid. p.31).

Critics may reply to this rather daunting survey that qualitative thinking was not being investigated : the criterion was the amount learned. In the context of the teaching of history Coltham (1971) certainly comes out strongly for social interaction in the classroom as "one of the surest ways of helping development of higher levels of thinking", always provided that there is a genuine desire by people to examine each other's thoughts (ibid. p.26). She also supports children choosing their own groups. "Children are more often than not the best judges of who will make the best learning companions" (op.cit. p.26). The concept of social interaction can be extended to the teacher-class situation, continues Coltham: "a teacher who poses a question is initiating interaction he puts the answer, whether correct or incorrect, to the rest of the class for an examination of its possible correctness, he is perpetuating interaction and, indeed, asking for more of it". (ibid, p.28). Coltham considers, however, that the most favourable situation for social interaction "is that where a small group of children has a well-defined problem to tackle, and this work method is possible with a variety of historical material and at all stages of learning" (op.cit. p.40). She points out that some initial help is needed before a group can analyse problems, possibly in giving the children practice as a class. "Presentation of one group's conclusions either to the teacher or to other groups can give rise to further exchanges and testing of ideas and if the rules of the game always require evidence to be forthcoming to support propositions, the children are certainly practising the study of history" (op.cit. pp.40-41).

In the present research the methods used with the experimental groups were not the more extreme types recommended by Piaget but those modified approaches supported by a number of writers on the teaching of history (for example, Nicholas and Thompson 1972, pp. 231-236). It was felt that the pupils had to have some framework as an introduction to any group discussion, and that this framework was best supplied through the more traditional methods of teacher exposition, question and answer or reading.

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CHAPTER 4 : EVALUATION

The vital issue in the present study was whether the different techniques of teaching history improved the thinking skills of the experimental group at each age level. Piaget, of course, would ask: what was the aim of trying such acceleration techniques. He has explained recently that while it may be possible to accelerate development through the stages, "there is not much to be gained by doing it beyond a certain measure" (Pines 1969, p.35, op.cit). Development, for Piaget, over-rides experience. Yet, research evidence has shown children operating at lower cognitive levels in history than one would expect or want. The present study, therefore, was an attempt to put into practice in school situations a modified version of the two crucial methods suggested by Piaget with two experimental groups. The two taught control groups at each age level received what were considered to be more traditional methods consisting in the main of exposition, followed by some form of written or drawing work. The verbal responses on a number of passages concerned with history were evaluated at the beginning and at the end of a year's teaching programme. The criteria for such an evaluation was derived from Inhelder and Piaget and had been used in previous research work (Hallan 1966). A critical question, however, to be faced in the next section is how far is that criteria related to historical thinking per se - in fact, what is historical thinking?

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PART IVTHE RELATIONSHIP OF HISTORICAL AND
LOGICAL THINKINGCHAPTER I : WHAT IS HISTORY?

There is an epistemological problem in starting with a model of the structure of thought such as Piaget's and then applying that model to children's responses on historical passages. Thompson (1972, p.31) refers to the danger "of forcing the analysis of historical thinking into a framework which may not meet its requirements and adequately bring out its important elements". After making the comment on earlier research work (Hallam 1966) that the predominant influence was not the particular requirements and characteristics of history, Thompson declares that the preliminary task should be an examination of what is meant by historical thinking. The earlier study was a specific attempt to try to discover if the characteristics of thinking postulated by Piaget were evident when children answered questions on the type of historical material met in schools. Having established that a developmental sequence was evident, it is now necessary to try to define what is meant by historical thinking. Before that can occur, however, the whole concept of "history" needs to be analysed.

Holloway (1967, pp.10-11) declares that the word is ambiguous, the same term being used to refer both "to what happened in the past and to the study of it : history, 'histoire', 'Geschichte', mean both man's past and the knowledge he strives to build up about that past". In the present context, we are more concerned with the latter meaning, with the study of "anything that has ever happened in the past, however long ago or however recently" (Kitson Clark 1967, p.1). Elton (1967, p.8) agrees in general with such an interpretation. His preliminary definition of history considers that it is everything that men have said, thought, done or suffered in the past. He then posits these reservations on his initial definition (op.cit. pp.10-11):

- a) History can deal only with the present traces of the past, that is, where evidence survives. This reservation would thus seem to exclude that type of "history" exemplified in novels and films which relies completely on the author's

interpretation of past events, for instance, un-authenticated private conversations between historical personages.

- b) History has certain habits peculiar to itself. It deals in events, not static situations, the transformations linking the situations being causal, temporal or merely coincidental. This last adjective seems to open the door a little to history being "just one damned thing after another", while scientists would surely argue that causal transformations link the data they study. The argument that transformations rather than static states characterise history would evidently be extended to other structures by Piaget (1971^A, p.11) : "All known structures - from mathematical groups to kinship systems - are, without exception, systems of transformations". The crucial term among the three would thus seem to be 'temporal' as far as history is concerned: History can be regarded as a process of change through time.
- c) History deals with the particular, people, events and facts being treated as peculiar to themselves yet made comprehensible to us by universal qualities present in differing proportions and arrangements. Elton would thus seem to adduce both the idiographic and nomothetic qualities of history. Gardiner (1961, pp.40-41) agrees with such an interpretation. "The historian concentrates upon the event in its unique individuality, regarding it as something which is to viewed for an end in itself". But, continues Gardiner, to call something 'unique' presupposes prior classification. Thus, the Norman Conquest was unique "in the sense that it occurred at a particular time and place" (op.cit. p.43). It was, however, also an example of the invasion of one country by another. Gardiner goes on to contend that the historian is not free to disregard "general laws in his work of reconstruction", for all his attention to the individual and the unique (op.cit. p.45).

Elton's consideration of the three reservations leads him to rephrase his initial definition of history so that it reads thus (1967, p.12) :

"(History) is concerned with all those human sayings, thoughts, deeds and sufferings which occurred in the past and have left present deposit; and it deals with them from the point of view of happening, change and the particular". While it is not an integral part of this thesis to argue the case for or against history as a separate discipline with qualities sui generis, one wonders whether this definition, shorn of its temporal connections, could be applied also to aspects of psychology.

The "human sayings, thoughts, deeds and sufferings" could presumably be classified as the "facts" of history, those nebulous desiderata which have caused so much concern to historians since the German school in Hanover sought to "eliminate the haphazard and the slipshod, to destroy inaccuracy and error, to provide history with a bedrock of proven and verifiable facts" (Thomson 1969, p.38). They transmitted their zeal to scholars like Ranke ("the strict presentation of facts is the supreme law of historical writing") and Taine ("the tiny facts, carefully selected, important, significant, amply authenticated and noted with minute care"). Marwick (1970, p.37) comments that Ranke for one did not confine himself to the treadmill that might be indicated by his remark; as all historians must do, he brought to his work definite concepts on the structure of historical processes. Yet it was the "factual" approach to history thought to be typified by the Rankean school that Trevelyan felt needed attacking in his famous essay "Clio, a Muse" (1903, republished 1913). No one, contended Trevelyan, can ever give a completely true account of the French Revolution. "He will give the best interpretation who, having discovered and weighed all the important evidence obtainable, has the warmest human sympathy, the highest imaginative powers" (quoted Marwick, p.57). For Trevelyan an historian such as Carlyle reached nearer to the truth of occurrences like the French Revolution than did those scientific historians "who, with more knowledge of facts, have less understanding of man" (ibid. p.57). Kitson Clark (1967, pp.99-107), however, gives a salutary warning against the school of "imaginative" historians when he considers Macaulay's account of Jeffreys' conduct after the battle of Monmouth. "Between the reader of Macaulay and the evidence there is interposed Macaulay's powerful historical imagination

It interprets and illumines. But it is not always clear what evidence has guided the interpretation, and therefore what is being illumined" (op.cit. p.101).

Croce, of course, was the philosopher of history who possibly most strongly opposed the arguments for 'scientific' history. Since the past itself has no existence, history has reality only in the mind of the historian: "all history is contemporary history". The historian must not be a mere chronicler of facts but one who "lives again in imagination individuals and events". Croce strikingly expressed his attitude in the following passage: "Do you wish to understand the true history of a Ligurian or Sicilian neolithic man? First of all, try if it be possible to make yourself mentally into a Ligurian or Sicilian neolithic man" (quoted Gardiner 1961, p.233). If this feat of imagination is impossible for a historian, then he should merely describe and classify the remains of neolithic man, which would be pseudo - history.

Croce's ideas were developed by Collingwood who postulated that the historian investigates both the "outside" and the "inside" of events. He may begin with the "outside", the discernible actions, but "his main task is to think himself into this action, to discern the thought of its agent" (op.cit. p.252). For Collingwood, the historian is thus not like a scientist investigating phenomena, but is a man searching for the processes of thought. Indeed, "all history is the history of thought", the thoughts of the characters being discovered by the historian "re-thinking them in his own mind" (op.cit. p.253). And history begins only when the historian asks a question. 'History' is the answering of this question: "the historian does not select, because no past facts are "there" before him, to select from, until he has put them there by sheer historical thinking" (quoted Marwick 1970, p.80). Collingwood's exaltation of thought as the prime aim of historical knowledge is demonstrated in this remark (op.cit. p.83):

"Military history is not a description of weary marches in heat or cold, or the thrills and chills of battle or the long agony of wounded men. It is a description of plans and counter-plans: of thinking about strategy and thinking about tactics, and in the last resort of what the men in the ranks thought about the battle".

Marwick thinks that this passage is "absolute rubbish",

asking why on earth cannot history be "a description of weary marches". Admittedly, the last clause in Collingwood's paragraph is rather oddly phrased, but cannot the passage be seen as illustrating two levels of history: the descriptive at the concrete level of thinking and the analytic at the formal level when history becomes a 'professional' pursuit (cf. Coltham 1971, p.35).

Namier, the scholar selected by Marwick as "the great man of the twentieth century" (1970, p.90) was essentially a Rankean professional: "One has to steep oneself in the political life of a period before one can safely speak, or be sure of understanding, its language" (op.cit. p.91). Elton (1967, p.16) also emphasises this aspect of the work of an historian. A professional historian, as contrasted with an amateur, truly understands an age from the inside, living with its attitudes and prejudices. "The professional lives in (history) as a contemporary, though a contemporary equipped with immunity, hindsight and arrogant superiority" (ibid. p.16). He knows his evidence: the range, how it came into existence, what people or institutions produced it, "what it can tell and what can never be got from it" (op.cit. p.19). The historian's guesses (? hypotheses) are supported by a profound knowledge of all the sources and "a solid kind of familiarity with the age". Elton's affirmation recalls Kitson Clark's dictum (1967, p.64), "Read till you hear them talking". Through this intimate acquaintance with the age, the professional knows the right kind of questions to ask of the evidence; he is able to exhaust the possibilities of the evidence. Above all, he must be critical and sceptical: "only a full ranging knowledge of what occurs in the papers of a given period or problem will prevent misapprehension" (Elton 1967, p.78).. When there is not enough evidence, then the historian must admit ignorance and concede the limits of rationality.

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CHAPTER 2 : IS THE STUDY OF HISTORY A
STRUCTURED DISCIPLINE?

An historian would thus seem to be one who has read so deeply and widely on a chosen period that he can approach its problems as a contemporary, but a contemporary who can see those problems in perspective. In order to achieve such a position, the evidence has to be scrutinised minutely, with the investigator remaining detached and sceptical, yet at the same time, being involved in the lives and thoughts of the people concerned. Well might Pares consider that twenty-five years is the right age to start studying history.

These distinguishing characteristics of an historian do not seem to give us what might be called a readily available structure of history : a structure against which we could compare the hierarchy of thinking skills promulgated by Piaget. Recently, the whole question of the nature of history has attracted the attention of a number of scholars (see, for example, Burston and Green 1972, Burston and Thompson 1967, Lamont 1972, Thomson 1962, Watts 1972 as well as historians mentioned in Chapter I). Yet, apart from the notable pamphlet by Coltham and Fines (1971), few of the studies give that definitive pattern of historical skills which would help the peculiar issues of this research. Even in the more general field of history itself, it is asserted that there continues "an uncertainty among historians about the kinds of explanation which they can legitimately give (Bernal in Connell-Smith and Lloyd 1972, p.30). Holloway (1967, pp.12-13) remarks that the study of the past is at present in a very unsatisfactory state. "Academic history has no systematic theory, no accepted conceptual apparatus and no explicit canon of interpretation : its only rationale is the research methodology brought to perfection well over a hundred years ago by Leopold von Ranke and handed on virtually unchanged from generation to generation". This is the opinion of a sociologist with a platform : "history and sociology must become one" (op.cit. p.13). While this is one solution, it is not a radical help in the present research where it is vital to delineate those characteristics of history which might be said to typify the structure of history.

According to Whitfield (1971, p.13) the structure of a developed discipline serves both to reveal patterns, relationships and distinctions and also to simplify understanding by permitting

a synoptic view of apparently random impressions and experiences. This recalls Bruner's explanation (1960, p.7): "Grasping the structure of a subject is understanding it in a way that permits many other things to be related to it meaningfully. To learn structure, in short, is to learn how things are related". Hirst is the philosopher who has been most concerned recently with trying to clarify the distinctive features of all forms of knowledge, one of which is history. He defines a form of knowledge as "a distinct way in which our experience becomes structured round the use of accepted public symbols" (Rogers 1972, p.75). Each form of knowledge has these characteristics.

- a) There are certain essential concepts that are peculiar to that form of knowledge, for example, gravity, acceleration, hydrogen, photosynthesis in science and God, sin, predestination in religion.
- b) These concepts, together with "other concepts that denote certain aspects of experience" (ibid. p.75), form a network of possible relationships in which experience can be understood. "As a result the form has a distinct logical structure".
- c) Each form of knowledge has distinctive statements or expressions which are testable against experience, albeit in an indirect way.
- d) The forms have developed particular techniques and skills for exploring experience and testing their distinctive expressions.

Each of these contentions needs to be studied in relation to history. All concepts which relate specifically to the past are obviously historical. Very often, however, the historian uses concepts which relate to other areas of understanding such as politics, social anthropology and psychology. These are presumably subsumed under Hirst's term "the social sciences", which he links with history (Hooper 1971, p.242). Furthermore, when an historian is dealing with causation in human affairs he has to use widely experienced human characteristics like obstinacy, fervour, determination and courage. Holloway (1967, p.5) declares that historians "imply motives without basing their statements on any general theory of motivation and without taking into account what social scientists have written on the subject". Later, he concludes that, "The language in which history is written is

ordinary everyday language : and the type of explanation which historians offer is the type of explanation that people offer in everyday life" (ibid. p.8). Blake also asserts "categorically" that "the language of the historian is ... (of an) indeterminate sort it is essential to historical writing that it enjoys the fluidity and adaptability of ordinary language" (Gardiner 1961, p.336). It thus seems that most of the concepts used in history do not possess an autonomy of the type met in a form of knowledge such as the physical sciences where a term like "wave" or "particle" has an esoteric or technical meaning (Rogers 1972, p.77). "In contrast with the physical sciences, history is continuous with, not distinct from, general human experiences" (ibid. p.77).

If history does not contain concepts peculiar to itself, other than those which have a temporal connotation, then can the second of Hirst's criteria be substantiated? If there are no special concepts, can a network of possible relationships be developed? Rogers approaches this quandary from another angle. For him, the "distinctive logical structure" allegedly appertaining to each form of knowledge through a network of "peculiar" concepts could hardly be the defining characteristic of a discipline; "for the same is true of any form of intelligible discourse whatever" (op.cit. p.76). Hirst specifically excludes geography, for example, from the realm of disciplines. But Rogers points out that this "field" of knowledge (Hirst's term) has such specific concepts as "contour" and "profile". Why then, asks Rogers, should history be treated as a separate discipline on the basis of Hirst's second criteria? (op.cit. p.77).

"The last two of these (criteria) seem uncontroversial" (op.cit. p.76). An historical expression, according to Rogers, has a distinct character "which makes it what it is and not something else" (ibid. p.76). Yet again one wonders what are the characteristics of any distinctly historical statement. The following quotations were taken almost at random from books readily to hand:

"Parliamentary authorisation for the federal army would run out in 1871" (Taylor 1961, p.115).

"In 1880 millions of Europeans still lived in a theocentric universe, untroubled by the corrosive scepticism of the Enlightenment on which the nineteenth century liberal culture was based" (Roberts, 1967, p.215).

"The peasants were the worst sufferers from the eighteenth century changed in the levels of general and relative prices" (Goodwin 1963, p.25).

These sentences, apart from their connections with the past, do not appear to belong to only one specific area known as 'history'. It seems difficult to assert that history has distinctive statements: what is often said by historians seems to partake of other forms and fields of knowledge. Hirst's third characteristic does not appear to be readily substantiated. The crux of the historical approach would seem to be evident in the way in which the historian interprets and links the statements, in what Walsh (1967, p.75) has called "colligation" : "to colligate is, broadly, to organise". Thompson (1967, pp.87-88) explains Walsh's understanding of colligation in this manner: "The historian must make the human past intelligible and 'significant'. He will bring the events of the past together in a particular sort of way, a way which demonstrates that the events grouped have a specific and internal connection with each other the grouping must help to make them intelligible". Hence, the historian's unique role, using his specialized techniques, is seen in the organisation and interpretation of what might appear superficially as disparate occurrences - the making of valid connections, soundly based on the evidence available. And the specialised techniques (Hirst's fourth characteristic) which make one man a chronicler, the other an historian, would seem to be those discussed in Chapter I and also those outlined in Table IX (see pp.189-191).

American scholars have also been involved recently in trying to define the structure of a discipline. Schwab (Fenton 1967, p.12) uses his own set of criteria, some of which resemble Hirst's. A discipline's structure, for Schwab, has two parts:

- a) a "body of imposed conceptions which define the investigated subject matter of that discipline and control its enquiries".
- b) "the pattern of its procedure, its method, how it goes about using its conceptions to attain its goals".

Fenton explains that the body of "imposed conceptions" has been defined in three ways (ibid. p.12):

- i) a body of generalisation
- ii) a set of concepts
- iii) a group of analytical questions

Fenton dismisses (i) as "inert" (op.cit. p.13), and considers that concepts (ii) such as "social class" and "supply and demand" are thought to be more useful in guiding a student in his search for data. Historians, however, according to Fenton, "feel more at home with questions to put to data than with lists of concepts" (op.cit. p.14). Some analytical questions grow out of concepts, for example, the concept of leadership lends to a question such as, "What are the attributes of leaders"? Fenton then contends that "the more concepts or analytical questions a student carries in his head, the more fruitful tools for inquiry he carries. Learning to use concepts and analytic questions should be a key objective of social studies because structure influences the hypotheses one can develop and hence controls inquiry". (op.cit. pp.14-15). Structure also includes, for Fenton, the method by which a discipline arrives at its conclusions - the proof process.**

There thus seem concepts which are recognisable as historical, primarily because of their temporal connotations, but the distinctive structure of history is essentially one of procedures : the investigation and evaluation of historical evidence followed by the construction of an analytic narrative which shows the intrinsic relationships within that evidence.

** Footnote: There is some disappointment in how Fenton presents material aimed at explaining how the criteria for history as a structure are applied in an eighth grade course "From Subject to Citizen" (op.cit. pp.79-81). One question to be asked is, "What happened to men's expectations of the New World"? On the evidence presented in his book the students do not seem to have been asked to evaluate an original source on Virginia in 1624. The particular account seems biased but Fenton merely remarks, "Questions help students to extract the salient points from the reading" (op.cit. p.81).

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CHAPTER 3 : THE NATURE OF HISTORICAL EVIDENCE

All artefacts are evidence for the historian - architecture, tools, paintings, music - but in the present context the term is reserved for written evidence. And that evidence is suspect, even if the original manuscript is being viewed. Elton (1967, p.75) argues that all evidence can be divided into two kinds:

- a) That produced specifically for the historian's attention such as chronicles, memoirs and letters intended for publication;
- b) that produced for some other purpose like reports of commissions.

The first type obviously must be approached with supreme caution but even when the possible bias and misinterpretation (conscious or unconscious) of the writer has been taken into account, there still remain technical problems. Kitson Clark (1967, p.63) says that we must ask what the words meant to the writer since the meanings of words change. Furthermore, different emphasis are placed at different times on particular words and phrases. For example, inflated language was common to large sections of the English people in the 1840's through the plays, novels and sermons of the time (op.cit. p.64). Even the second type of evidence is suspect; parliamentary commissions could have presented biased reports because they did not have time to collect all the evidence (op.cit. p.79). Carr gives an illuminating account (1964, pp.16-19) of how Streseman, the Foreign Minister of the Weimar Republic who died in 1929, rendered a selective account of his conversations with the Soviet Ambassador in Berlin. "The documents do not tell us what happened, but only what Streseman thought had happened, or what he wanted others to think, or perhaps what he wanted himself to think, had happened" (op.cit. p.19). Such reports have to be compared with other evidence like the Soviet Ambassador's communications: evidence must always be tested against other evidence. And the evidence can only be assessed in a controlled and orderly manner because the historian has immersed himself in the ethos of the period so that he knows how contemporaries think and the nature of their life-styles.

Demands like these seem to give a gloomy outlook on the possibility of reaching any conclusive decisions regarding events

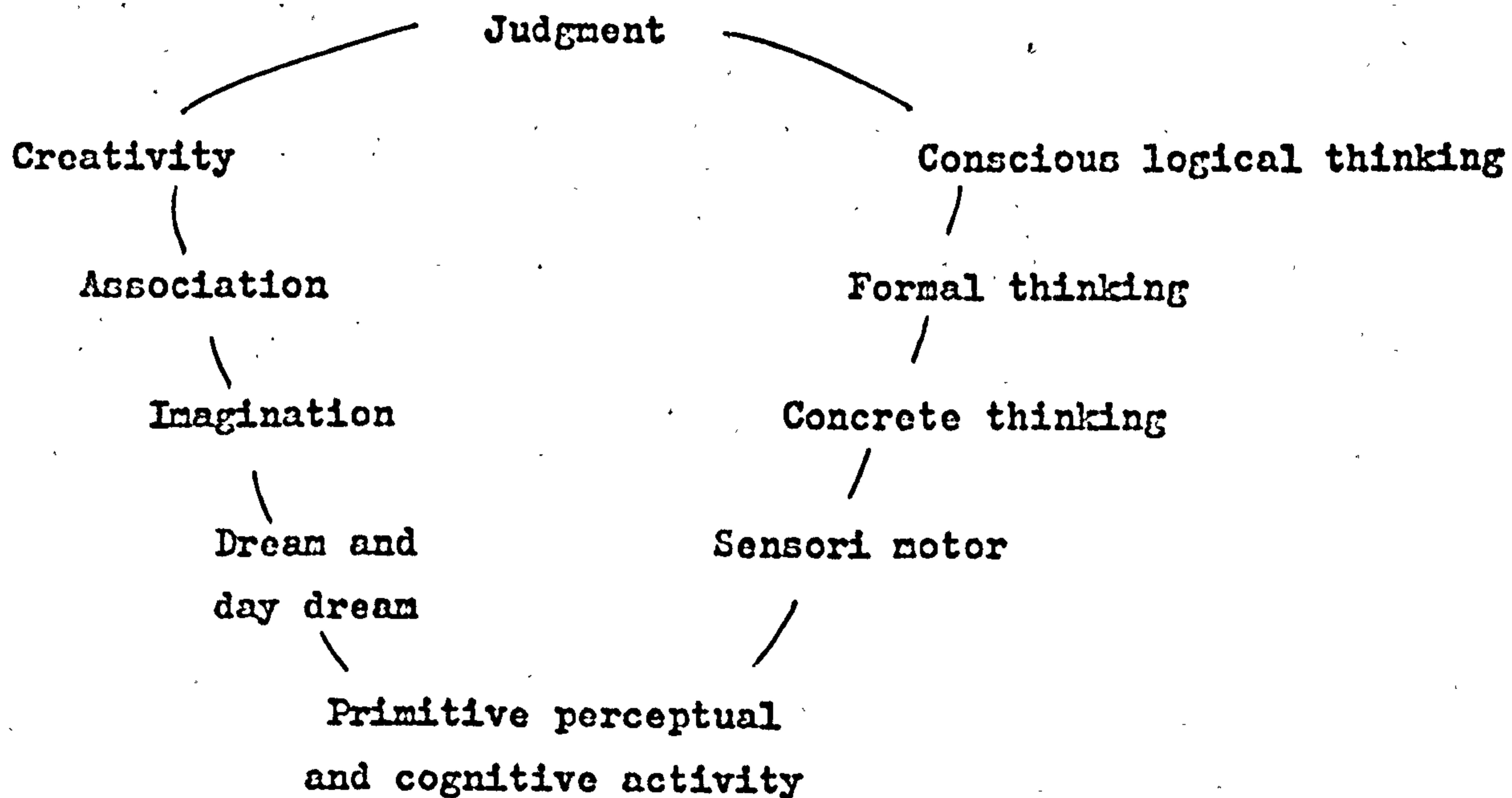
or characters in the past. There need not, however, be total scepticism about the possibility of historical knowledge. Both Elton (op.cit. p.59) and Kitson Clark (1967, p.41) state that there is a large body of agreed historical knowledge on which no dispute is possible such as: "Who was the eldest surviving child of Henry 8th"? (Elton 1967, p.59), or, "The battle of Waterloo was fought on Sunday, 18th. June 1815" (Kitson Clark 1967, p.41). Yet Thomson (1969, p.37) explains that "even the seemingly most undisputable facts and dates are always open to question. E.H. Dance cites the familiar formula : "Battle of Hastings A.D. 1066". He points out that it "contains at least two mis-statements of fact and one expression of religious prejudice". The battle was fought at Senlac and since Christ was evidently born earlier than we suppose, the date should be some time between 1069 and 1074. "Anyhow, why should a predominantly non-Christian world be afflicted with a Christian system of chronology which is known to be inaccurate? (ibid. p.37). This would seem to be taking scepticism to the extreme, though. And the detection of fallacies in such a simple statement does at least show that historical data can be investigated and evaluated.

We can thus accept that there are events such as accessions to thrones, dates of invasions, the position of historical sites and so on which are beyond reasonable doubt. We can also compare less concrete evidence such as reports against the evidence of other authorities or against what we know of the period as a whole (Gardiner 1961, p.76). Most importantly, Rogers (1972, p.113) declares that evidence in itself is not history. Even when we leave the area of agreed fact, there are reputable procedures available which confine disagreements of interpretation within the limits of rational dispute (op.cit. p.119). "The criteria underlying the procedures are in part logical and in part concerned with the knowledge and meaning of sources" (ibid. p.119). The foregoing discussion seems to lead to the point that since we cannot expect school children to have either the technical expertise by which they can evaluate source evidence, or the experience through which they can "live in an age as though a contemporary", if we wish to introduce them in a scholarly manner to the study of historical evidence, then it would appear we shall have to rely upon the development of logical procedures.

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CHAPTER 4 : LOGICAL PROCEDURES IN HISTORY

There have been a number of analyses of logical thinking skills (Bloom 1956; Peel 1967; Coltham and Fines 1971). The present research was based primarily on that created by Inhelder and Piaget (1950 : 1958). A problem arises immediately in that Piaget's can be considered an over-logical model, an over-rational definition of thinking (Watts 1972, p.19). Watts (op.cit. p.21) posits the following model which would include those cognitive processes falling outside Piaget's definition:



One difficulty of this model is the problem of hierarchy involved in the two routes: for example, adults can day-dream whereas they seldom, if ever, regress to the sensori motor level. Are the stages in the two routes meant to be separated by equivalent intervals? Watts suggests that we accept A (associative) and R (rational) - thinking as the terms for the two modes of thought (op.cit. p.22).

Associative thinking involves the association of ideas, an element in imagination, intuition and creativity. Watts instances the work of Guilford in the 1950's as an example of a recent interest in this area. He thinks that associational thinking provides the pseudo-concepts from which genuine concepts are developed (op.cit. p.27). Watt declares that it seems reasonable to suppose that A (association) thinking can develop "from the A¹ hoises of the baby to the A⁴ images of Kubla Khan". There is an AR (Association - Rational) region of fusion such as AR⁴ used in that combination of knowledge, experience and hunches which is called judgment in adult life (op.cit. p.28).

Bryant (1970, p.274) is also concerned with the development of images in the teaching of history. She wants history at the age range 8 to 13/14 years saturated with the touch, sights, sounds, smells and movements from the past. Any history teacher worth his salt would concur with the ideas behind such an approach: visits, illustrations, films, plays, stories, models and so on. It should be stressed, though, that the present research was concerned basically with one aspect of history teaching, and one that could be considered among the most valuable reasons for the teaching of history: the development of logical skills with regard to written evidence. "The study of history justifies itself insofar as it assists reason to work" (Elton 1967, p.49). While admitting, then, the importance of concrete images in history, the criteria used to assess children's answers will be based on the R - model. Moreover, even if one were to try to use the A - model criteria, there would be difficulty in devising appropriate criteria by which children's answers could be assessed. "Imagination" is a concept used very frequently in the discussion of history teaching, but what exactly does it mean? The process can vary from a semi-mystical identification with the past in evocative surroundings (Housesteads, Rievaulx Abbey, York Minster) to the creation of hypotheses after tough and powerful wrestling with an idea (Duckworth 1971, p.49). And could not this latter type of imagination be identified with conscious logical reasoning? Burston (1972, p.68) points out that "the process of imagining oneself in a past age can, in the end, be the greatest and most distinctive intellectual challenge entailed by the study of history". Therefore, the request that children "should use their imagination" needs to be viewed cautiously. The question has to be asked, "At what level of validity is such an experience"? It is fairly easy to have children write, say, an impressionistic letter from a Roman soldier stationed in Britannia in which images are conveyed but there might be but little regard for the historical situation; it is far more difficult for the pupils to give a disciplined historical response to such a task. Duckworth (1971, p.49) argues that wise teaching must be content to garner what every stage of childhood can yield, instead of striving after the unattainable, namely the power of analysis and a grasp of the causal nexus of events. Children should catch through feeling and imagination something of the glory and travail of the human past (ibid. p.49). He suggests, as an example, that the pupils should read an extract from "Mein Kampf" and then write a letter

by a concentration camp guard justifying his treatment of the Jews. Surely, such an exercise, historically, is appropriate only for a pupil who is able to handle a number of variables (? formal level) and has a knowledge of Germany, theories of Aryan supremacy, economic tendencies during the 1920's and 1930's and so on? "Imagination" seems an intangible kind of concept.

There seems equal difficulty in devising appropriate criteria for assessing "creativity", another of Watts' postulates. Creativity is often measured by a type of divergent thinking test. Nuttall (1972) has recently surveyed the field of divergent thinking and concludes that "the case for viewing these tests as tests of creative ability remains, at best, unproven" (ibid. p.2). Vernon (in Royce 1974, pp.137-138) writes that the majority of subsequent workers after Guilford seem to have reduced 'creativity' to a single factor, "a kind of combination of ideational fluency and originality; and this has proved to be partially, though not wholly, distinguishable from verbal intelligence". It would seem that the frames of reference studding Watts' A - route do not in themselves provide precise enough criteria for assessing thought, nor do they provide a powerful counter-balance to the Piagetian model.

It can be argued that the Piagetian criteria are inappropriate for investigating thinking in history since they are derived from children's answers on physical experiments (1958). Experiments such as the combination of colourless liquids and equilibrium in a balance have an assured solution unlike problems in history where one can seldom, if ever, arrive at a precise and incontrovertible judgment. Bartlett (1958, pp.23-24) characterises the former type of thought as "thinking in closed circuits", amenable to controlled investigation and illustrated best in numerical or logical form. In social problems, on the other hand, as more and more of the evidence available is used by the observer, "it becomes the less likely that definite issues will be reached" (op.cit. p.178). Bartlett quotes some remarks by John Summerson: "Mathematical demonstration, being built upon the impregnable foundations of geometry and arithmetic, are the only truths that can sink into the mind of man, void of all uncertainty; and all other discourses participate more or less of truth according as their subjects are more or less capable of mathematical demonstration". (op.cit. p.195). Presumably, such an attitude can help to account in part for Piaget's attempt to present a symbolic model for the different stages of

thinking. Such a model, states Piaget (1953, p.25) "would mediate between psychology and pure logic as mathematical physics relates physics, concerned with the real world, and mathematics, where the criterion of truth is the internal consistency appropriate to a vigorous deductive system".

At present, we still seem some way from the realisation of such a valuable model which could be used to analyse thinking in various branches of general knowledge such as the physical sciences and history. Is it appropriate, then, to adapt the criteria derived from the one to thinking skills based on passages derived from the other? Not if it can be proved that the approach to a science such as physics is radically different from the approach to history. Blake, for example, argues that physics, "the most mature science", presents "a formal deductive system built around a logico-mathematical framework" and that this helps to show the ideal structure of the sciences (Gardiner 1961, p.336). Recent writings on the physical sciences, however, seem to detract from any such Olympian certainty. According to Marwick (1972, p.99) both natural sciences and history deal in probabilities: "save on the most banal level, there are no absolutes in the natural sciences". The most striking difference between the two areas of knowledge is the degree to which proof can be established of the various contentions made by the scientist and the historian respectively (op.cit. p.98). The scientist has an explanatory theory which gives testable hypotheses: these can be confirmed or derived through an experiment. The experiment can be repeated, although this will never again be in the exact form of the original experiment. Furthermore, the scientist may remain more detached from the phenomena he is observing than the historian: there is a danger in history that what the investigator considers is significant will be influenced by his upbringing or his personality characteristics. Sturley (1969, p.37) writes that, "value judgments will be influenced to a greater or lesser degree by personal likes and dislikes, by social, religious or national prejudice by views on human nature and on life itself". The historian, also, cannot produce a general or covering law which it is true for all instances of the observed phenomena.

It can be argued, however, that historical explanation is of a general scientific pattern and that it has general laws. Hempel defines such a law as "a statement of universal conditional form which is capable of being confirmed or disconfirmed by suitable empirical findings" (Perry 1967, p.28). Hence, from a general law plus the

initial conditions (which refer to the particular instances of the historical situation) an explanation can be logically deduced. Difficulties inevitably arise, though, when a general law is applied to a particular historical situation. The argument that a race in armaments will lead, sooner or later, to war can be supposed as an example of the covering law theory (Burston 1967, p.51). "It is to be observed that we could apply this model of explanation to the Sarajevo assassination, by saying that whenever a ruler, visiting a subject territory, is assassinated, stern reprisals on the territory will occur - again, a general classification of a particular event, and an explanation in terms of a general law" (ibid. p.51). But surely stern reprisals did not occur in Bosnia, unless general involvement in World War I is that reprisal; Austria turned her anger against Serbia. Covering laws in history can thus break down.

An historian, moreover, cannot promulgate a law, as occurs in science, by which predictions can be made. Even so, Marwick considers that worthwhile inferences are able to be made from history which have a conditional validity. Possibly an instance of this is the "law" that "if a government prints more paper money than the state of the economy warrants, inflation is likely to result". In the physical sciences, as is obvious, there are laws which differ in scale from such a generalisation. Sturley (1969, p.39) explains that even the best informed and most balanced judgment "cannot explain historical events with the same degree of satisfaction that Kepler's formula, for example, can 'explain' the motions of the planets".

There would thus be a great gulf between explanation in history and the physical sciences if we accepted the above as the determining differences. It can be argued, however, that both history and science deal in probabilities: there are no absolutes in either branch of knowledge. Scientific laws which were once promulgated as "true" such as Newton's theory of gravity are now seen to have but only a conditional validity. "Natural science today deals in probabilities rather than in the certainties of the palmy nineteenth century days". (Marwick 1970, p.99). Elton also contends that, "The natural sciences have, it would seem, virtually abandoned the concepts of truth and falsehood; phenomena once regarded as objectively true are now seen to be only a statistical abstraction from random variables" (1967, p.52). Practising scientists, then, use a phrase such as "more probable"

or "more accurately descriptive" (ibid. p.52). A prediction may come close to certainty, but a scientist will never claim inevitability.

This line of argument seems to be leading us to a meeting point for history and the natural sciences : that they approach their data in a similar manner using both inductive and hypothetic-deductive reasoning, and that their conclusions can be but tentative. An historian and a scientist both have to examine the evidence and induce some conclusions on the basis of that evidence. The analogy between the work in the two branches of knowledge should, therefore, be reasonably close. "The historian's first duty is careful and expert observation" (Kitson Clark 1967, p.26). From those observations, some explanation will follow: "and any explanation must in effect present some hypothesis about the causes which made the sequence of events happen in the way it did", (ibid. p.26). Both the historian and scientist then have to confirm or refute any hypothesis through further analysis of the evidence. Kitson Clark, therefore, considers that "a reasoned hypothesis based on a careful consideration of evidence which has been tested critically and systematically might be considered to have a claim to be called 'scientific'" (op.cit. p.27). We seem thus at the stage where it can be argued that any scholar, be he historian or scientist, operates by observing the data, formulating hypotheses from that data, modifying those hypotheses on the basis of the evidence found, proposing a possible rule which in turn is likely to be modified as more evidence becomes available.

It is contended, therefore, that there is no enormous gap between the procedures used by an historian and a scientist, and that Piaget's developmental scale of criteria, although originating from research involving physical experiments, can be applied to thinking in history. The next question, therefore, is what, if any, are the similarities between "pure" history and the history that is taught in schools.

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CHAPTER 5 : THE RELATIONSHIP BETWEEN HISTORY
AS SUCH AND HISTORY AS TAUGHT IN
SCHOOL.

Some historians consider that it is impossible to teach 'pure' history in schools : only a type of 'practical' history (Gakeshott in Marwick 1970, p.157) can be utilised in history lessons (Elton 1971, p.221; Paros 1961, p.4). Stephens (1970) dismisses the claim of the Newcastle Archive Teaching Units to provide opportunities for "historical research in the classroom" as "the sort of clap-trap that brings the scholarship of educationists into doubt" (in Burston and Green 1972, p.219).

Bryant (1970, p.272) refutes such a deprecation of the history teacher's work : "we must teach real history, historian's history, and not some peculiar substitute for it. But not necessarily mature history" (cf. Lamont 1972, pp.168-169; Gosden and Sylvester 1968, pp.48-49). Presumably this 'mature' history is that depicted by Elton (1967) and others : the immersion of a scholar in a period until he regards the evidence from a contemporary's viewpoint. 'Real' history possibly has analogies with a scholar's approach towards historical data, concentrating particularly in the analysis and evaluation of the evidence available. If we accept this as reasonable stance, that teachers should demand some competence in the skills of historical enquiry from their pupils, somehow on the lines of Nuffield Science (cf. Jones 1973) then we can probably avoid the charge that having children evaluate evidence is an ill-conceived aim which will be futile in execution.

The difficulty implicit in expecting children to act in an historical manner is perhaps seen in Barraclough's definition of history : the attempt to recreate the significant features of the past on the basis of imperfect and fragmentary evidence. "This imperfect and fragmentary evidence is the historian's sources. An historical work is deemed scholarly and reliable according to the extent to which it is based on 'primary' sources, the basic, raw, imperfect evidence" (Marwick 1970, p.131). The use of sources in the teaching of history has quite a long and a respectable pedigree (Keatinge 1910, Happold 1928, Batho 1962). If pupils are to be asked to act in an historical manner, then it seems that they must be placed in the position of evaluating the evidence contained in original documents. Recently, however, there have been a number of warnings against accepting too glibly that merely presenting a document to a class means that the children are thereby 'doing'

history. All of the warnings are relevant to the present research study (see also p.160).

First of all, any "sources" used during the teaching programmes were not the original documents, nor even on most occasions facsimiles of those documents : all that was given to the class was reproduction. This reproduction might contain a modification of the language in the hope of conveying the meaning more clearly to the children. Nicholas and Thompson (1972, p.231) remark that sources "have to be carefully selected and possibly modified to suit the limited knowledge and thought of the child". Historians would undoubtedly refuse to accept such amended versions as true "sources". "Any real guidance from the teacher has been dismissed as 'removing the genuineness inherent in teaching from documents', a genuineness present only when the evidence is presented in its crude, unsifted state" (Edwards 1972, pp.218-219). Secondly, as indicated earlier, an historian approaches an original document with a richness of knowledge about the period and the people involved which a school child cannot hope to have attained. "The past does not 'speak for itself' to strangers. Its voices need skilled reception and interpretation, and knowledge of the right questions to ask" (op.cit. p.218). What teachers should do in this context is to get the children on the inside of the operation, "showing them, however dimly, how history ticks, how historians work" (Bryant 1971, p.38). A third objection to the "children as historians" argument is that the documents used are limited and pre-selected : the pupils do not search, select or even chance upon them. Once an historian has chosen a main area of study, "he becomes the servant of his evidence of which he will, or should ask no specific questions until he has absorbed what it says (Elton 1967, p.62). Children in classrooms do not study the past "in its own right, for its own sake and on its own terms" (op.cit. p.65), such a study involving a knowledge of all the sources and a competent criticism of them. Once again, one has to accept this argument. Bryant (1971, p.43), indeed, adds a further caveat that teachers should not concentrate on the mere comprehension of documents. The children must be made aware of the process or events which produced the document. Questions of the comprehension type, while these may be the pre-requisite for historical interpretation, must not be confused with it.

In the present research, an aim with the younger children (9 - 10 years) was indeed to concentrate on their comprehending documents as the extract on the Murder of Rizzio seems to show.. (Appendix E, p.117)

On the other hand, the older pupils (13 - 14 years) were required on occasions to think about a document's "reliability, about the process or events which produced the document, about its form and overall disclosures" (Bryant 1971, p.44).

(See, for example, Appendix K pp. 242-244)

It is accepted, then, that in the present research children were manifestly not being asked to "act as historians", in an historian's understanding of that phrase. Rather were they being asked to organise and evaluate verbal data concerned with history in a logical way in the hope that they would gain some understanding of the nature of historical enquiry. Nicholas and Thompson (1972, p.232) state that the stress on "new history in schools" is on methods of work which should lead to a greater understanding of what history as a subject is, and to the development of important intellectual skills, (cf. Fenton 1966, p.150; Wake 1970, p.155; Watts 1972, p.38). Yet, they think that this approach should not be over-emphasised in schools (op.cit. p.233). If the emphasis were centred completely on the use of sources this might mean "there could be a syllabus throughout the school which consisted solely of local history, and this would be the extent of the pupil's contact with the human past" (ibid. p.233). Content also has to be considered. Furthermore, using sources has no monopoly of the development of thinking skills : "for at least some of them can be encouraged by the critical examination of secondary history" (op.cit. p.234). They also warn, as most teachers who have tried source work with children would probably concur, that too much use of sources can lead to boredom: "motivation may suffer". In conclusion, Nicholas and Thompson (op.cit. p.235) suggest that the use of source material, if it is to be more than a straight test in comprehension, "will often require some teaching of a more traditional kind to give it an historical context". Perhaps, they suggest, the place of source material "is best seen as being regularly built into a general treatment of a particular topic" (ibid. p.235). Such a treatment would also make use of such traditional methods as oral work, narration, the use of text books and group work of various kinds. The approaches suggested by these authors would appear to have been carried out with the children in the present research (Appendices E and K.)

If it be argued that aiming to make children thinking historically is mistaken, that school children's thinking skills are not ready for

such an experience, then one has to ask when the process would start. Piaget suggests that the three significant factors in intellectual development are maturation, experience of various types and equilibration (see Part II, pp.78-86): experience is a crucial component of such development. Historically-minded students do not emerge simply by entering the Sixth Form or University; the ground has to be prepared. A teacher has to ascertain skilfully the gap which exists between a child's mental skills and the problems to be solved, thus taking note of the inter-related processes of assimilation and accommodation. If the gap is too wide there is likely to be rejection or assimilation without understanding; if there is no gap at all, but the material fits exactly the existing cognitive skills, there is hardly likely to be much development either. Vygotsky (1962, p.104) discusses this aspect of learning: "the only good kind of instruction is that which marches ahead of development and leads it; it must be aimed not so much at the ripe as the ripening functions". Nicholas and Thompson (1972, p.232) echo these sentiments when dealing with methods of teaching history. "Teaching which is designed to develop historical understanding does not have to wait for the maturer mind of the secondary school. Just as reading readiness activities precede reading, so too history readiness activities create the soundest basis for the development of higher levels of historical appreciation".

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CHAPTER 6 : AN ATTEMPT TO RELATE THE COGNITIVE
SKILLS DEMANDED IN STUDYING HISTORY
TO THOSE POSTULATED BY PIAGET.

The foregoing discussion has been attempting to argue that history as such was not violated in the classroom context in this research. The data of history was used in an attempt to lead the children into adopting some of the skills which have been designated by historians as peculiarly characteristic of their discipline. It has also been contended that the use of Piagetian criteria as a means of assessing children's answers was not treating history in an unjust manner : it is at the least arguable that there are links between history and Piaget's model of intellectual development.

From the point of view of a teacher in a classroom, it may seem that the whole of the foregoing exercise was somewhat unnecessary. There is the discipline of history (described by Whitfield(1971, p.14) as the framework within which facts and experience are made intelligible) and there are children's thinking skills. The teacher's task is to mediate between the two, Bruner defining teaching as the "interpretation of the structure of a subject in terms of a child's way of viewing" (in Prosser 1971, p.484), ^{Prosser thinks} that there are dangers in studying structuring at a theoretical level; "for the writers, even where they are themselves teachers, appear to be far removed from the needs and capacities of average boys and girls". Again, he writes, "If we are to use subjects as an educational means rather than as an end, we should define both the children's needs and our strategy". By children's "needs" Prosser evidently means something like "thinking skills" for he comments that, "much of the American science material proved to be successful and stimulating with clever children but much less so with average and less able children" (op.cit. p.487). If a subject is to be taught in an academically acceptable manner and is to be the means of leading children towards historical thinking, then the teacher needs to be aware of the essential attributes of the subject and also of the psychological development of his pupils. The teacher's peculiar task is to teach at the classroom level so that the structure is not destroyed or distorted but the subject matter presented in such a way that the children are able to assimilate its essential attributes.

Piaget's model has been taken as the guide for the different stages of logical thinking in general. Peel (1965, 1971) has used that model as a means of analysing children's responses to questions on historical passages. Historians give their opinions of what to

expect at different levels of historical judgment. Coltham and Fines (1971) have devised a valuable guide for the assessment of educational objectives in history. While they emphasise that the categories do not follow each other in a developmental sequence (op.cit. p.22) a hierarchy of thinking skills seems feasible from their work. Table IX is thus an attempt to show that there might be some form of relationships between the thinking skills at the concrete and formal levels and criteria suggested by educational psychologists and historians for the analysis of verbal statements. If the criteria in Table IX are acceptable (and the quotations used admittedly are selective), then a child's verbal response should satisfy the demands in each of the columns. Two answers are now given from the 1966 research to try to show that although they were originally graded on Piagetian criteria it may also be possible to evaluate them on parallel but different models.

The following question was set on a passage about Mary Tudor (Hallam 1966, 1972):

"Do you think the people of England in the sixteenth century would have thought that not having women as rulers was a good policy after the reign of Mary Tudor"?

Here is how a pupil aged 15 : 10 years, IQ 110, answered:

"Yes, I think they would. Not many of them really wanted to become Catholics and she burnt some of those that wouldn't. Through giving in to her husband they lost the last British possession in France and that was a blow to Britain".

This reply seems to exemplify these aspects from the Table.

- 1) Concrete operations: limited to what is immediately apparent in the text; an ability to forecast a result from the evidence available.
- 2) Peel's "describer thinking": the logic of classes and relations (People in England subdivided into "Catholics" and "not Catholics", this latter sub-class further subdivided into "burnt" and "not burnt"); responses based solely on the given content of the passage.
- 3) Historians: the simple details of accurate chronology and historical geography.

* Footnote: Measured by the Otis Gamma C and D Intelligence Test.

Coltham and Fines: recalls names of particular places, people or groups of people associated with specific events; comprehension, the result of examination at the literal level.

Contrast the answer at the concrete level with the following reply from an exceptional boy aged 14 : 8 years, IQ 127 :

"I should think so. She had to marry a foreign ruler in order to stabilise her throne, which in turn had caused her to join England in a war against France which brought no benefit to England though it was probably a good thing in the long run. Further, unlike her father, she had burnt men for being heretics as opposed to her father who had burnt them for being traitors. Burnings for being heretics would be opposed by most people since they would understand executions for political reasons but not for faith - especially the many simple people who were executed. Most people would not be devoutly Catholic or Protestant - they would go with the wind, but they would object if things got too violent".

This response seems to reflect these aspects from Table IX.

- 1) Formal operations: the separation of variables; reasoning by implication at an abstract level.
- 2) Peel's "imaginative thinking": reasoned discourse in terms of cause and effect relations; imagined possibilities in which ideas outside the phenomena are invoked.
- 3) Historians: "the answer lies in considering the probable and possible as well as the obvious"; the weighing of evidence; considering "the most that can be said for and against any hypothesis, and the relative weight of evidence on either side, before reaching decisions about 'the truth'".
- 4) Coltham and Fines: interpretation from own fund of knowledge and experience; putting forward tenable propositions to fill gaps in evidence and framing a reasonable hypothesis.

While Piaget has been concerned on the whole with experiments having an assured solution, a realm quite different from the often probabilistic world of history, it seems that his work may thus be used as an acceptable means of illuminating the types of answers often received in history and also provide a model by which students and teachers are able to analyse and evaluate the thinking skills of their pupils.

AN ANALYSIS OF THINKING SKILLS IN HISTORY AND IN HISTORY AT SCHOOL

TABLE IX

<p><u>Hallam (1966, pp 122-125) derived from Inhelder and Piaget (1958)</u></p> <p><u>Concrete Operations</u></p> <p>The ability to give an organised answer but limited to what is apparent from the text.</p> <p>Using the information available; tending to judge a verbal problem in terms of its own content.</p> <p>Ability to forecast a result from the evidence available but not to formulate a mature hypothesis after considering all the implications of the situation.</p> <p>Movement from one point of view to another but no co-ordination between the two points of view.</p> <p>Ability to compensate one statement by another or to negate a statement but not able to co-ordinate negation and reciprocity.</p>	<p><u>Peel (1965 and 1971)</u></p> <p><u>Descriptor Thinking</u></p> <p>"The logic of classes and relations seems to account for much of descriptive writing" (1971 p 23)</p> <p>Responses based solely from the given content of the passage (1971 p 25)</p> <p>"Description merely involves an account of the phenomenon and a relating of its parts without reference to other ideas, analogies, similarities and antecedent or contiguous circumstances" (1971 p 26)</p> <p>Circumstantial answers where the content of the passage appears to dominate (1971 p 34)</p>	<p><u>Historians and Philosophers of History</u></p> <p><u>Butterfield (in Sturley 1969, pp 41-42)</u></p> <p>"The historian is essentially the observer ... he deals with the tangible, the concrete, the particular ... History is indeed a form of descriptive writing."</p> <p><u>Eaton (1967 pp 59-60)</u></p> <p>"There is ... a very large body of agreed historical knowledge on which no dispute is possible, and ... is entirely indispensable to any study of (the past) ... Without the simple details of accurate chronology, genealogy and historical geography, history would have no existence."</p> <p><u>Kilson Clark (1967 p 26)</u></p> <p>"The historian's first duty is careful and expert observation ... if he is able to use the evidence to get as near as is practicable to an accurate account ... he has performed an important service for mankind."</p>	<p><u>Coltham and Pines (1971)</u></p> <p><u>Descriptive level thinking</u></p> <p>(a) <u>Cognitive</u></p> <p>"'Imagination' at its simplest requires the formation of an image in the mind - and this may be pictorial or verbal" (op. cit. p.70)</p> <p>(b) <u>The nature of history</u></p> <p>(1) Recalls types of material which may be examined as evidence (eg portraits, documents)</p> <p>(11) Recalls names of particular places, people or groups of people associated with specific events.</p> <p>(111) Recalls names of techniques developed by man (farming, writing).</p> <p>(1v) Recalls theories and ideas (supply and demand, spheres of influence)</p> <p>(v) Exploratory examination of a single piece of evidence.</p> <p>(c) <u>Skills and abilities</u></p> <p>(Considered also under (b))</p> <p>(1) Vocabulary acquisition, for instance, gives examples to demonstrate understanding of specific terminology (feudalism)</p>
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<p><u>Formal Operations</u></p> <p>Proofs must go beyond an observation of "empirical correspondences"</p> <p>The separation of variables. Envisaging all possible explanations and finding out through logical analysis which are true. Logical analysis can be said to be holding certain factors constant and varying others systematically.</p> <p>The tendency to try out possibilities in a systematic way.</p> <p>Hypotheses are postulated and these are confirmed or not by the data. The child "commits himself to possibilities": there is a reversal of direction between reality and possibility.</p>	<p><u>Comprehensive - Imaginative</u></p> <p>Explanation - an equilibrium between information received and information possessed.</p> <p>"All natural and contrived situations involve the idea of equilibrium - disequilibrium. Behind this interaction there are the ideas of cancelling an operation or a state and compensating for such a change to re-establish equilibria" (1965 p 178)</p> <p>Referring the phenomenon causally to previous phenomena and independent generalisations.</p> <p>Reasoned discourse in terms of cause and effect relations.</p> <p>Judging among alternatives according to certain criteria.</p>	<p><u>Elton (1967)</u></p> <p>"Not everything can be known, and the historian, since he deals with men, must concede the limits of rationality. However, reason also exists ... the answer lies in maintaining a balance controlled by rigorous study of the evidence in considering the probable and possible as well as the obvious and in avoiding simplification one way or another." (op cit p 82)</p>
<p><u>High Level Thinking</u></p> <p>The nature of history</p> <p>Establishment of questions to be asked of evidence.</p> <p>Evaluation of source material.</p> <p>Recognition of any gaps in evidence and pursuit of appropriate action by, for example, extrapolation forwards or backwards from collected evidence, interpretation</p>	<p>(II) Uses correctly basic time indicators (year, century)</p> <p>(III) Recalls procedures for examining evidence.</p> <p>(IV) Comprehension: the result of examination at the surface or literal level, attention to the immediately observed features without any depth of cognitive treatment.</p>	

Reasoning by implication at an abstract level.

Realising a multiplicity of possible links.

"As far as formal operations are concerned, one can find their principal forms in language: implication ("if ... then" or "either ... or"). The possibility of reasoning on simple hypotheses is a characteristic of these hypotheses - deductive operations and is produced by a correct handling of these terms".
(Piaget in Furth 1971, p122)

Deductive reasoning whereby the child relates the phenomena to general principles and to independent antecedent events tied by a necessary relationship with those being investigated. Imagined possibilities in which ideas outside the phenomena are invoked.

Kitson Clark (1967)
"more important than any grasp of scholarly techniques is the lesson of the habit of scholarly hesitation, the habit of the mind which teaches the great difficulty, even the impossibility, of arriving at the truth about many of the facts relating to events in the past"
(op cit p 127)

I.A.A.M. (In Sturley 1969)
"more peculiar to history itself are the weighing of evidence, the detection of bias, the distinguishing of truth from falsehood, or at least the probable from the impossible."
(op cit p 7)

Thomson (1969)
"the historian ... must consider the most that can be said for and against any hypothesis, and the relative weight of evidence on either side, before reaching decisions about 'the truth'
(op cit p 42)

A possible summary

- (a) Evaluate evidence for both internal and external consistency.
- (b) Be aware of the paucity of evidence.
- (c) Draw together evidence in an attempt to see connections between seemingly disparate facts and events.

From own fund of knowledge and experience.
Analysis of source material, primary and secondary so as to detect existence of points of view, detect bias and separate fact from value judgements.
Synthesis of evidential material with items from own fund of knowledge and experience.

Skills and abilities

Extrapolation, that is, putting forward tenable propositions to fill gaps in evidence and framing a reasonable hypothesis.
Evaluating several possible interpretations of material.
Interpreting material in accordance with values of the period under study but using caution and admitting doubt.

PART V
A REVIEW OF RELEVANT RESEARCH WORK

CHAPTER 1 : STUDIES BASED UPON THE PIAGETIAN
MODEL IN HISTORY AND RELATED FIELDS.

Hallam (1966, Chapter II) reviewed various studies which tended to show that children's thinking skills and powers of conceptualisation develop relatively late in a verbal subject like history (for example, Bassett 1940; Lodwick 1958; Coltham 1960). Since that date there have been further studies which seem to corroborate the findings of that earlier research. Bell (1965), for example, replicated Lodwick's study using the clinical interview method with 40 children aged 7:0 to 11:8 years in two primary schools in Berkshire. His general conclusion is that, "no child in the sample could reason consistently at higher than the concrete level" (op.cit. p.78). With one hundred 10 to 12 year old children McNaughton (1966) read a descriptive statement of episodes in the lives of African bushmen and then asked questions about them. It was found that "simpler (concrete) statements were still in the majority at the end of the story" (op.cit. p.29). McNaughton concludes that very few of his twelve year old subjects were capable of dealing with social studies problems "in the way Piaget has described for formal operations" (op.cit. p.30). McNally (1970) assessed the responses of Australian children on Peel's "Pilot" story and Lodwick's account of King Alfred and Stonehenge. These are his results (op.cit. p.130).

Table X McNally's (1970) Results

	<u>Intuitive</u>	<u>Concrete</u>	<u>Formal</u>	<u>Number</u>
Grade 6 (average age 11:5 years)	0.7%	96.7%	2.7%	151
2nd Form (average age about 13:5 years)	0.6%	97.0%	2.4%	164
4th Form (average age about 15:5 years)	0.0%	42.7%	57.3%	157

One reason for the large number graded at the concrete level in the second form, McNally suggests, is that that group contained a considerable number of migrant children and children of low socio-economic standing (op.cit. p.132). In the article, however, he does not give the mental ages of his subjects and it is possible that the subjects' intelligences were determining the levels of their replies and also affecting their use of language.

As part of a wider research study, Lodwick (1972) asked 16 children in each of the age groups 9, 11, 13 and 15 years a total

of 9 questions on three stories. The answers were assessed by two judges on a scale of five levels of criteria. Lodwick's general results are (op.cit. p.117):

- a) the responses of the 9 year old subjects were predominantly at the level where a single reason taken in isolation was considered to be sufficient to form a judgment.
- b) the incidence of this form of response decreased steadily with age to the point where 50 per cent of the replies of the 15 year old subjects showed an ability to balance possibilities.
- c) while children generally fluctuate in their reasoning levels, individual children show predominant modes of thinking, particularly at 9 years and 15 years.

Davies (1965) gave 25 boys and 25 girls aged 14:8 to 15:10 years from a Birmingham secondary modern school various written tests on verbal reasoning. In one battery they were given premises that were likely to be unacceptable to them such as, "All children are lazy". The premise was followed by a second statement ("All lazy people should be punished") and a conclusion ("All children should be punished"). The children had to decide whether the conclusion was true or false and choose one from four reasons for their decision. Davies (op.cit. p.135) explains that under these conditions the children's "preconceived notions and beliefs nearly always win the day. If, as Piaget claims, the ability to make deductions from hypothetical premises regardless of the truth value is a mark of the formal thinker, then these subjects for the most part fall far short of the required criteria".

Davies' subjects also answered questions on five passages, two of which dealt specifically with historical topics ("The Vikings" and "Child Workers"). Grades were given on a five point scale, said to correspond to five Piagetian developmental levels (op.cit,p.51). On the evidence of some of the answers quoted by Davies, however, one wonders whether the answers awarded 5 points should be graded at the hypothetico-deductive level of thinking. For example, on the passage concerning the Vikings (op.cit. p.144):

Question 2. "Were the writers of the Church Chronicles honest men?"

"I should say half and half"

"Why?"

"Well, like everybody, as the story gets told more and more, they exaggerate it" (5 marks)

Question 4. "Were the English afraid of the Vikings?" (op.cit.p.148).

"I think in the beginning they were but probably not after they had settled". (5 marks)

Yet the passage explains that the church records probably exaggerated the dreadful nature of the attacks of the Vikings and that documents show the Vikings had to make do with poorer land not already settled by the English. Despite this type of reply receiving 5 points, only 5.5% of the replies on the verbal passages were graded at the formal level. Davies' conclusion is that, "the statistical summaries support the view that the thinking of these subjects is still typically at the concrete circumstantial level. The boys are marginally better than the girls but not significantly so" (op.cit. p.215).

Booth (1967) examined 147 boys and girls from the fourth year of five secondary grammar schools in the South of England. One of the schools was a large direct grant boys' school. His three tests were based on the schools' history syllabuses for the previous $3\frac{1}{2}$ years (op.cit. p.63). The questions set fell within two broad categories: those relying more obviously on factual information and those giving more freedom (op.cit. pp.69-70). Papers I and II seem to have demanded memorisation of the work done during the previous three years; Paper III required analysis of data. For example, on this Paper the pupils had to read two poems on war and reflect on the purpose and results of war. Booth comments that in practice the pupils did not seem to make a distinction between the two types of tests (op.cit. p.70). The answers were graded into three major categories (op.cit. pp.144-145):

Historical understanding (H): powers of critical thinking and, "above all, of the ability to work relevantly outside the given material but within an historical framework".

Précis comprehension (PC): comprehension of the material.

Précis non-comprehension: little real comprehension.

Again, one has to question at times the grades given to individual answers. For instance, two replies are quoted (op.cit.p.146) to this question.

"Write two sentences each giving one reason why Britain was the first country in the world to undergo the industrial revolution".

Child 214 (14:11 years, I.Q. 139).

"Britain was a rich country and could afford to start industries. There was also available coal for the industries".
Child 502 (15:3 years, I.Q. 134).

"Because the British were the first to invent the means of power to drive machines instead of using man-power which was slower and more costly. Also the British were easily supplied with coal for steam and wool which was the main beginnings of British industry".

The second answer is placed at the *Precis Comprehension* level since the girl is thought to have "merely picked on one or two important factors", while the former is considered to show "a clear historical understanding of the economic state of Britain in the eighteenth century". (H category). The two answers, however, do not appear so strikingly different. While neither instances the increase in population as a causal factor, the second seems the more developed answer in that the pupil cites the invention of steam power. The question does not really give the subjects a chance to put forward a series of possibilities and to evaluate their effects, but an H-type answer would surely require such an approach?

Harvard (1970) had a random sample of 160 pupils, 40 in each age group, drawn from the 1st, 2nd, 4th and 5th years of a secondary modern and a grammar school. They wrote answers to 12 questions on 4 passages relating to poverty and man's control of the environment (op.cit. p.107). Each subject received a criterion score on the basis of his general performance. The test passages were so devised that there was "variant presentation of the information" (op.cit. p.115). Treatment 'a' gave the minimum of information while treatment 'b' embodied further details from which, states Harvard, more causative explanations and multiple perspectives could be derived. Each age group was divided for treatment in the following ways:

Table XI Harvard's (1970) subjects and treatments in each age group.

<u>Grammar</u>					<u>Secondary Modern</u>				
5	working	class	and	treatment 'a'	5	working	class	and	treatment 'a'
5	"	"	"	" 'b'	5	"	"	"	" 'b'
5	middle	class	"	" 'a'	5	middle	class	"	" 'a'
5	"	"	"	" 'b'	5	"	"	"	" 'b'

Among his results were these:

- a) 1st and 2nd year age groups showed significant intra-age level differences in favour of the 'b' treatment. The treatments did not lead to significant differences for the older pupils (op.cit. p.136).
- b) The inter-school difference for the younger subjects reached .001 level of significance. The "high age" grammar school subjects (4th and 5th years) showed superior performance but this was not sufficient to yield a significant difference over the secondary modern subjects (op.cit. p.137).
- c) The group mean scores indicate that, "there appears to be a minimum threshold of performance for formal operational thought which appears at the end of the second year and does not become completely stabilised until the end of the fourth year" (op.cit. p.170). Does Harvard mean here that formal thought is stabilised or the threshold?

Brydon (1967 in Peel 1971, pp.53-54) did not find such a clear result as did Harvard when he added extra information to his passages. Peel explains that if a thinker is really impelled to fit the problem into his cognitive structure, then the extra data should lead the subject into explaining it and thus the invocation of further thinking (op.cit. p.52). Brydon found "there were no significance differences between the means and standard deviations with and without added information" for the boys and girls he tested (op.cit. p.54). Peel considers that, "providing extra information sets off further processes of invoking facts and ideas and apparently the readiness hypothesis is confirmed", (op.cit. p.55).

Stokes (1970) aimed to discover the extent to which adult, analytical thinking had developed among 40 subjects aged from 17:7 to 18:11 years in a College of Art and Design. For his three test passages he chose an editorial on fireworks from the "Observer", and an extract from a speech by Mao Tse-Tung and the passage on William of Normandy (Appendix A, Passage D). Although the students said that they did not think the passage on William as interesting as the others, there was a high degree of consistency in the replies over the three tests (Kendall's $W = 0.87$, $P < .001$). Stokes found that the "average C.A. for the presence of stable formal thinking could not be before 18 years" (op.cit. p.8). In many ways, Stokes considers, the "findings in this research are very discouraging. It seems that many young people are not able to deal logically with historical ideas, and by extension political and social ideas, in

many cases more than two years after they leave school" (ibid. p.8). Furthermore, many were "not able to make simple rational judgments about matters not within their own immediate experience" (op.cit.p.9).

Miles (1971) also investigated adolescents' comprehension of verbal passages by following Goldman's (1962) research. Miles used four Biblical stories: the Crossing of the Red Sea, the Prophet Hosea, the Temptations of Jesus, and the Prodigal Son. His research project was to measure some effects of conventional grammar school teaching on two "O" level groups, consisting of 20 and 14 pupils, and one "A" level group consisting of 10 pupils. Each group was matched with a control group of pupils for age, IQ, sex, religious denomination and church attendance. Miles taught one "O" level and the "A" level group; another member of staff in his first appointment taught the smaller "O" level group. The subjects were assessed for logical thinking on the four passages at the beginning and end of the school year. From his analysis Miles concludes (op.cit. p.383-4) that "within the field of religious studies a pupil is unlikely to attain the level of formal operational thought, given present educational aims and methods, until he reaches the sixth form", giving the chronological age of 18:0 years as the likely one (op.cit. p.388). He considers there were two limitations within his subjects' understanding, their quoting of "verbal formula which they hope will answer the question" (op.cit. p.151) and "adolescent egocentricity". By the latter phrase, Miles means an inability to refer to other interpretations of a problem, a desire to relate a problem to their own assumptions which they regard as "sensible" (op.cit. p.156).

Miles' work has interesting implications for the present research in that he analysed the pupils' grades at the beginning and end of a school year, although no attempt was made deliberately to accelerate their thinking skills during that time, apart from the effects of normal grammar school type teaching.

- a) Group I consisted of the 20 subjects taught by Miles. There was little evidence of 'transfer of training' from answering the taught New Testament to answering the "unknown" Old Testament stories at the end of the year (op.cit. p.233). The effect of teaching on thinking in respect of the taught stories was not statistically significant (ibid. p.233), but the effect of maturation was considerable, being significant at the 1% level (op.cit. p.234). However, the effect of the course interacting with maturation over ten months was statistically significant at the 5% level. Hence, "the effect of teaching on the whole

- experimental group for the taught stories was significant, but had less effect than maturation alone" (ibid. p.234).
- b) Group II of 14 subjects was taught by the assistant master, the results providing a "complete contrast with Group I" (op.cit. p. 234). Group II returned at the end of the year lower scores for the taught stories than did their control group : "it seems as if the course retarded their thinking on the 'taught stories'" (op.cit. p.236). Furthermore, whereas with Group I I.Q. was one of the main reasons for the range of scores in September, I.Q. was not significant at that time with Group II. By the following July, however, I.Q. had become a statistically significant factor in the case of the Group II pupils. Miles considers that, "The only satisfactory explanation is that in the absence of effective teaching, I.Q. became a significant factor affecting the logical thinking" (op.cit. p.237). And he makes the wry comment that, "in light of this data and the fact that all pupils failed their 'O' level course, their religious education would have been better served without this course" (op. cit. p.245). It has to be remembered, in some mitigation of these gloomy results, that all 14 candidates had previously failed their 'O' level English language which they re-sat at the end of the first term in the fifth form. In light of this, they had only two periods of R.E. a week for that term compared with the four which Group I had.
- c) There were only 10 members in each of the experimental and control groups at 'A' level : therefore, "fluctuations within the statistics need to be interpreted with considerable caution" (op.cit. p.245). In September the stories and questions were of comparable levels of difficulty but by the following July, "small but significant scores were made in the logical scores on the taught stories in comparison to the untaught story" (which was "The Crossing of the Red Sea") (op.cit. p.255). The course presumably had some effect on the pupils' logical scores but, in general, "the effect of the course on the logical scores of the experimental group was extremely small" (op.cit. p. 248). I.Q. was a significant factor at the beginning of the course and seemed to become increasingly significant, which was in marked contrast to the Group I result. "This is clearly a factor which affects the rate at which pupils attain formal operational thinking - attained only by the Upper

I.Q. experimental group in July" (op.cit. p.256). Miles, therefore, considers that, "the main factor affecting the transition from an intermediate developmental level to the fully formal stage of operational thinking is inherited ability rather than environmental influence of the course" (ibid. p.256). Furthermore, "alone the course made no significant difference to the logical thinking of the pupils maturation etc. on the other hand, was highly significant - well above the one per cent level. However, the effect of the course interacting with time was just statistically significant at the five per cent level" (op.cit. p.259). Miles does repeat his warning that any deductions from these results must be highly tentative because of the small samples involved.

Miles gives two general conclusions on the results for both age groups which are of great relevance to the present research:

- (i) The data may afford some support to the thesis advanced by Inhelder and Sinclair (1969, p.42) that, "the evolution of operativity is malleable only within certain limits imposed by the laws of development". Miles sees this principle acting in his own research in that, "teaching may help pupils working at a clear operational level, as was true with Group I, rather more than with a group of pupils on the threshold of the new level of formal operational thinking, as is the case with Group III. In the latter case I.Q., as Inhelder and Sinclair suggest, was clearly a more important factor than the course" (1971, op.cit. p.259).
- (ii) The very slight effect of the course can be interpreted as affording the pupils an opportunity to become familiar with the material and variables used in the questions.

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CHAPTER 2 : CONCEPTUALISATION IN HISTORY

Peel (1971, p.129) explains that the "most mature imaginative judgments always imply the invocation of more general or higher level ideas. It is the absence of such invocation which characterises circumstantial thought". It can be noted, for example, how the pupil aged 14:8 years (see Part IV, p.188) counter-balanced the complex concepts of 'traitor' and 'heretic' as part of his formal level answer on Mary Tudor.

Stones (1967) has put forward an interesting argument that the development of formal thought in history may be hindered through an adolescent's inability to handle abstract concepts. "History comprises second order operations with second order concepts" (op.cit. p.38). Furthermore, "It would seem that the capacity to reason with abstract terms is very dependent, not only on the modes of thinking but also on the existence of appropriate concepts" (op.cit. p.118). She considers that experience of using such concepts in adult contexts is essential. In her experimental work (see Part II, p.132), those pupils "whose replies fell consistently in the higher grades tended to make the widest generalisations and see connections beyond the evidence of the material (op.cit. p.131). The group receiving the programmed instruction achieved significantly higher scores on the judgment tests than did the group which was merely given a list of the definitions of the same concepts. The improvement was most noticeable with the pupils of higher intelligence (AH4) and lower verbal fluency (op.cit. p.4.).

It could, no doubt, be argued that people could show the ability to put forward hypotheses, combine variables and so on without a full comprehension of the concepts being used, but at the present we do not really know enough about the relationship between the possession of concepts and the ability to reason at the different levels of logical thinking. Peel (1971, p.135) for instance, comments that, "we know little about the adolescent formation of the more complex relational concepts called for in human knowledge".

Peel (op.cit. p.142) cites the research of De Silva (1969) to indicate some of the difficulties learners meet in forming historical concepts when they are presented with only an unfamiliar name embedded in a textual setting. Ten concepts such as "taxation", "monopoly", "cold war" were each given a code name. 160 children aged between 12 and 16 years from a Birmingham comprehensive school were tested

on their ability to work out the meaning of each word from contextual cues in ten passages and also from 6 separate sentences, each sentence containing the word in a different context. The replies on the passages were graded into four main categories:

- (i) Logically restricted responses - inconsistent, irrelevant guesses.
- (ii) Circumstantial conceptualisation - a very limited, trivial response in terms of one aspect of the presented data.
- (iii) Logical possibilities - "realistic appraisal showing capacity to combine two or more pieces of evidence" (op.cit. p.132).
- (iv) Deductive conceptualisation - evaluation of the possibilities against the facts of the situation.

Peel (1971, p.144) gives a useful table showing the percentage of responses in the different answer categories:

Table XII Percentages of Frequency (De Silva 1969)

Answer Category	Age	12	13	14	15	16
	No:	20	40	40	40	20
No response		4.0	3.5	6.5	9.5	5.5
Logically restricted		71.0	68.8	63.0	47.0	40.0
Circumstantial conceptualisation		10.0	9.3	10.5	15.5	16.5
Logical possibility		4.5	6.0	4.3	8.8	3.5
Deductive conceptualisation		10.5	12.5	15.8	19.0	34.5

One notices the high frequency of responses at the logically restricted level; "Only at 16 does there appear to be a significant appearance of concept formation at the most mature level" (op.cit. p.145). De Silva plotted developmental curves for the grammar and secondary modern subjects. Until the age of 15 years the two curves

ran more or less parallel to each other, but after that age the curve for the grammar type took a sharp curve upwards while the other curve continued at the same level (1969, pp.242-243).

The extracts from the passages have shown that the language of a textbook can be needlessly difficult for children (see Lawrence pp.110-143, in Lamont 1972 for an interesting discussion on history textbooks). De Silva comments that the failure of a child to acquire a concept through reading may arise from the poor choice of expression by the author rather than from any weakness in the child (1969, p.272). He gave, therefore, two of the passages to a Postgraduate Certificate of Education group of students in their final term. Twenty-nine of a possible 111 responses on the "cold war" passage were classified as logically restricted. This type of result "may be taken to mean that the choice of expression has been too poor even for them" (op.cit.p.272). The work of Wason and Johnson Laird (1972) seems to show the vital importance of content for the comprehension of concepts, formal operations possibly being elicited only by familiar tasks; they need not be cognitive skills which can be applied to any problem whatsoever (see Part I, pp.34-37).

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CHAPTER 3 : THE INFLUENCE OF SOCIO-ECONOMIC FACTORS
ON CHILDREN'S JUDGMENTS.

Peel (1971, p.113) considers that the level of adolescent judgment "may be quite susceptible to cultural and educational influences". He explains that in the homes of the upper and professional classes, "ideas tend to be discussed and language may be used for purposes of rational discussion in a much more prevalent way than in many working class homes" (op.cit. p.50). He does, however, remind us of the possibility that the differences between the classes are in part due to differences in intellectual capacity (ibid. p.50).

Brydon (1967) found that maturity of judgment (as assessed in his research) was associated with the socio-economic level of the home. He evidently obtained information of social class from the children themselves. This, says Cherrington (1971), forms a basic weakness in Brydon's research. He quotes from St. John (1970) who has decided that for sixth graders anywhere, "the reports of children can neither be accepted at face value nor used with confidence as indications of parental socio-economic status" (op.cit. p.66). Cherrington himself used Peel's five categories of thinking in order to classify the responses of 160 pupils in a mixed comprehensive school on three verbal passages of geographical material (op.cit. p.34). The pupils wrote their answers. The overall trend suggested for the years 11:11 to 14:9 that, "there is a slow, uneven and somewhat limited progression in the levels of thinking achieved. The majority of subjects seems to be progressing towards the consolidation of structures at the Concrete Operational level; and a minority appears to be moving slowly towards the attainment of Formal Thought" (op.cit. p.63). He obtained information on the pupils' social background through a letter to the parents. He found that no statistically significant relationship existed between the measure of social class and the levels of thinking. Cherrington, therefore, suggests that, "the particular index of social background is not directly influential in determining a child's level of thinking" (op.cit. p.71).

Harvard's (1970) results differed from those of Cherrington with regard to social class. Harvard correlated each child's criterion score against social class (Registrar-General's scale of occupations) and other variables (see pp.195-196). He concludes that in general there was a marked difference in favour of middle class students using the "b" treatment. The working class groups' performance was

considerably below that of the middle class groups irrespective of treatment or age level. He links this superior performance with language usage where middle class subjects were able to operate at a high level. "If, as it seems to be, this is a function of social class - which we have adopted as indicating ownership of different linguistic codes which have immediate repercussions for logical thinking - it may point to the primary importance of language usage and its close alignment to formal thinking" (op.cit. p.168).

A number of investigators have argued that language usage has an important effect on children's levels of thinking. Stones (1967, p.118), for example, considers that, "the capacity to reason with abstract terms is very dependent, not only on the modes of thinking but also on the existence of appropriate concepts, the correct syntax, and the grammatical structure needed to express the reasoning sequences". There has not been a great deal of research done in this area. From his results Bart (1971) considers that language competency is a contributive factor in effecting and sustaining formal thought. Peel and Bartholomew (Peel 1971, pp.50-51) used tests of the use of language (Lawton 1969 and Flesch 1950) in a preliminary comparison between productive writing and maturity of judgment. Using Lawton's (1969) analysis a marginal positive association resulted between maturity of judgment and (a) the use of subordinate clauses, (b) the use of uncommon words. There was a clear positive association with the use of impersonal pronouns as subjects of sentences. Flesch's (1950) scheme for analysing a person's written work in terms of the "Definiteness" of the description (words which tend to be concrete and particular), showed a significant negative association between the number of "definite" words and maturity of judgment.

Inspection of answers considered to be at or near the formal level in the present research (see Appendix I) reveal that subjects had to have a strong control of language to reason at that level and it is likely that language is a significant factor in mature judgments. But, as Peel comments (op.cit. p.51), the research to date has only been of a preliminary nature and we shall have to await more extensive investigations before any clear conclusions are reached.

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CHAPTER 4 : ATTITUDES TOWARDS HISTORY AS
A SCHOOL SUBJECT.

Brown (1959) has made one of the few attempts to assess children's attitudes towards history. His major experiment was concerned with two classes aged approximately 14 years, one in a girls' (Class A) and the other in a boys' (Class D) grammar school. These two classes were selected from his original sample of four classes because the girls scored appreciably higher than the boys on a Thurstone based attitude questionnaire (op.cit. p.311). At first he taught history in a 'conventional' manner for 9 (Class A) and 8 (Class D) periods over a few weeks. During that time he strove also to direct attention to the "human reality" of the people of the past (op.cit. p.225). It is difficult to know what precisely is meant by that phrase, Booth (1967, p.25) commenting that, "Philosophically, the problem posed by the phrase 'human reality' is vexed". The children were tested on their attitudes before and at the end of this short teaching period. In general, their attitudes were very similar (Brown 1959, p.511), although Class A still showed a significantly more favourable attitude towards history as a subject.

After this initial period of teaching, each class then experienced a group interaction experiment following different syllabuses, the groups being formed on the basis of sociograms. After six weeks of varied activities in groups, a third administration of the attitude test gave these results:

- a) Class A - the pupils' attitude to history significantly improved, although there were significant individual differences among the girls (op.cit. p.551).
- b) Class D - Brown claims "tentatively" that the interaction technique was responsible for modifying the boys' attitudes (op.cit. p.555).

Brown concludes (op.cit. p.615) that, "the central emphasis of the present research is that if history has failed to appeal to the middle years of adolescence, it is primarily through a failure to recognise that the pupil is the subject, and not history". Although this does not appear a "startling" statement to Booth (1967, p.26), it is interesting that we still have similar demands fourteen years later: "method in its widest connotation, comes first and knowledge takes second place" (Turner in Jones 1973, p.26). The relatively short period of teaching carried out by Brown makes one wonder, however, whether a type of "Hawthorne effect" was influencing

the scores on the attitude tests.

Both Stones (1967) and Booth (1967) gave questionnaires aimed at investigating their subjects' attitudes to historical pursuits and history in school. Although none of her results on attitudes was statistically significant, Stones states that the trend in scores indicated that a higher number of interests in history was associated with higher criterion scores (1967, p.171). Booth's subjects generally preferred world to national history but Booth contends that, "the treatment of the topic rather than the topic itself is what matters to the pupils" (1967, p.119).

Musgrove (1963) constructed five attitude scales to study secondary pupils' interests in different aspects of history. 700 pupils aged from 10 + to 15 + years in seven different schools completed all or some of the questionnaires. The results detailed below, then, were not obtained from the whole sample.

- a) "The great majority preferred a balance of activity between the teacher and themselves" (op.cit. p.427).
- b) There was "a consistent average preference for history remote in time" (ibid. p.427).
- c) The mean score of every class indicated "a very strong inclination towards foreign and away from parochial history" (op.cit. p.431).
- d) The general trend favoured social history but there was not an "overwhelming and exclusive preference" for this type of history (op.cit. p.432).
- e) While the girls' mean score inclined more towards pacific than military aspects of history, the girls were not entirely without military interests.

Musgrove concludes (op.cit. p.439) that his inquiry "lends no support to the common view that local and/or recent history make a strong appeal to secondary modern pupils - even the less able ones. The tendency was to prefer history which is distant in time and place and involves an imaginative effort at reconstruction". If we accept Musgrove's results - and his seems to have been the largest investigation into attitudes in history to date - then the content in the present research for the secondary groups seems to have aligned itself in the main with the preferences of Musgrove's pupils, namely, for history that was distant, foreign, and included

some military and social history. The methods used with the experimental group were possibly more active than some pupils might have wished; with the traditional group, more passive than certainly the experimenter liked! The main aim of giving the Osgood Semantic Differential Test to these pupils was an attempt to assess whether their attitudes altered over the year to certain topics in history and to aspects of history teaching (Part VII).

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CHAPTER 5 : RELATIONSHIPS IN THINKING SKILLS ACROSS
(DIFFERENT AREAS OF) THE CURRICULUM.

The previous research (Hallam 1966) had shown that the subjects' level of thinking remained generally the same across the three stories used, Kendall's coefficient of concordance W being 0.874 (op.cit.p.127). The answers in the present research are assessed in the same manner (see Parts VI and VII). In addition, since the model used was Piaget's, it was decided to investigate whether the pupils' responses on two Piagetian experiments (the balance and the combination of colourless liquids) correlated positively with their answers on verbal material.

There have been a number of investigations aiming to discover how far children's thinking remains stable over various tasks. Lovell used five combinations of ten of Inhelder and Piaget's experiments. These were given to different groups of subjects between 8 and 18 years of age. The value of Kendall's W varied from .89 to .52 depending upon the age and ability range of the pupils concerned (in Green et al 1971, p.86). Jackson (1965) found that only 12.5% of his normal subjects (as contrasted with E.S.N. children) were at one level of thinking across six Piagetian experiments. Small details of apparatus and questioning were found to affect crucially the responses and, therefore, the assessments. Jackson decides that the ability to think at a certain logical level in one situation does not necessarily imply the ability to think at that level in other situations.

Hughes (1965) assessed the thinking skills of 40 boys in a secondary modern school; their mean score in a verbal reasoning test at 11 plus years was 94.6. For each year of their secondary school career (11 to 15 years) they were tested on 4 Piagetian experiments; in the final year an extra Piagetian test was administered. In the first form Kendall's W ^{was} .394 for thinking on the four experiments (op.cit. p.57). The coefficient of concordance had increased to .57 by the fourth form. Lovell (in Green et al 1971, p.87) thinks that this movement suggests that, "as the move to formal thought takes place in respect of these tasks, the level of thinking becomes steadier". He continues that this evidence "also implies that those who are slow to move towards formal thought in one of the tasks, tend to be slow to move in the other tasks" (ibid. p.87).

Hughes also carried out intercorrelation coefficients for a total of 7 tests given to each subject in the fourth year of the investigation (1965, p.95).

Table XIII Hughes' (1965) Results.

	Non-verbal intelligence quotient	Plane	Pendulum	Flexibility of rods	Chemicals	Bal- ance
Non-verbal (1) intelligence quotient						
Plane	.414 **					
Pendulum	.243	.155				
Flexibility of rods	.411 **	.303	.487 **			
Chemicals	.530 **	.396 *	.498 **	.428 **		
Balance	.410 **	.347 *	.283	.191	.425 **	
Series and (2) Numerical Analogies	.600 **	.381*	.158	.431 **	.540 **	.245

* significant at the 5% level

** significant at the 1% level

The most interesting of the findings for our purposes appear to be these:

- (i) The N.V.I.Q. correlated at the 1% level with all but one of the other tests.
- (ii) The two non-Piagetian type experiments correlated better with each other than with any of the five Piagetian experiments (op.cit. p.96)
- (iii) The highest correlation coefficient for the Piagetian experiments was .498 (chemicals vs pendulum). Both experiments, of course, demand the isolation and combination of a number of specific variables.

Footnotes:

(1) N F E R Non-Verbal Reasoning Test 3 given in the fourth year : mean score = 99.6

(2) Used also in the present research (see Appendix: B)

- (v) The surprising result that there was not a significant correlation between the results on the balance and on the Series and Numerical Analogies test.

A principal components analysis of the data yielded a first component which accounted for 47 per cent of the variance. All of the tasks were found to have quite high correlations with this first principal component, ranging from .57 to .811. Hughes thus seems to have defined a general component for formal thinking skills, but it has to be remembered that he had only 40 subjects.

Butterworth with Lovell (1966) gave 20 tasks which demanded some understanding of proportion to 60 children aged from 9 to 15 years of age. A principal components analysis revealed that there was a large general component accounting for a little over 44% of the variance. This reflected some central intellectual ability embracing the scheme of proportion. Wollman and Karplus (1973) have also studied children's understanding of ratio and proportion. They argue that, "proportional reasoning, as an element of formal thought, is a highly adaptable technique that is used in appropriate mathematical and physical situations regardless of the data or the content" (op.cit. p.1). Seventh and eighth grade (13-14 years) students were tested on six problems that required proportional reasoning, each problem representing different degrees of concreteness. From a given exemplar, for instance, they had to shade in the equivalent fraction in a series of geometrical patterns. In two other problems they had to show an understanding of ratio in relation to (a) different piles of paper clips and, (b) different amounts of candy. The answers were graded into six categories ranging from no explanation, through guesses, to proportional reasoning. (op. cit. pp.4-5). Four conclusions emerged quite clearly (op. cit. p.16):

- a) Where concrete aspects existed, as in the geometrical items, more students answered successfully.
- b) About one fifth of each group at two different schools applied proportional reasoning consistently at the formal level on several tasks.
- c) About one quarter applied this type of reasoning in an unpredictable way on some tasks but not on others.

- d) Incorrect additive strategies (e.g. "20 to 35 is 15 so you add 15 to 12 and get 27") were used by many students on several tasks. About 20% were at this level which suggests a stable strategy. Wollman and Karplus suggest that mathematics teaching may concentrate too much on addition; multiplication, for instance, frequently being treated as repeated addition (op.cit. p.17).

The lack of generality of proportional reasoning may be interpreted in two different ways, say Wollman and Karplus (ibid. p.17):

- a) In line with Piaget's theory, since only about 15 per cent of the subjects had reached the level of formal thought, most children being transitional between concrete and formal reasoning.
- b) Following Lunzer, who declares that we cannot provide for a definite stage of formal thought. "Rather, there are formal operations, such as proportional reasoning which are used by individuals when they are suitably motivated, have certain cues that suggest a formal rather than an intuitive approach, and/or are pressed to justify their conclusions".

Bart's (1971) research studied pupils' responses across both Piagetian and predominantly verbal tasks. His sample consisted of 30 scholastically above-average students at each of the three age levels, 13, 16 and 19 years in Chicago-area schools. They were given 4 Piagetian tests and 3 formal operational reasoning tests based on a set of logic items which provided either abstruse or absurd information. In order to solve these items the subjects had to choose a correct solution from six alternatives. The tests were set in the content areas of biology, history and literature (op.cit. p.72). The pupils also took a test of general intellectual ability. Through factor analysis it was found that the Piagetian tests were unifactor and that the three formal reasoning tests had a unifactor quality: these results tend to confirm "an alternative bifactor hypothesis" (op.cit. p.74).

Davies (1965, see also pp. 193-194) gave a wide range of tests to 50 boys and girls aged approximately 15 years. These included the AH4 intelligence test; a test of hypothesis formulation; a verbal battery of tests; four verbal comprehension passages; a non-verbal test battery which included experiments on the balance and a combinatorial problem (bulbs and switches). With the warning that the sample may not be typical (op.cit. p.363), Davies explains that, "an over-whelming preponderance of answers were at and around the concrete level" (op.cit. p.348). There was some difference among individuals in their responses:

"the less able performers on the tests were uniformly poor whereas the more able varied relatively widely in the level of their responses" (op.cit. p.349). Rank order correlations between the main items of the tests revealed only a moderate level of agreement (op. cit. p.358). Analysis of variance showed that individuals had marked preferences for non-verbal or verbal tests, and also preferences for particular tests (op.cit. pp.367-368). These results lead Davies to suggest that "given suitable conditions of stimulated interest and previous educational experience, the level of thinking shown by the average child could be appreciably raised" (op.cit. p.368). Surely, though, it could equally well be argued that the results show that motivation, specific abilities and previous experiences lead children to reason at different levels on different areas of the curriculum?

As well as testing 64 predominantly working-class Liverpool children aged 9, 11, 13 and 15 years on three passages of history, Lodwick (1972, see also pp. 192-193) gave them four Piagetian-type experiments and other tests including the Mill Hill Vocabulary scale and Ravens' Standard Progressive Matrices. With a warning that there are limitations in his study through the small number of subjects, through subjectivity in allocating responses to particular levels, and so on (op.cit. pp.66-67), Lodwick explains that factor analysis revealed that two factors of formal reasoning accounted for the communalities between the tests. One had a mainly scientific and mathematical flavour and the second was more verbal in nature. Few of the tests drew on one of these factors to the exclusion of the other (op.cit. p.3). Furthermore, examination of the results yielded by the Kendall coefficient of concordance W revealed the following (op.cit. p.214):

- a) Verbal comprehension questions (refined criteria) $W = .560$
 $P < .001$
- b) Piagetian tests $W = .642$ $P < .001$
- c) Verbal comprehension questions and Piagetian tests
 $W = .625$ $P < .001$

Thus, while the verbal comprehension questions belong to one group of tests, and the scientific and mathematical belong to another, there is a relationship between the two groups.

The one experiment which did not correlate significantly with any of the verbal comprehension questions was that testing the combinatorial system (bulbs and switches). Excluding the responses on that, Lodwick compared the results on the remaining Piagetian experiments with those

on the verbal passages. A higher proportion of formal answers was scored on the former : "this shows that the subjects in this study had greater difficulty reasoning with verbal material than they did with scientific - mathematical material" (op.cit. p.155).

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CHAPTER 6 : CONCLUSIONS

Are there any general conclusions which can be culled from this review of research work? There is certainly some agreement that thinking develops relatively late in a verbal subject like history. Concrete or descriptive thinking in verbal contexts seems to be stabilised somewhere around the age of twelve to thirteen years (Bell 1965, McNaughton 1966, McNally 1970) and to last for some time (Davies 1965, De Silva 1969, Cherrington 1971, Miles 1971). Formal thought begins to appear during early and mid-adolescence but Stokes (1970) and Miles (1971) think that stability at this level may not be attained until the age of 18 years. Peel (1971, p.26) comments that the studies he reviews seem to show that the "transition from content dominated to possibility-invoking answers seemed to be the predominant feature of early and mid-adolescent thinking. Logically restricted answers do also occur but they are associated with younger, less able and more unsophisticated subjects".

How far does the thinking stay consistent over different passages and across different content areas? Obviously, the type of passage used may affect the results. While accepting that there are differences Peel concludes tentatively (op.cit. p.40), "that if the passages do not differ greatly in difficulty, sophistication and area of coverage they will evoke answers from any one person at not too disparate levels". Using Kendall's coefficient of concordance W as an indication of the degree of association between a number of sets of rankings, Stokes (1970) found W for three stories equalled .873 and in Lodwick's study (1972) W for three stories was .560 (refined criteria). Comments and criticisms have been made during the previous survey on some of the answers graded at different levels of thought. This is one of the most sensitive aspects in assessing children's responses and Peel decides (1971, p.40) that "usually a reduction to three or four categories is necessary".

Does the level of thinking exhibited depend upon the amount of data in a passage? Conflicting answers to this question have resulted from Harvard's (1970) and Peel's (1971) studies. Harvard declares that increasing the amount of information led to improved answers, while Peel thinks (1971, pp.52-55) that if the mature mechanisms of thought are not sufficiently developed then the pupil does not gain a deeper insight into the problem.

When thinking on verbal passages is compared with thinking in other areas such as mathematics and physics, there is some similarity across the different contents but factor analysis tends to show a

bi-factor formulation (Davies 1965, Bart 1971, Lodwick 1972).

It is interesting to note that at times scores agreed less well among Piagetian tasks than they did between certain of those tasks and other tests (Hughes 1965).

The elusive influences of such factors as parental socio-economic status and language are always difficult to assess. McNally (1970) and Harvard (1970) think that such variables affect thinking skills; Cherrington (1971), on the other hand suggests that social background "is not directly influential in determining a child's level of thinking" (op.cit. p.71). The relationship of language and thought in general is a highly controversial area at the moment. The results cited in this section certainly do not give any conclusive answer to the influence of language on historical thinking. It seems very likely that language will affect thought in history, especially at the formal level, but for any firm conclusions we have to await further research.

Again, there is little conclusive evidence to report on the effects of different treatments on historical thinking. Stones (1967) affirms that the programme on concepts accelerated her subjects' thought processes but this was a short-term experiment. Miles (1971), studying the teaching of theology, confirms from his experimental data over a school year the less optimistic prognosis of Inhelder and Sinclair (1969, p.42) that, "the evolution of operativity is malleable only within certain limits imposed by the laws of development". The research programme in the present study also extended over most of a school year with the results that are shown in Part VI for the primary pupils and Part VII for the secondary pupils.

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PART VI
THE RESEARCH PROJECT WITH THE PUPILS IN THE PRIMARY SCHOOLS

CHAPTER I : THE RESEARCH PROGRAMME

(1) THE AIMS

The major aims of the research project were these:

- a) To assess the level of logical thinking in respect of passages concerned with history,
 - (i) at the beginning of the pupils' third year in primary education (9 - 10 years),
 - (ii) at the beginning of their fourth year (10 - 11 years).
- b) To attempt to accelerate the development of thinking skills through the teaching of history with one class of children (henceforth to be called IE - experimental) while adopting what will be called traditional methods with another class (IT henceforth). As these two classes were necessarily in different schools, in order to try to allow for the effect of school life in general and also to compare taught classes with a non-taught group, the class which succeeded IE in that school (IC from now on) was also tested on the same passages, but a year later than IE and IT.
- c) To compare the level of responses on the passages with those obtaining on two typical Piagetian experiments, namely equilibrium in the balance and the combination of colourless liquids.
- d) To investigate certain variables which might be associated with the levels of logical thinking such as scores on verbal reasoning tests; reading ability as measured by the N.F.E.R. Sentence Reading Test; socio-economic aspects of the pupils' lives; personality factors measured through Eysenck's inventory and certain items of the Terman-Merrill questionnaire (for all these measures see Appendix B); and the children's moral judgments on certain questions (Appendix P).

(2) THE SCHOOLS AND THE TEACHERS

As the research was carried out in a small town in the North of England with a population of 47,000 people, the choice of schools was limited. Two primary school headmasters whose one form entry schools were near to each other, kindly allowed the testing and teaching of their third year pupils. This age group was chosen since it was anticipated from previous research that the majority of children should be reasoning between the preoperational and concrete levels in respect of verbal passages on history. The aim was to try to accelerate the thinking skills of one of these classes. The two classes were taught on Tuesday and Thursday afternoons from October 3rd to June 25th (inclusive) at these times:

Tuesday	IE	1.25 to 2.25 p.m.
	IT	2.45 to 3.45 p.m.
Thursday	IT	1.30 to 2.30 p.m.
	IE	2.45 to 3.45 p.m.

Each class was taught in old buildings. Class IT was in a Church of England school, sharing a vastly vaulted room with the fourth year, divided only by a movable partition. There was no spare classroom space in the school at all, much of the testing being carried out in a corridor near the top of the stairs. Classes IE and IC were part of an L.E.A. maintained school entered through some dark cloakrooms. The classrooms debouched from a central hall where much of the testing was conducted. The hall had to be used for drama, P.E. and dining. In both schools, therefore, there was inevitably some disturbance during the testing sessions.

The traditional school was traditional in its classroom arrangements (rows of desks); competitive approach (at the end of their annual examinations, through their teacher's advice, the children laughingly made "a snake" to show me who was at the head and who the tail of the class); and emphasis upon coaching for the 11 plus examination.

The other school ostensibly might have appeared more concerned with co-operation (desks grouped together), tried to give the children an awareness of life outside the school, and laid little if any emphasis on preparation for the eleven plus examination. Places in the town's grammar schools were allocated on the result of verbal reasoning scores in conjunction with the headmasters' recommendations. Only three children from the experimental group were admitted while ten were successful in IT, eight of them girls.

It might be suspected that the T school would have had rigid, perhaps rather cold relationships with the children. This was not so; the headteacher knew the pupils and their families very well and developed a most happy, co-operative atmosphere in his school. He was always ready to stop and talk to the children as they passed him. The headteacher and staff at the other school showed a concern for the children's progress and welfare, seemed to talk more of educational aims and methods, were more involved in new approaches to primary work, but the headmaster did not have the same close contact with children and parents. He was a more formal type of man. This difference was shown when the headmasters completed a questionnaire on each child (see Appendix B). Whereas the head of IT generally knew not only the occupations of each child's parents but also their educational history, the headmaster of IE and IC was only rarely able to comment on these characteristics.

Class IE was taught by a young woman in her first post, lively and enthusiastic, but without the experience of the woman teaching IT. This teacher was married, in her fifties, highly competent, with a well-developed sense of humour. IC should have had the teacher of IE as their form-mistress for the teaching year: they would have thus acted as a control group on her methods as well as on the ethos of the school. Unfortunately, from the point of view of this research, she moved unexpectedly to another post late in May and the

control group was taught by a newcomer to the staff. This was a man in his late 30's or early 40's - a nervous, energetic person.

The teachers and the headmasters kindly completed a questionnaire on their attitudes towards various aspects of school life. In Appendix B are certain statements selected from the initial longer list. These possibly indicate attitudes which might have affected the children, namely, attitudes towards challenging the children, towards group work, and on streaming. In general, their scores usually fall on the same side of the continuum. The teacher of IT seems against activity methods and challenging the children, according to the raw scores, but she noted that her replies were affected by the very restricted conditions in which she worked. The general tenor of her replies and those of her headteacher seem to be opposed to the other school's on the question of streaming and selection but again she made a note of reservation about streaming.

None of these teachers was a history specialist. The headmaster of IT would have taught history to the children of IT had he not agreed to this research project. From the evidence of one observed lesson his approach seemed to be to talk for over half an hour, put a few notes on the board in no particular order, and have the children copy them. The form teacher of IE would have taught history through a mixture of exposition and activity methods. In IC the history lessons were called "social studies". The children's work consisted quite often of making notes. For example, they had to write about Mary and Elizabeth in their own words. Generally, this resulted in their copying from Unstead (1961, p.8). Hence, most books contained such phrases as: "Mary, Queen of Scots, Elizabeth's cousin, was a clever but foolish woman (Elizabeth) was a great queen because she understood her people both rich and poor. Sir Walter Raleigh brought potatoes from America" The written work in another lesson consisted of copying from the blackboard the family tree of the Tudors.

(3) THE CHILDREN

Both the taught classes, IE and IT, numbered over 36 during the year, IE at one point reaching a maximum of 43 children. The movement of children during the year, especially noticeable in IE, and the attempt to equate the numbers of boys and girls, restricted the final sample to 14 boys and 14 girls in each of the three groups. This meant that while every pupil in each class was tested individually on the historical passages and the Piagetian experiments, a number had to be eliminated from the final analysis by the use of random sampling numbers (Lindley and Miller 1968, pp. 12-13).

After having worked with the children for over a year, and from their and the teachers' replies on a number of measures (Appendix B), the general impression was that they were of average intellectual ability. Their mean I.Q.s based on verbal reasoning tests are shown in Table XIV.

Table XIV Mean I.Q. scores for the Primary Groups^x

	IE		IT		IC	
	I.Q.	S.D.	I.Q.	S.D.	I.Q.	S.D.
Boys	103.07	9.95	102.79	10.36	99.86	9.30
Girls	102.40	7.46	112.04	12.90	103.14	12.90

As far as this measure is concerned, the girls in IT were generally a more able group. With IT and IC girls there was a wider dispersion of scores than occurred in any other of the sub-groups. The girls of IT gained the highest mean score on the N.F.E.R. Sentence Reading Test (Appendix B), and the boys of IT the lowest. There was, however, a wider dispersal of scores in IE for both the boys and the girls.

Footnote: Measured by N.F.E.R. Primary Verbal Test I (IE and IT) and Moray House V.R.86 (IC).

Table XV Mean Scores on the N.F.T.R. Sentence Reading Test

	IE		IT		IC	
	Mean Score	S.D.	Mean Score	S.D.	Mean Score	S.D.
Boys	102.7	11.02	96.4	9.70	101	7.35
Girls	100.4	12.87	109.5	7.96	105.5 ⁽¹⁾	9.51

Most of the children at the two schools lived in small terraced houses or council houses with just a few living in semi-detached homes. There can obviously, though, be considerable differences among families whose houses have a similar external appearance. The headmasters' scores for housing standard, children's appearance and cleanliness, and the child's speech (suggesting good language models at home), show that the children of IE tended to be rated at a lower level than the other two groups.

Table XVI The Mean Scores for the Headmasters' Assessments (2)

		Housing standard of neighbourhood	Appearance and cleanliness of child	Child's speech (suggesting good language models at home)
IE	Boys	2.9	3.3	2.9
	Girls	3.2	3.8	2.9
IT	Boys	3.2	4.6	3.1
	Girls	3.1	4.4	3.7
IC	Boys	4.0	4.6	3.1
	Girls	4.1	4.9	3.1

Footnotes: (1) This result was obtained from only 13 girls; when the tests were marked it was discovered that one girl in IC had not completed a single item.

(2) IE and IC were rated by the headmaster of one school; IT by the headmaster of the other school.

No child in IT received a grade less than 3 for any of the variables in Table XVI. This might have been a result of that headmaster's uncritical appraisal, but these children did give an impression of being in general cleaner, more alert, more spontaneous, and more outgoing than did the children of IE. Some of the pupils in IE were inclined to be rather withdrawn and even, on occasions, a little morose; at times, some gave the appearance of disinterest in the lessons. The headmaster rated a number of the pupils in IE low on all three variables (for example, CLE 1 : 1 : 1 and HOTH 1 : 2 : 1). I certainly noticed at the beginning of the year's teaching programme a friendly competitiveness and eagerness in IT which was lacking initially in IE. It was encouraging, however, to note a warmer response from IE as the academic year progressed.

Parental occupations, as classified by the Registrar-General (1961) were predominantly in Class III and below, many being in Class V (unskilled). Only nine from the total of 84 children in the two schools had parents in Class II (for example, a schoolteacher, a nurse, an engineer in charge of laying cables). I asked the headteachers if they would state whether the children's home lives were disrupted in any sense, for example, through parents being divorced, the child adopted or illegitimate, since both Plowden (1967, Vol. II p.356) and Fraser (1959, p.62) had found that children's performance in schools were adversely affected by such factors. One headmaster decided that he could answer only under the global heading, "Emotional tension of a domestic origin". Accordingly, this was the final description on the relevant form (Appendix B). Nine children in each of IE and IC, and eight in IT, were described as suffering in some degree from such tensions.

The headmasters also commented, over a five point scale, on three aspects of the children in school: behaviour, attainment, and attitude to school and learning.

Table XVII The Mean Scores of the Headmasters' gradings on
behaviour, attainment and attitude

		Behaviour in School	Attainment in School	Attitude to school and learning
IE	Boys	4.4	3.5	4.1
	Girls	3.8	3.5	3.6
IT	Boys	4.3	3.3	3.3
	Girls	4.5	4.1	3.9
IC	Boys	3.8	3.3	3.1
	Girls	4.3	3.1	3.4

The headmasters were asked to rate parents' attitudes towards education under the four headings shown in Table XVIII. On a merely quantitative count of ticks in each column, IE girls received fewer ticks than any other group, IT girls and IC girls the most.

Table XVIII The Headmasters' gradings on parents' attitudes
towards education

		Shows concern	Shows knowledge	Mother visits School	Father visits School	Total
IE	Boys	11	7	11	5	34
	Girls	9	2	11	2	24
IT	Boys	13	4	12	5	34
	Girls	14	10	13	8	45
IC	Boys	12	10	12	9	43
	Girls	13	11	14	7	45

The children also completed a questionnaire concerned with literary and historic interests (Appendix B) based on the type of items used by Stones (1967) and found significant in the Plowden Report (1967, Vol. II). While

some of the answers were used as part of the assessment of social factors in factor analysis (see Part VI, Chapter III), not too much emphasis was laid on the children's replies in view of the notorious difficulties of gaining valid answers in this way (Cherrington 1971).

In any attempt to sum up the impressions from these various measures the only really telling distinction appears to concern IT girls. They seemed superior on I.Q. scores, verbally, and in their attainment at school. They were also rated quite highly on their attitude to school and on their parents' involvement in education. Class IE's scores were a little depressed in relation to the other groups seen, for example, in appearance and cleanliness. As far as this research is concerned, it seems reasonable to state that Class IE were certainly not favoured on intellectual or social grounds when compared with the children of the two control groups, IT and IC.

Piaget has been criticised for concentrating unduly on the cognitive aspects of learning; it is obvious that the emotional or conative side of human nature also exerts a "tremendously important effect on our behaviour" (Eysenck 1973, p.164). While it is impossible to take into account all the emotional variables which might affect the children's thinking, an attempt was made to consider the possible influence of personality factors. While "personality" is rather a nebulous concept, all of us tend to assess people on commonly-accepted traits such as foresight, determination and so on. Shields (1968, p.26) refers to a number of studies which have shown that ratings made by primary school teachers of the personality characteristics of their pupils have predicted success in grammar school work. In the present research, therefore, an attempt was made to assess some aspects of the children's personalities through using two types of ratings: the Terman-Merrill Inventory and Eysenck's (1965) questionnaire.

The instructions on the Terman-Merrill form (Appendix B) request the rater to compare each named child with the average child of the same age. The rater is also warned in so many words of the danger of the so-called "halo" effect through the second instruction: "Try to make real distinctions.

Do not rate a child high on all traits simply because he is exceptional in some". The form teachers of IE and IT completed the forms for their own groups but the pupils in IC were rated by the mistress who taught them in their second year since they were to have a teacher new to the school in their third year. It was explained that the traits would be graded on a seven point scale (high = 7; average = 4; low = 1; see Appendix B). Despite the warnings, it might be considered that the ratings for some children were influenced by the "halo" effect. Comparing the teachers' opinions with scores on standardised tests shows that the intelligence of certain children was under- or over-rated. HO (IE), for example, was graded as below average (3) but his I.Q. was 106; on the other hand, his below average rating (3) for 'Permanency of Moods' compares well with the rather high score of 20 for Neuroticism on Eysenck's test. Indeed, factor analysis (Table XXXV) gives a loading on neuroticism as contrasted with the teachers' opinions of the children's permanency of moods (Factor II, see p.269).

The teachers were not asked to rate every one of the 25 traits listed by Terman-Merrill but only those which might have influenced the children's performance on the criterion tests and the learning situation during the year. Qualities of prudence and foresight, for example, might have affected their responses on the history questions, on the Piagetian experiments and their readiness to consider alternative arguments during the history lessons. Self confidence, to take another trait, meant that they might not have been affected adversely by having to face a strange person at the beginning of the session (see Factor V of Table XXXV). In all, the teachers were asked to rate the children on the ten traits shown in Table XIX.

Table XIX Mean ratings on the Terman-Merrill Inventory
(primary pupils)

	IE		II		IC	
	Boys	Girls	Boys	Girls	Boys	Girls
Prudence and forethought	3.7	3.9	3.9	4.5	3.9	4.1
Self-confidence	4.0	3.9	3.9	4.2	4.1	4.3
Will-power and perseverance	4.2	3.8	3.3	4.6	3.5	3.8
Permanency of Moods	3.9	3.8	4.4	4.7	4.6	4.1
Desire to excel	4.2	3.9	3.9	4.5	3.9	4.4
Conscientiousness	4.1	3.8	3.8	4.5	3.8	4.3
Desire to know	4.1	3.9	4.3	4.2	3.9	3.9
Originality	3.5	3.7	3.8	4.1	3.9	3.9
Common-sense	4.1	4.1	4.4	4.5	4.2	4.5
Intelligence	3.9	3.8	4.2	4.5	4.1	4.3
Compare the mean I.Q. scores for each group (see page 220).						
I.Q. Scores	103.1	102.4	102.8	112.0	99.9	103.1

It is appreciated that teachers tend to give "average" scores to children on a questionnaire such as the Terman-Merrill Inventory. With these particular children the general trend of each group's mean rating on most of the traits was towards or slightly below the average (average score = 4). The girls of II, however, do seem a somewhat superior group on the class teacher's reckoning, especially when it is appreciated that she graded two of the subjects at well below average for most of the traits. In light of the results of statistical analysis (see Part VI, Chapter III), it seems of

interest here to note that IE boys, II girls and IO girls, when compared with the other groups, were generally rated as above average on these characteristics: will-power and perseverance (not IC girls); desire to excel; conscientiousness.

The Junior Eysenck Personality Inventory was also used in the present research. Of this Sybil Eysenck writes (1971, p.13) that too little is known about its validity to make any claims for its use, "other than as an instrument for experimentation". Entwistle and Cunningham (1968) also declare that, "The validity of this instrument has not been clearly demonstrated except on clinical subjects with extreme symptoms of neuroticism and extroversion" (ibid. p.37). Eysenck has argued elsewhere (1972, p.96) that the two major dimensions affect children's performance in school at different ages. "Neuroticism" has a negative effect on performance at both primary and secondary school, with more emotional or anxious children doing rather worse than stable ones. Bynner (1972), however, suggests that there is likely to be a U-shaped relationship between achievement and neuroticism, in that the pupils in the middle range of neuroticism scores should do better at an educational task of moderate difficulty than either those with high scores or those with low scores (ibid. p.26). The other dimension, introversion, has a differential effect, seeming to favour good performance at secondary school but not being advantageous at the primary level. (Eysenck 1972, p.96). Eysenck gives two alternative explanations for the result at the primary level. Possibly the "free and easy" style of the primary school is better suited to the extrovert child, or, the introvert corresponds to the "late developer" who might rather be an "early developer", disadvantaged at the primary level because of the inappropriately immature level of thinking expected there. Possibly another explanation is that an extrovert child does not maintain his position in relation to other children at the secondary level because he tends to give up more quickly in face of tasks demanding sustained concentration. After having analysed the results of some 4,000 eleven year old children using criterion tests such as two

Moray House verbal reasoning tests and examinations in English and Mathematics, Eysenck and Cookson (1969) lay greater emphasis on the extroversion - introversion variable for success at the primary level, stable boys and girls doing "only marginally better than unstable ones" (ibid. p.109). A sex difference was evident, however, in that unstable, extrovert girls did unexpectedly well, unstable extrovert boys unexpectedly poorly (ibid. p.109). Both Savage (1966) and Rushton (1966), however, found that the most successful primary children were the stable extroverts (quoted Bynner 1972, p.30).

It was thus interesting in the present research that the girls of IT had the highest mean score on the extroversion variable, being significantly different from the mean scores of IE girls and IC girls ($P < .001$ in both instances). The mean score of IT girls on the neuroticism variable, while the lowest of the six sub-groups, did not reach significance against the mean scores of either IE girls or IC girls.

Table XX The mean scores for extroversion and neuroticism.
(primary pupils)

Boys (10 years of age)	Extroversion	S.D.	Neuroticism	S.D.
Eysenck's norms (1973)	17.791	3.334	11.222	4.997
IE	17.714	2.839	15.929	2.952
IT	16.714	3.509	14.357	3.221
IC	17.714	2.943	14.357	4.529
Girls (10 years of age)	Extroversion	S.D.	Neuroticism	S.D.
Eysenck's norms (1973)	16.808	3.175	12.190	5.032

Table XX The mean scores for extroversion and neuroticism
(primary pupils)

IE	15.429	4.221	16.214	4.206
IT	20.643	1.145	13.296	3.554
IC	15.786	3.648	14.357	3.715

(4) THE ASSESSMENT PROCEDURE

The historical passages to be used with these children had to contain accurate data and allow for a series of answers from which a global grade could be derived. Moreover, they had to be succinct enough not to weary the children. Seven passages were used in a small pilot scheme with ten primary children aged 9 - 10 years (individual testing) and the younger (11 - 12 years), rather below average ability, forms of a large comprehensive school (group testing). As difficulties in the content and vocabulary became evident, and after taking into account the children's expressed interest in the stories, three from the seven were selected for the research project: "Ancient Sparta and Athens", "Mary, Queen of Scots" and "Moving Westward" (Appendix A). These appeared to present historical data in relatively simple terms, with the questions allowing for a variety of responses. The first of the three was also used with the older pupils in this research (Part VII) as one on which the answers from two different age groups, could be compared.

A number of the questions seemed to be particularly revealing of the groupings postulated by Piaget as underlying the concrete operational period of development, for example, Question (1) on "Ancient Sparta and Athens", Question (2) on "Mary" and Question (2) on "Moving Westward". It must be stressed, though, that the crucial assessment used in statistical analysis (Part VI, Chapter III) was the global grade on each story, that is,

where all the child's answers to that story were considered. Certain questions were set in an attempt to elicit some form of moral judgment from the pupils: one of these was also used to assess logical thinking ("Ancient Greece", Q.4(a)).

The three passages were used before and after the completion of the teaching programme. The topic of Mary, Queen of Scots, formed part of the history syllabus for all three classes (IE, IT and IC) while the other topics were not taught during the history lessons. The question was whether the children would show evidence of any transfer from having been taught in a particular way, (a) to the passage connected with the year's syllabus and, (b) to other passages concerned with historical topics. On the second occasion of testing a fourth passage which was related to the course was introduced ("Henry 8th and Sir Thomas More", Appendix A). This gave another measure by which to assess the effects of the teaching programme.

The children of IT were the first to be tested. The headmaster introduced me to them and explained that I was going to talk to them individually about three stories in history, ask them some questions, and also have them do two experiments. He emphasised that these did not form part of any school work. Over the next ten school days the children were tested individually on the three passages and the two Piagetian experiments (see p.231-7). A similar procedure then ensued in Class IE during the latter part of September. The children of IC were tested initially in June/July of the following year, and then one year later.

The interview with each child normally took this form. A passage was read by or to the child. After this reading the child was asked if he had any problems or questions about the story. These were discussed, then I read the passage while the child followed the words on his/her copy of the story. Explaining that it was not a test or an examination, that they could reply "Don't know" if they wanted, and that no one in the

school would know of their replies, I asked them the questions, writing down their answers verbatim. During the questioning I reminded them to look at the passage if this seemed necessary. The same method of reading, discussion, and so on, followed with the next two stories. The stories were always given in this order: "Greece", "Mary", "Westward". On the second occasion "More" came last. The Piagetian experiments might follow after the session dealing with the historical stories, or the child might volunteer to do them during the lunch hour or immediately after school had finished. The clinical interview technique was necessary because supplementary questions often had to be asked in order to try to discover some of the reasons for the replies. Furthermore, with such young children, there was always the problem that a pupil might have difficulty in reading the texts. In the event, it seemed that only one boy experienced real difficulty with reading. Although his replies were not lower than those of most of his peers, his answers were not included in the final sample.

After the scripts had been transcribed the answers were graded separately by a person experienced in this field and myself, using the nine point scale for logical thinking which had been used previously (Hallam 1966 and see Chapter III). Any discrepancies or doubts concerning the grades were resolved by my supervisor. A nine point scale was used to try to ensure that there was as much precision as possible in the grading: it also increased the possibility of measuring any movement in the levels of responses over a year. The answers on the Piagetian experiments were assessed by two experienced experimenters and myself; again, any discrepancies were resolved by my supervisor. In order to try to avoid any over-lap between the two scales, one year after the scripts had been analysed for logical thinking, the three questions set on moral judgments were graded by the same people and in the same manner (Appendix P).

One year after the initial testing, the children were assessed again on four historical passages and the two Piagetian experiments. For IE and

IT, therefore, there was an interval of at least two months (July and August) between the final lessons of the course and the second session of testing, IT preceding IE in the interview situation. There was an even longer gap between the teaching of the particular topics, Mary and More, on which the children were answering questions (see Appendix E). After the second batch of scripts had been transcribed, the historical answers and moral judgments were again graded by the same person and myself, my supervisor acting as adjudicator. The replies on the Piagetian experiments were also marked by the external assessor and myself, any doubts being resolved by my supervisor. Perhaps the following figure will help to illustrate the pattern of the research and teaching programme:

Figure II The pattern of the testing and teaching programme
in the primary schools

Testing of IE and IT on 3 passages and 2 Piagetian experiments	September
Teaching history to IE and IT from October 3rd to June 25th (inclusive) on Tuesday and Thursday afternoons	October to June
Testing of IC on 3 passages and 2 Piagetian experiments	June/July
Testing of IE and IT on 4 passages and 2 Piagetian experiments	September
Testing of IC on 4 passages and 2 Piagetian experiments	June/July

(5) AN ANALYSIS OF THE QUESTIONS ON THE FOUR HISTORICAL PASSAGES

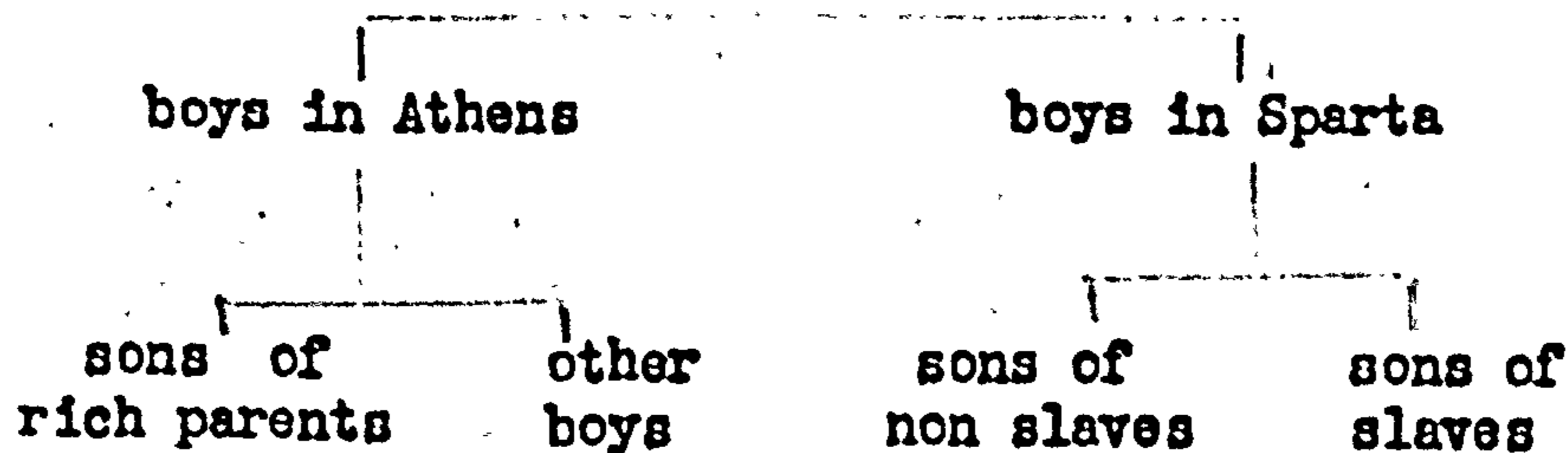
As was discussed in Part IV, it is necessary that the passages and questions satisfy both historical and psychological criteria. All the passages were checked for accuracy by historians of the Institute of Education, Leeds University. The questions were devised primarily to

assess whether children's answers fell at the preoperational or concrete operational levels (see Table I, pp.13-17; Table IX, pp.189-191; Table XXIV, pp.257-258). While the individual questions are being examined in this section, it is probably as well to emphasise again that the global grade on each passage was the crucial measure by which a child's stage of thought was determined. This is in line with other research (cf. Hallam 1966 and Miles 1971) and with the contention of Inhelder and Piaget (1958, p.278) that any assessment must rest upon, "a subject's entire reasoning or a sufficiently systematic series of inferences". Examples of subjects' individual answers, chiefly at the two major levels of preoperational and concrete operational thought, are given in Appendix C. It is proposed here to examine some of the reasons for posing the particular questions on each passage, together with a few examples of the replies received.

Ancient Sparta and Athens

Question (1) a.b.c. requires the ability to handle classes and sub classes (Table I, p.13). Peel comments that "the logic of classes and relations seems to account for much of descriptive writing" (1971, p.23). Two other quotations also seem apposite for this question: "simple details of accurate historical geography (Elton 1967, pp.59-60), and "produces with accuracy names and terminology specific to topic being studied" (Coltham and Fines 1971, p.18). Question (6) b. also required the ability of classification, namely:

boys in Greece



Question (7) was an attempt to discover if the children could compare the various factors about life in the two cities and come to some simple conclusion.

A number of questions on this passage needed reversibility of thought so that events were regarded from a contemporary viewpoint. Question (2) could be answered neatly with, "We do not have slaves," or the child could argue strictly from the mores of the present-day. Questions (3)b and (4)a also demanded the use of reversibility of thought.

Question (3)a required pupils to distinguish between the two types of beating mentioned in the passage and to realize that one was for "doing nothing wrong". The great majority at both testings concentrated on an explanation such as, "They failed to find food". It was an exceptional child who could assess the implications of the first type of beating. Question (3)c was set initially to ascertain the children's moral judgment. Since the great majority simply disagreed with hitting boys since, "It is wrong", this question was disregarded in the final analysis.

Question (4)b demanded that the children should try to analyse variables and put forward theories: this question gave them a chance to reason at the formal level. One idea, however, was not enough: they had to put forward a combination of theories and pose and counter-pose arguments. Most of the primary children concentrated on one characteristic of the situation, seen in such a remark as this: "He (the master) might have known that he had the fox because it would have made his stomach fatter" (ERI, IT¹)*

The pupils were asked why Spartan parents told their children the story of the boy stealing the fox (Question (4)c) to see if they could comprehend the underlying inference. This was a difficult question for them, as was the interpretation of the inscription after the battle of Thermopylae (Question (5)b). Most children here either could not answer

Footnote: * ¹ refers to the first occasion of testing; ² to the second.

or centred on the most compelling information in the passage and decided that the "laws" meant that the boys had to steal food. An occasional pupil, however, could interpret the inscription, for example, CRI (IT¹):

"It meant they did what they were told."

"What were the 'laws'?"

"To fight until they died."

Question (5)a was used for moral judgments and will be considered later in this chapter.

Question (6)a was an attempt to discover if the pupils could relate this progression:

music in Athens equalled saying poetry, which was said to a guitar.

Mary, Queen of Scots

Questions (1)a and b, (2) and (5) are based on Piaget's groupings at the concrete level (see Table I, pp.13-17). The answers can also be analysed under Peel's "describer thinking" or Elton's "simple details of accurate chronology, genealogy and historical geography" (see Table IX, pp.189-191).

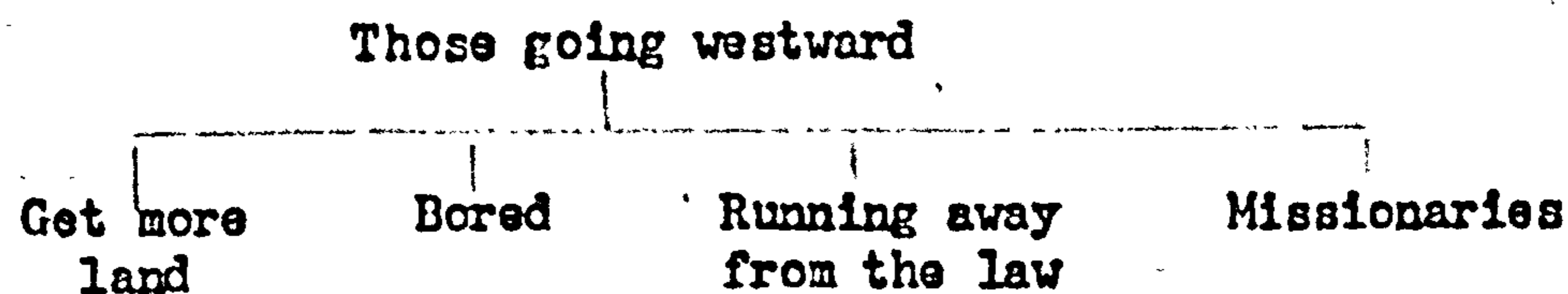
Questions (3) and (4)a were set to discover if the pupils would reason on a superficially acceptable level, or whether they would be able to appreciate some of the inferences suggested by the information. Piaget has remarked that children at the preoperational level will consider any deed affecting royalty more important or dreadful than if the same event were to happen to any person of lower rank. This was the rationale for the not over-subtle Question (4)b. Only one pupil, however, gave such a response on one occasion (Appendix C). It was expected in their replies that the children would concentrate on such physical things as number of knives, size of explosion, and so on. This, indeed, did happen, but they also reasoned that Rizzio's was the worse death because the Queen loved him, or that Darnley's was the worse since he was married to Mary. Some replied that they did not know, but none pointed out that it is difficult

to distinguish between different types of violent death. Probably the phrasing of the question deterred that type of answer. Question (6) also allowed for a reply based on the bare facts of the passage: circumstantial answers for Peel (1971, p.34) and comprehension for Fines and Coltham (1971, p.18) - "the result of examination at the surface or literal level". It was not expected that these young children would be able to decide that there was not enough apparent evidence on which to judge Mary.

Moving Westward

This passage was included in order to try to discover if the children's putative watching of "Cowboys and Indians" films would affect their thinking skills compared with their responses to events less well publicised by the media. The mean scores (see Table XVI, p.260) do not seem to indicate great differences between the average global grades on each story. It is interesting that on the first occasion of testing, IE girls received the highest mean grade. Possibly a visual stimulus such as a film was needed on this topic, although a number of questions on the passage seemed to relate to what has been called "intuitable data", that is, perceived or imaged data.

For successful answers, Questions (2)a, (3)a and (3)b required the ability to handle classes and sub-classes. (2)a called for Grouping I, an operation to be performed on this simple hierarchy:



Correct replies to Questions (3)a and (3)b seemed to demand the type of thought seen in Grouping II. The sentence, "The Sioux were the strongest and the most intelligent" was included deliberately in order to see if the children equated "more Indians" with "strongest" and "most".

Questions (2)b and (2)c were asked in order to assess if the pupils possessed Grouping V, "the qualitative setting up of a series without equality of 'steps' being implied" (see Table I, pp.13-17). Question (3)c merely required the correct reading of the passage but it was set to check if the children confused television-presented events with the data of this text. Of course, they could have given sound reasons for choosing a tribe other than the Crow, but they should have mentioned those reasons and possibly also referred to the fact that the Crow were friendly to white men. Questions (3)d and (5)b aimed at probing children's comprehension of two commonly used terms in the story of the West. In general, they found "frontiersman" very difficult to explain but many gave a credible interpretation of "crooked tongues".

The three sections of Question (4) needed simple inferences from what should have been visual images. Hardly anyone gave, "There would be dust in the faces of the people driving the rear waggons" as an explanation for Question (4)b, although there were some creditable attempts at answering. Here is where actually seeing the convoy of waggons might have provided the concrete clue. From the evidence of the replies to Question (4)c many must have seen and assimilated the reasons for the settlers placing the waggons in a circle. Question (5)a was posed to test the children's moral judgment on the issue and will be considered later.

Henry 8th and Sir Thomas More

On the second testing an extra text was added which was related to the history syllabus of the third year in the two primary schools. The composition of this text presented problems since the children's energies and interest were likely to be lagging towards the end of the interview situation. The data, therefore, was made extremely sparse. The control group, in particular, might have suffered from the lack of descriptive detail in the text. In general, however, the global scores did not seem lower on this passage compared with the scores on the other passages. (Table XXVI p. 260).

Question (1) gave the opportunity for children to show that they could recall and use coherently information learnt during the preceding year. Possibly they might use that information in an inferential manner (see ALE's reply, Appendix C). Question (2)a and b could be answered merely with a type of "symptom response" but for accurate comprehension the child has to understand the class of "Christian Church" and appropriate sub-classes. "Rome", also, has to be seen as a particular type of city within a particular country.

Questions (3)a and b required the ability to handle concepts often used in history. These can be held at different levels of complexity. The meaning of "oath" can range from something like "a promise" to "complete allegiance" while "traitor" can evoke a host of interpretations. These may include a simple response like "a spy" or lead to an examination of the problems which may arise when a man is faced with conflicting loyalties to king or to country or to church. At the most abstract level a bright adolescent might contemplate the question of the nature of loyalty and the ideas which exert the greatest influence on people. Questions (3)b and (4)b gave the children the chance to discuss the implications within an historical context of their definitions of these two words.

Question (5) was set to see if the children could interpret this famous sentence. A successful reply seemed to require an analysis of "good" and "servant" and a type of variation, that loyalty to God preceded loyalty to the king. On Question (6) a pupil could forecast a result from the evidence available and/or put forward reasoned possibilities. Question (7) allowed the children to give answers based on the content of the passage or to bring in external evidence to support their judgments.

(6) THE PIAGETIAN EXPERIMENTS

Since Inhelder and Piaget emphasise the importance of the combinatorial system and the combination of inversions and reciprocities

(the I.N.R.C. group) in the analysis of thinking skills (see pp.23-31), both the primary and secondary pupils were tested on the experiments concerned with the combinations of colourless liquids and equilibrium in the balance (Appendix D). These two experiments were described originally in "The Growth of Logical Thinking" (1958) where the children were allowed rather free experimentation. Lovell (1961) combined this fairly open clinical approach with one whereby a number of common questions were put to each child: this was the procedure in the present research.

The protocols resulting from the combinatorial experiment were analysed on a nine point scale which ranges from a completely unsystematic approach to one where the subject envisages all possibilities and systematically tests his hypotheses (Appendix D). As can be seen from Table XXI (a) and (b) the majority of the children's replies on the first testing (9-10 years) were classified at the preoperational level and at the second testing (10-11 years) most were graded at the concrete level.

Table XXI The Combinations of Colourless Liquids

(a) Results on the first testing

Substage	1A	1AB	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	9	
IE	Boys		10	2	2					14
	Girls	3	9		1	1				14
II	Boys		13	1						14
	Girls	3	7	4						14
IC	Boys	1	3	1	4	4	1			14
	Girls	2	3	5	1	3				14
Totals	9	45	13	8	8	1				84
Percentages	10.71	53.57	15.47	9.52	9.52	1.19				99.98%

Table XXI The Combinations of Colourless Liquids

(b) Results on the second testing

Substage	1A	1AB	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	9	
IE	Boys	3	5	4	2					14
	Girls			4	9	1				14
IT	Boys		1	2	8	3				14
	Girls		1	6	6	1				14
IC	Boys	1		2	8	3				14
	Girls			6	4	4				14
Totals	1	5	25	39	14					84
Percentages	1.19	5.95	29.76	46.42	16.66					99.98%

Six major sets of criteria were used to analyse the protocols resulting from the balance experiment, but, as so often with Piagetian experiments, substages were detected. Hence, the final analysis contained eight substages as in Table XXII.

Table XXII Equilibrium in the Balance

(a) Results on the first testing

Substage	1	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	
IE	Boys		11	1	2				14
	Girls		11	3					14
IT	Boys		8	4	2				14
	Girls		11	2		1			14
IC	Boys		2	4	2	6			14
	Girls	1	10	3					14

(a) Results on the first testing (continued)

Totals	1	53	17	6	7				84
Percentages	1.19	63.09	20.23	7.14	8.33				99.98%

(b) Results on the second testing

Substage	1	1B/3A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	
IE	Boys		2	1	11				14
	Girls	1		4	3	6			14
IT	Boys		7	2	3	2			14
	Girls		3	4	4	3			14
IC	Boys	2		2	6	2	2		14
	Girls	4	2	5	2	1			14
Totals	7	5	24	18	26	4			84
Percentages	8.33	5.95	28.57	21.42	30.95	4.76			99.98%

Once again, there was a notable shift in the level of responses over the year from 63.09% at 1B/2A on the first testing to 80.9% being graded at some point in the concrete period (2A, 2AB, 2B) on the second testing. Four boys were graded at 2B/3A (intermediate concrete and formal) on the second occasion of testing. One of these was HAM (Appendix D) and it could be argued that his protocol should have been graded as 3A when it is compared with ROG's protocol in "The Growth of Logical Thinking" (1958, p.173). But HAM does use a 'trial and error' method at times and fails to reach equilibrium in the fifth problem. Therefore, his answers were considered to lie between the concrete and formal levels.

The pupils also tackled 16 problems involving series and numerical

analogies in an attempt to discover what type of relationship existed between the ability to cope with proportion in numerical form and performance in the balance experiment (cf. Hughes 1965, pp.94-95). The results were used in factor analysis (Chapter III); it is sufficient to note here that the total correct scores ranged from BRI's thirteen (IT) to BU's one (IE), and that despite his developed reasoning on the balance experiment HAM (IT) managed to answer exactly two correctly.

(7) MORAL JUDGMENTS IN HISTORY

As an extension of part of the previous research (Hallam 1966) three questions were assessed for moral judgments, namely:

Ancient Greece

Question (4)a: "Was it wrong of the Spartan boys to steal food?"

This was set to discover if the children would obey moral codes without discussion or whether they would view the question in a more dispassionate manner, taking into account, perhaps, the social pressures on the boys and also the harm done to others.

Question (5)a: "Do you think it would have been all right for some Spartans to refuse to fight in the battle?"

Would the children respond with a "morality of authority and duty" or would they allow for particular circumstances which might affect individuals?

Moving Westward

Question (5)a: "Do you think the Indians were wrong to attack the white men?"

This question was aimed at seeing whether the children would express sympathy with only one aspect of the situation or one group in a conflict situation, or whether they would realise that different types of "white men" might have merited different types of treatment.

The answers to these questions were assessed on criteria derived from Piaget (1932) - (see Appendix P). From the 1932 research Piaget suggests that there are three main stages in the development of moral judgments, or rather, "the capacity for problem solving in the moral sphere" (Williams 1967, p.256). At the earliest or heteronomous stage children will not consider the motives behind an action but will judge it in accordance with inflexible sets of rules accepted from others. An autonomous stage then develops where situations are considered according to the principle of equality. Finally, the level of equity is reached where allowances are made for individual motives, needs and deserts. The findings of the 1966 research (Hallam 1966 and 1969) led to an extension of this three level model backwards towards essentially illogical answers and forwards to advanced responses which were characterised as theonomous. As can be seen from the following table the majority of the pupils on both occasions, as might be expected, were at either Stage 1 or 2, exhibiting an essentially heteronomous approach to moral judgments in history, (see Appendix P for examples of answers).

Table XXIII Mean scores on moral judgments in history (primary pupils)

		"Greece" 4(a)		"Greece" 5(a)		"Westward" 5(a)	
Occasion of Testing		First	Second	First	Second	First	Second
IE	Boys	1.93	1.86	1.96	1.86	1.75	1.86
	Girls	1.79	2.00	1.79	1.86	1.61	1.79
IT	Boys	2.18	1.86	2.04	1.75	1.96	1.93
	Girls	1.93	2.03	1.86	1.79	1.86	1.68
IC	Boys	2.18	2.21	1.89	2.07	2.00	2.36
	Girls	1.86	1.96	1.75	1.61	1.71	2.03

These raw scores indicate that IC boys on average gave rather more advanced answers than the other sub-groups. There was little change over the year for any sub-group. No attempt was made in the teaching programme towards accelerating moral judgments in history since it was thought that the children would be too young to appreciate the subtleties of many of the moral issues involved in the history studied during the year.

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CHAPTER 2 : THE TEACHING PROGRAMME(1) PREAMBLE

Although Piaget has disclaimed the role of an educational practitioner, his contentions on the development of knowledge have obvious significance for the school curriculum (see, for example, Schwebel and Raph 1974). Piaget's fundamental tenet as far as the teaching of children is concerned lies in the distinction between knowledge and information, knowledge being "general objective knowing" (Lovell 1971, p.242) or that "solid cognitive bedrock, something flexible and plastic and yet consistent and enduring, with which (the child) can structure the present in terms of the past without undue strain and dislocation" (Flavell 1963, p.165). Knowledge and information are related but only in so far as there is this underlying knowledge through which the information becomes meaningful and usable by the child. For Piaget fundamental knowledge is acquired through action upon and interaction with the environment. "Action" is not inevitably an action upon physical objects. Piaget has said, for example, that Socrates used an active method with language and that "the characteristic of the Socratic method was to engage the learner in actively constructing his own knowledge" (Kamii in Schwebel and Raph 1974, p.203). Hence, the teacher's task for the Piagetians is to avoid handing out pre-digested information. He should, rather, present situations which result in the active recombination of schemes by the children themselves (op.cit., p.72).

The primary aim in the present research was to discover whether "active" learning experiences would accelerate children's responses on passages concerned with historical events. It was hoped that there might be a movement from the pre-operational to the concrete levels of thinking for many of these younger pupils: that is, after the teaching programme more children would be able to show that they comprehended the import of the passages and could even discern simple implications suggested by the texts.

The approaches adopted with the two taught classes have been labelled "traditional" and "experimental". "Traditional" was chosen since the methods used were traditional to the teaching of history in that school and, from reports (Junior History Review 1972) still traditional to a great many other primary schools, at least in that region. "Experimental" seemed a better description for the other group than, say, "heuristic" because, while active, collaborative methods were organised, the children were not allowed to plan completely their historical experiences for themselves. There was teacher directed structure and guidance behind the lessons and it would seem that Piaget himself would not oppose such an approach (Kamifin Schwebel and Raph 1974, op.cit., p.292).

A number of research workers have characterised teaching styles under dichotomies such as "unilateral" and "interdependent" or "expository" and "open-ended". The two approaches adopted with these children would appear to have resemblances to such dichotomies but neither class was taught in such an extreme manner as might seem at first indicated by these terms. Wallace (1972, pp.121-122) refers to a distinction made by Schroder et al (1967) between unilateral and interdependent training environments. In the former the learner "learns to adopt by looking for externally provided schemata", while the interdependent method provides the learner with an environment "which affords information as feed back or as a consequence of his own questions or exploratory behaviour". The other pair of epithets which could have been used are described in a recent paper on physics teaching: "expository" and "open-ended" (Houston and Pilliner 1974), although the following quotations refer to methods at the extremities of a continuum. "Expository teachers tend to explain beforehand exactly what has to be done they rarely ask questions and only seldom involve pupils' participation" (op.cit., p.164). At the other end of the spectrum, for Houston and Pilliner, are those teachers, "who expect pupils to draw their own conclusions based on their own interpretation of results" (op.cit., p.165). Whatever labels had been chosen in the present research, however, the

essential difference lying behind the two approaches was that one approach was expected to lead to what Piaget has described as figurative knowledge, the other to operative knowledge.

(2) THE LESSONS WITH IT

"Figurative" describes actions which are essentially passive, whether this entails the children listening or copying some external representation such as a map or notes. The lesson notes for IT (Appendix E) show that the pupils very seldom had to act constructively on the material presented to them. Within the lesson plans the following terms occur in a regular progression, either among the behavioural objectives (Mager 1962) or within the plans themselves:

(a) (Teacher) to describe/narrate/explain/read

For example:

- the chief events of Leonardo's life (October 3rd);
- the main events of More's life (October 24th);
- the story of Mary, Queen of Scots (November 21st);
- the causes and chief events of the Armada (January 11th);
- the basic structure of a three field village (April 25th).

(b) (Children) to copy

(i) Notes

For example:

- on Leonardo (October 5th);
- on Henry VIII's youth (October 17th and 19th);
- a simple sentence for each section dealing with the life of Mary, Queen of Scots (November 21st and 23rd);
- on houses and furniture (February 1st);
- on guilds (March 19th).

(ii) Maps

For example: Europe (October 10th)

(iii) Timetables

For example:

- (a) of an Elizabethan schoolboy (March 21st);

(b) of the day in an Elizabethan villager's life (May 9th).

(iv) Pictures and sketches

For example:

a "manuscript" letter (October 12th);

Henry VIIIth (October 19th);

a ruined monastery (October 26th);

a Tudor warship (January 30th);

the plan of an Elizabethan village (April 30th).

The children, as was to be expected in a school-based situation, were not merely passive recipients for surely only the most extreme of teachers would demand silent automatons as pupils? Furthermore, the nature of their emotional involvement in the lessons had to be considered. The children would have resisted (mentally at least) "expository" methods being used for the whole teaching programme. Hence, the children on occasions did take part in more active learning experiences, than those already described. For example:

(a) The children to discuss

(i) what they considered to be important inventions in history
(October 10th);

(ii) relationships within the Tudor and Stuart families (May 16th);

(iii) the results today of the Gunpowder Plot (May 30th).

(b) To find out in the atlas places associated with Leonardo's life
(October 5th).

(c) To make their own notes or write their own account

(i) on Elizabeth's youth (November 14th);

(ii) on Drake's early life (November 28th);

(iii) of the education of a wealthy girl in Elizabethan times
(March 26th).

(d) To draw their own sketch maps or pictures

(i) of the major events in the life of Mary, Queen of Scots (Nov. 21st);

(ii) of the triangular slave route (November 30th).

A question and answer technique was used quite extensively (see, for example, Transcript E, Appendix F). The approach was not, therefore, as extreme as the "expository" method described by Houston and Pilliner (1974).

As one result of the methods used, at the end of the teaching programme each pupil in IT had two exercise books containing clear and colourful information on the Tudor and Stuart periods. These books were generally attractive to look at and had useful reference material within them. There was a structure evident behind the written work in that events proceeded chronologically and different aspects of a reign, say the social life of the Elizabethan period, were dealt with at the same period of the term. The books, on the whole, appeared more appealing and seemed more logically organised than those kept by the children of IE. This, no doubt, resulted from the children of IT following a precise syllabus which allowed for few diversions. At the end of the year IT had studied a larger amount of historical data than had IE. This did not, of course, reveal how much of the historical information had been internalised in a meaningful way so that it became part of the pupils' general ways of knowing.

(3) THE LESSONS WITH IE

While it was necessary at times that the children of IE should listen to the narration of events (March 19th, for instance) and also have the occasional opportunity for illustrative work (November 2nd), the basic aim with this group was that they should be "active doers", both physically and mentally. It was hoped that such an "active" approach would lead to operative knowledge: "Fundamental knowledge is acquired through action upon and interaction with the environment" (Schwebel and Raph 1974, p.36). One can perhaps make an analogy here with the type of development which occurs between the end of the sensori-motor and the beginning of the concrete operational period in physical development. This can be characterised negatively but Sinclair (op.cit., p.58) points out that progress is obviously occurring through the child's "active reactions

to environmental action" and through the "active recombination of schemes by the child himself" (op.cit., p.72). Hence, in an attempt to move the pupils towards the concrete stage in history, the children were given both physical and mental activities. The following categories are by no means exclusive but are an attempt at a form of classification of the various activities which took place.

(a) Physical activities

As the preoperational child needs a physical stimulus such as combining and recombining different types of flowers to help with classification skills, so these children performed physical actions as an aid to representation in history. Flavell (1963) has remarked that, "The student must be led to perform real actions on the materials which form the learning base, actions as concrete and direct as the materials can be made to allow" (ibid., p.367). He also says that, "The point is to differentiate the basic physical actions related to or engendering a given phenomenon and then getting the student to practise them" (op.cit., p.368). The most obvious instance which illustrated Flavell's didacta was when the children acted and moved as members of the Tudor royal family in order to analyse the various relationships (November 7th, 9th and 14th). Again, on March 19th they were asked to exemplify through movement how Mary, Queen of Scots, had a claim to the English throne (see Appendix F, Transcript A). On another occasion (May 16th) a map of the world was drawn on the classroom floor. Volunteers had to "go on" Drake's 1577-80 voyage, explaining to the rest of the class what had happened at the different places. Similarly, on May 30th there was a map of Western Europe drawn on the floor so that the events in the Armada could be dramatised and imitated physically. Possibly the most extreme example of physical action was when the children represented barley, wheat and fallow land and showed through their movements what they understood by "the rotation of crops" (June 18th).

(b) Dramatic play

A step further on than mere physical representation was when the children took roles in historical situations. Since the organisation of this type of activity Furth has published an account of what he did when serving as a consultant to a school system in the U.S.A. (Schwebel and Raph 1974, p.231):

"We also talked about dramatic play as a way of encouraging thinking There are many ideas that children can act out which they cannot articulate in words or which they cannot write about." In the present research, the idea generally was to have the children imitate and express points of view as historical characters in the hope that such role playing would clarify the issues involved and form the basis of their written work (and, hopefully, help towards operative knowledge).

Thus:

(i) January 11th - The four children who imagined they were commissioners on 9th January to give their reasons why monasteries should be abolished.

Two pairs of children to invent a conversation between Henry 8th and Cromwell on why monasteries should be abolished.

(ii) March 26th - Miming or acting any difficult sections arising from Lord Ruthven's account of the Murder of Rizzio (see Appendix F, Transcript B).

(c) Activity in thought

"But one will not of course want the child to be limited to performing only concrete actions in situations providing maximal support for these actions" (Flavell 1963, p.368). Much of history cannot be represented physically or even visually. The implications within a narrative, the realisation of causal factors, the understanding that no definite conclusion may be reached - all these depend on activity of thought. History is permeated with what might be called "the probability concept". Furth has remarked on this in relation

to concrete apparatus: "the point was not to teach the children (or the teachers) the probability concept, but to give them experiences which would allow them to construct the idea" (Schwebel and Raph 1974, p.281). Hence, the objectives and lesson plans in Appendix E contain or imply phrases which indicate that the children were to be placed within an equilibration - equilibrium situation. Developing the plan from Piaget's explanation for the attainment of the concept of conservation (Flavell 1963, pp.247-8), the children were often placed in a situation where they had to hold and balance seemingly contrasted facts or views. "Cognitive conflict induces a re-organisation of the subjects intellectual actions, one which proceeds along the lines postulated by Piaget's equilibrium model" (op. cit., p.374). Thus, the following phrases occur within the lesson notes:

(i) To discuss

To read and discuss the play on the scribe and the printing press (Power 1960) (October 24th).

To discuss how various opinions can be held of the same person, relating this to Henry 8th (October 26th).

To discuss what Melville's report tells us about Elizabeth (March 19th).

(ii) To analyse the text

To begin to examine the implications of the passage on Glastonbury Abbey (January 9th).

To examine the implications of the commissioners' statements (January 11th).

To examine the validity of written statements concerned with history (e.g. p.23 "How do we know that Anne's (Boleyn) eyes filled with fear?") (January 16th).

To discuss how far we can believe such statements as Hawkins' argument that a bargain had been struck with the Spanish governor

at San Juan (May 9th), followed by written work:

"Can we believe - how can we know - that the Spanish promised not to attack the ships at San Juan?" (May 14th).

Can you find TWO ways in which the nobleman tried to put the blame for the murder on Lord Darnley? (March 26th).

(iii) To answer questions (which demanded more than merely repeating the data given)

For example, on More (November 23rd and 28th):

Q.(5) What is a traitor? Do you think More was a traitor?

Q.(8) What does his death tell us about religion in the sixteenth century?

The difficult concept of 'traitor' was referred to again in the lessons of January 11th and 18th where the children were asked whether they thought the Abbot of Glastonbury should have been executed as a traitor.

(iv) To find out for themselves

To answer questions from Unstead (1956) on Princess Elizabeth's youth (January 18th and 23rd).

To answer questions on Raleigh (February 8th and 13th).

The heuristic work (February 15th to March 5th inclusive).

(v) To imagine

Imagine you are a lady or gentleman of Edward IV's Court and tell of your visit to Caxton (October 24th) (see MOR's answer in Appendix G).

Pretend you went with Raleigh on his second voyage. Write a letter back to England telling a friend of the journey and what happened (February 8th).

Write your own "newspaper" account of Drake's 1567 expedition (May 9th).

(vi) To contrast

At a simple level, the differences between their own houses and

Tudor houses (January 30th), between a coutier's clothing and the teacher's clothes (March 12th and 14th) (see BU's answers, Appendix G).

At a more complex level, the views of two imaginary contemporaries of Leonardo (October 12th and 17th) (see HO's answers, Appendix G).

(vii) To analyse the meaning of remarks made in history

To read Unstead's account of More, discussing the meaning and reasons for More's remarks quoted in that account (November 16th).

(viii) To examine alternatives

What were the difficulties facing Drake in each of the routes he could have taken to return to England? (May 21st).

After the Armada, which religion might people think God supported? (June 13th).

(ix) To devise questions

Class to compose questions from their own books and Unstead 1956 on Raleigh, then to question each other (April 4th).

(d) Social collaboration

As has already been discussed in Part III (see pp.160-162) Piaget argues that interaction with his peers is one of the principal means by which the child is liberated from egocentric modes of thought. "One can acquire the rationality and objectivity which only a multi-perspective view can confer - only by pitting one's thoughts against others and noting similarities and differences. The extension of this view to education consists of plumping for group activities in the classroom - projects to be undertaken in common, discussion sessions and the like" (Flavell, op.cit. p.369). Aebli emphasises that teachers should accord "an important place to socialised activities in the curriculum" (ibid. p.369). The work described under the earlier sub-headings all took place in common, either as a class or in small groups. The children discussed their thoughts on the various issues

put before them. The most obvious examples of collaboration, however, were probably these:

- (i) To write a play about More and record it (December 5th, 7th and 12th) (see the product of DOB's group, Appendix G).
- (ii) To select a topic from the Tudor period, answer questions in small groups and report some of the findings to the class (February 15th to March 5th inclusive).
- (iii) To write a play based on the events at Holyrood Place in 1565 (March 28th).

Questions and answers formed an integral and exacting part of the whole teaching programme (see the transcripts, Appendix F). Unlike IT, who were also asked questions during the lessons, these oral sessions with IE were followed by periods when the pupils had to reflect together and answer in writing questions which often demanded the ability to examine problems raised by the historical material. The results of some of this work can be seen within Appendix G.

CHAPTER 3 , AN ANALYSIS OF THE RESULTS WITH THE
PRIMARY SCHOOL CHILDREN

(1) THE GRADES AND CRITERIA FOR THE HISTORICAL STORIES

All the pupils involved in the research were assessed globally on the three stories at the first assessment and four stories at the second.* They were allocated a grade for each story on a nine point scale used to quantify their stage of development. It is important to notice that the grades do not form an equal interval scale. It does not follow, therefore, that it is as easy to move, say, from 2B/3A to 3A as it is to move from 1/2A to 2A. This caution will be particularly relevant when the results of the secondary pupils are compared with these results from the primary children.

The following criteria formed the basic measures on which the answers were assessed but it has already been noted that these criteria possibly may be related to Piaget's model of nine groupings (Table I, pp.13-17) and also to the standards which historians consider integral features of historical thinking (Table IX, pp.189-191). Examples of individual replies by the children considered at various developmental levels are given in Appendix C.

Footnote: * The stories were always studied in this order: Greece, Mary, Westward and More.

Table XXIV Criteria used to assess the operational level of the subjects' answers

<u>Stage</u>	<u>Quantification at and within the different levels</u>	<u>Criteria used</u>
1 Pre-operational thinking	1	<p>Intuitive thought: not relating the question to the information provided.</p> <p>Egocentricity: not taking the point of view of other people; not looking for possible contradictions in the thought process; not realising other people might not understand; not reflecting upon the thought processes.</p> <p>Isolated centrings on one feature only: not balancing two possible influences which could modify and compensate each other.</p> <p>An unstable, discontinuous cognitive life: "(the) cognitive organisation tends to rupture and dislocate itself in the process of accommodating to new situations" (quoted Flavell 1963, p.153); therefore multiple, contradictory answers given.</p> <p>Irreversibility: not able to work back from one point of an argument because of an inability to keep premises unaltered during a reasoning sequence.</p> <p>Transductive reasoning: movement from one element to another without considering all the factors involved; a tendency to make associative "and" connections rather than true casual relations in a chain of reasoning; the juxtaposition of elements.</p> <p>Syncretic reasoning; "a multitude of diverse things inchoately correlated within a global schema." (Flavell 1963, p.161).</p>
1/2A Intermediate between pre-operational and concrete operational thinking.	2	<p>More than one feature of the situation considered but the attempts to relate differing facts not too successful. Uncertainty of judgements. Attempts at reversibility end in failure. Crude and faulty elementary systematic thinking.</p>

2A	Concrete operational	3	The ability to give an organised answer but limited to what is apparent from the text.
2AB	thinking at different	4	Using the information available; tending to judge the verbal problems in terms of their own content, especially if the material deals with concrete "realities".
2B	levels.	5	Ability to forecast a result from the evidence available but not to formulate a mature hypothesis after considering all the implications of the situation.
			Ability to compensate one statement by another or to negate a statement but not able to co-ordinate negation and reciprocity.
2B/3A	Intermediate	6	More advanced logical thinking, at a more abstract level.
	between concrete		Going outside the known data in the story to form hypotheses but not too successfully. Beginning to relate a number of variables.
	and formal		
	operational thinking.		
3A	Formal operational	7	Inhelder's and Piaget's suggestions for distinguishing concrete from formal thinking:
3AB	thinking at	8	a) study whether the child tries to separate out variables,
3B	different levels,	9	b) if the proofs employed "do not go beyond observation of empirical correspondences, they can be fully explained in terms of concrete operations. (1958, p.279)
			Realising a multiplicity of possibilities.
			Envisaging all possible explanations and finds out through logical analysis which are true. Logical analysis can be said to be holding certain factors constant and varying others systematically.
			This is propositional thinking, the tendency to try out possibilities in a systematic way.
			Hypotheses are postulated and these can be confirmed or not by the data. The child "commits himself to possibilities", there is a reversal of direction between reality and possibility (Inhelder and Piaget 1958, p.255).
			Reasoning by implication at an abstract level. Thinking about thoughts. Realising a multiplicity of possible links.

(2) Friedman's two way analysis of variance was used to ascertain if the grades came from the same population of grades (Siegel 1956, pp.166-172).

Table XXV The Friedman two way analysis of variance
(primary pupils)

<u>First Assessment</u>	<u>3 stories</u>	<u>4 stories</u>
IE and IT (combined)	.70 > P > .50	
IE, IT and IC (combined)	.70 > P > .50	
<u>Second Assessment</u>		
IE and IT (combined)	.10 > P > .05	.20 > P > .10
IE, IT and IC (combined)	.02 > P > .01	.05 > P > .02

These results indicate that there was little difference in the level of the replies across the three stories on the first testing, whether two or three groups were combined for statistical analysis. There was, however, a change on the second testing when the three stories are considered. For these results it seems that the null hypothesis should be rejected.* The pupils scored the highest grades on "Mary" and the lowest on "Greece". With regard to the global grades on the four stories (that is, including the passage on More as well), the Friedman analysis indicates that there was not a great deal of difference for IE and IT (combined). With IC's scores included, there is less likelihood that the replies came from the same population since IC found "More" more difficult to answer than did IE and IT. This was probably caused by the relative sparseness of information in that passage which has already been remarked upon. (see p.237).

Another, more descriptive, method of comparing the children's responses is through the means of the average grades on each story awarded by the two assessors.

Footnote: * For IE and IT (combined) P equals the probability that a value of Xr^2 arising by chance lies between one in ten and five in a hundred.

Table XXVI Mean scores for logical thinking on the historical stories (primary pupils) *

		Ancient Greece		Mary, Queen of Scots		Moving Westward		Henry 8th and More
Occasion of testing		First	Second	First	Second	First	Second	Second
IE	Boys	2.14	3.04	1.96	3.43	2.36	3.18	3.14
	Girls	2.00	2.71	2.07	3.50	2.71	2.96	3.36
IT	Boys	1.57	2.21	1.57	2.54	1.93	2.57	2.54
	Girls	2.25	3.11	2.36	2.96	2.25	3.04	2.86
IC	Boys	2.11	2.50	2.04	2.39	2.18	2.79	2.36
	Girls	1.79	1.93	1.79	2.57	1.64	2.04	1.96
Group mean (IE, IT, IC combined)		1.98	2.58	1.96	2.89	2.07	2.76	2.70

These group means of the original grades show that there was a general similarity across the stories on the first occasion but that on the second testing "Mary" received the highest average score, followed by "Westward".

(3) KENDALL'S COEFFICIENT OF CONCORDANCE "W"

In order to discover if the levels of responses were stable across the stories, Kendall's Coefficients of Concordance were found for each subgroup. "W" indicates the degree of association between a number of sets of rankings (Siegel 1956, pp.229-239).

Footnote: * An average score of 3 denotes the beginning of the concrete operational stage in relation to these passages.

Table XVII Kendall's Coefficient of Concordance

		First Assessment (3 stories)	Levels of significance
IE	Boys	0.560	.10 > P > .05
	Girls	0.635	P < .02
IT	Boys	0.621	P < .05
	Girls	0.701	.02 > P > .01
IC	Boys	0.348	P > .50
	Girls	0.696	.02 > P > .01
		Second Assessment (4 stories)	
IE	Boys	0.477	P < .05
	Girls	0.779	P < .001
IT	Boys	0.702	P < .001
	Girls	0.819	P < .001
IC	Boys	0.625	P < .01
	Girls	0.762	P < .001

It seems that two conclusions may follow from these results:

- (a) As the children become older, so the coefficient of concordance tends to rise since thinking skills become more stable with advancing years (cf. Lovell in Green et al 1971, pp.86-87).
- (b) Values as large as the various coefficients of concordance did not arise by chance except in the case of IE boys and IC boys, both on the first occasion of testing.

(4) THE ANALYSIS OF COVARIANCE

"Through covariance analysis one is able to effect adjustments in final or terminal scores which will allow for differences in some initial variable"

(Garrett 1965, p.295). While it was appreciated that in any analysis of covariance the scores strictly should lie on a scale of equal intervals, it was decided that this technique of analysis was most helpful in the present research. In the following tables F is the variance ratio, which compares the apparent treatment effect with the estimate of error. The null hypothesis is that the apparent treatment effect is due to error. This can be confirmed or rejected at different levels of significance (P) by reference to tables of F ratios (for example, Lindley and Miller 1968, Table 7).

Table XXVIII Analysis of covariance adjusting the post-scores on "Mary, Queen of Scots" for the initial scores

		ss	d.f.	V	F	P
<u>Boys</u>						
(a)	<u>IE v IT</u>	3.54 12.74	1 25	3.54 0.51	6.94	< .05
(b)	<u>IE v IC</u>	7.59 11.42	1 25	7.59 0.46	16.5	< .001
(c)	<u>IT v IC</u>	0.56 14.42	1 25	0.56 0.58	0.97	N.S.
<u>Girls</u>						
(a)	<u>IE v IT</u>	3.45 19.47	1 25	3.45 0.78	4.42	< .05
(b)	<u>IE v IC</u>	4.00 19.63	1 25	4.00 0.785	5.10	< .05
(c)	<u>IT v IC</u>	0.06 17.67	1 25	0.06 0.71	0.08	N.S.

Two conclusions seem indicated by these results:

- (a) The content of the teaching programme led to a significant improvement in the scores of IE boys and IE girls compared with their control groups in IT and IC.
- (b) The general ethos of the "experimental" and "control" school did not affect IC's scores on "Mary" compared with those achieved by IE; that is, acquaintanceship with the content within the context of the teaching methods adopted led to a significant improvement in IE's scores compared with IC's, at the .001 level for the boys

and the .05 level for the girls.

Further discussion of these, and other results, will be left until Chapter 4.

As "More" was also a "taught story", an additional criterion score was obtained by averaging each child's scores on "Mary" and "More". An analysis of covariance was then carried out adjusting the post-test average scores for the initial scores on "Mary".

Table XXIX Analysis of covariance adjusting the post-test mean scores for "Mary" and "More" for the initial scores on "Mary"

	<u>Boys</u>	ss	d.f.	V	F	P
(a)	<u>IE v IT</u>	2.11 14.98	1 25	2.11 0.59	3.59	N.S.
(b)	<u>IE v IC</u>	5.96 10.84	1 25	5.96 0.43	13.86	.01 > P > .001
(c)	<u>IT v IC</u>	0.58 15.20	1 25	0.58 0.608	0.95	N.S.
	<u>Girls</u>					
(a)	<u>IE v IT</u>	3.79 19.35	1 25	3.79 0.77	4.92	< .05
(b)	<u>IE v IC</u>	6.78 16.06	1 25	6.76 0.64	10.59	< .01
(c)	<u>IT v IC</u>	0.62 13.28	1 25	0.62 0.53	1.17	N.S.

These results confirm in general the results obtained from the analysis of covariance on the "Mary" scores, apart from the lack of significance when the scores of IE boys were covaried against those of IT. Certain boys in IT did particularly well on this passage and moved away from the rather low level of the scores of this group. Even so, the F ratio still approaches the .05 level of significance (F for 1 and 25 degrees of freedom is 4.24).

The crucially important criterion scores in Piagetian-based research are those which occur on related tasks, in this case, the other passages on which the children answered questions.

Table XXX Analysis of covariance adjusting the post-test average scores on the three stories for the initial average scores on those stories

	<u>Boys</u>	s.s.	d.f.	V	F	P
(a)	<u>IE v IT</u>	0.90 4.34	1 25	0.90 0.17	5.29	<.05
(b)	<u>IE v IC</u>	2.69 4.51	1 25	2.69 0.18	14.94	<.001
(c)	<u>IT v IC</u>	0.72 5.77	1 25	0.72 0.23	3.13	N.S.
	<u>Girls</u>					
(a)	<u>IE v IT</u>	0.23 9.32	1 25	0.23 0.37	0.62	N.S.
(b)	<u>IE v IC</u>	2.31 10.89	1 25	2.31 0.44	5.25	<.05
(c)	<u>IT v IC</u>	0.57 6.75	1 25	0.57 0.27	2.11	N.S.

With IE boys the approaches adopted during the teaching programme wherein the children were challenged on the analysis of passages seems to have had a significant effect as far as these scores are concerned. With the girls, however, the only significant result is between the scores of IE and IC. It is, perhaps, not surprising that IT's average scores did not differ greatly from IE's in the analysis of covariance. This group has been noted as superior on a number of counts (see Part VI, Chapter II). They increased their average score more than did IE over the year on "Greece" (the difference between the means of the two sub-groups increased from 0.25 to 0.40 - see Table XXVI), while they reversed the initial differences on "Westward" (from -0.46 to +0.8, in their favour). The girls in IE, however, increased their mean score on "Mary" from 2.07 to 3.50 (+1.43) over the year while the mean score of IT girls moved from 2.36 to 2.96 (+0.60). It would appear from this analysis that the ability of IT girls was having a greater effect than that achieved by the different approaches adopted with the two groups. With regard to the girls of IC, these pupils had lower average scores than IE or IT on all three stories at the first time of testing. There was a significant increase for IE against this group on the second

testing, but this did not occur with IT. Presumably, the decrease in the difference between the scores on "Mary" for IT and IC led to a non-significant result.

Another analysis of covariance which was thought worthy of scrutiny was an adjustment of the final scores on "More" to make allowances for differences in the initial average scores.

Table XXVI Analysis of covariance adjusting the post-test scores on "More" for the initial average scores on the three passages

	<u>Boys</u>	S.S.	d.f.	V	F	P
(a)	<u>IE v IT</u>	0.45 21.56	1 25	0.45 0.87	0.52	N.S.
(b)	<u>IE v IC</u>	3.58 14.86	1 25	3.58 0.59	6.07	<.05
(c)	<u>IT v IC</u>	3.27 18.30	1 25	3.27 0.73	4.48	<.05
	<u>Girls</u>					
(a)	<u>IE v IT</u>	4.01 11.74	1 25	4.01 0.47	8.53	<.01
(b)	<u>IE v IC</u>	6.94 12.96	1 25	6.94 0.52	13.35	.01 > P > .001
(c)	<u>IT v IC</u>	0.71 11.87	1 25	0.71 0.47	1.51	N.S.

The effect of IT boys' scores on "More" is still being demonstrated (cf. Table XXIX p. 263): no significant difference is found between IE and IT but both these groups score more highly on this passage than IC when the grades are covariated against the initial average scores on the three passages. With the girls, the superiority of IE's scores on "More" is seen when covariated against the initial average scores of IT and IC. The difference between the scores of IT and IC girls when compared with their initial average scores on the three passages is not great enough to be of significance.

The final analysis of covariance was to adjust the average scores on the three history passages (second assessment) for variations in I.Q.

Table XXXII Analysis of covariance adjusting the post-test history scores for variations in I.Q.

	<u>Boys</u>	s.s.	d.f.	V	F	P
(a)	<u>IE v IT</u>	4.03 7.51	1 25	4.03 0.304	13.26	<.01
(b)	<u>IE v IC</u>	2.33 7.04	1 25	2.33 0.28	8.32	<.01
(c)	<u>IT v IC</u>	0.30 9.13	1 25	0.30 0.37	0.81	N.S.
<u>Girls</u>						
(a)	<u>IE v IT</u>	1.64 11.09	1 25	1.64 0.44	3.73	N.S.
(b)	<u>IE v IC</u>	5.32 11.48	1 25	5.32 0.46	11.57	<.01
(c)	<u>IT v IC</u>	1.25 10.54	1 25	1.25 0.42	2.93	N.S.

It will be helpful to consider these results in relation to the following summary:

Table XXXIII Summary of mean I.Q. scores and the average grades for three stories^{*} on the second testing

		Mean I.Q.	Average Grade
IE	Boys	103.07	3.217
	Girls	102.40	3.057
IT	Boys	102.79	2.440
	Girls	112.04	3.037
IC	Boys	99.86	2.560
	Girls	103.14	2.180

The boys, with not markedly dissimilar mean I.Q.'s but with IE boys scoring more highly on the stories, gave expected results: when the final average grades are covariates against the mean I.Q. scores there is a significant difference in favour of IE as compared with IT and IC. The higher mean I.Q.

Footnote: * The stories were Greece, Mary and Westward.

scores for IT girls might have been expected to lead to a significant difference when compared with IE, but the result in Table XXXII approaches only marginal significance (F_c for 1 and 25 degrees of freedom is 4.24). Covariating final grades against the scores on the I.Q. tests leads to a significant difference between IE and IC girls but not IT and IC girls.

(5) THE PIAGETIAN EXPERIMENTS

Another area of empirical interest was the relationships between the responses on different tasks, in particular, the thinking on the historical stories (the average grade on the three stories) compared with that shown on the chemicals and balance experiments (see Appendix D). The criteria used for assessing the protocols on these experiments are based on Inhelder and Piaget (1958), as modified by Hughes (1965) - (see Appendix D).

The following correlation coefficients were obtained through the Product Moment method.

Table XXXIV Correlation coefficients for the grades on the two Piagetian experiments and the average grades on the three historical passages

	First Testing	Second Testing
Average grades v. grades on Chemicals	0.025	0.129
Average grades v. grades on Balance	0.173	0.359
Grades on Chemicals v. grades on Balance	0.465	0.326

Kendall's Coefficient of Concordance (W), giving a measure of stability across the grades on the two Piagetian experiments and the average historical grades, resulted in similar values of "W" on both occasions:

First Testing $W = 0.477$ $P < .001$

Second Testing $W = 0.487$ $P < .001$

The very low correlation coefficient for the results on the chemicals experiment compared with the average grade on the three stories seems to indicate that the two types of tests were assessing different levels of reasoning: a result borne out by factor analysis where the chemicals experiment was found on a different factor than the scores on history (see Tables XXXV and XXXVI). Ignoring the first testing, there seems some degree of correlation between grades on the balance and the historical stories. Again, this result appears supported by factor analysis (see Tables XXXV and XXXVI). There is moderate agreement between the scores on the two Piagetian experiments. Kendall's coefficient of concordance also revealed a moderate degree of agreement in the position of the children in relation to their peers across the three different types of tests.

(6) FACTOR ANALYSIS

The information collected from various sources on the second occasion of testing was submitted to factor analysis. Since the data obtained on several of the tasks were markedly skewed, the scores on the variables were split as close to the median as possible and phi-coefficients calculated. A Principal Components Analysis was obtained, the factorisation being continued only as long as the eigen value was greater than one. The Components were rotated to a Varimax solution as shown in Table XXXV.

Table XXXV Varimax analysis of a number of features obtained on the second occasion of assessment

Tests	Rotated Factor Loadings						
	I	II	III	IV	V	VI	VII
1. I.Q.	.6153		.3357	.4116			
2. Series and Numerical Analogies	.5709						
3. N.F.E.R. Sentence Reading Test I	.6717						
4. Ancient Greece	.3296			.6922			
5. Mary				.6421			

Table XXXV (Continued)

Tests	I	II	III	IV	V	VI	VII
6. Moving Westward				.6881			
7. Henry 8th and More				.7000			
8. Chemicals					.6491		
9. Balance				.5556			
10. Moral Judgment Question 4(a) Ancient Greece							.8913
11. Extroversion			.7729				
12. Neuroticism		.7839					
13. Prudence	.8196						
14. Self Confidence	.5027				.6311		
15. Will-Power	.6657						
16. Permanency of Moods		-.4907					
17. Desire to Excel	.8383						
18. Conscientiousness	.6565	-.3200			-.3449		
19. Desire to Know	.8447						
20. Originality	.5131					.4324	
21. Common Sense	.7837						
22. Intelligence	.8055				.3103		
23. Social Questionnaire						.8096	
24. A pass at the 11-plus	.7405						
25. Headmasters' comments	.6803						
Percentage Variance	29.4334	5.8777	5.2356	10.0432	6.2759	5.6165	4.7912

Factor I accounts for 29 per cent of the variance and would appear to reflect scholastic attainment as judged by the class teachers.

Factor II is a bipolar factor, loading heavily on neuroticism as contrasted with the teachers' opinions on the children's permanency of moods.

Factor III is largely a specific factor concerned with extraversion but it also has a substantial loading on intelligence (cf. Eysenck and Cookson 1969).

Factor IV seems to reflect the ability to reason on the four historical passages and has also substantial loadings on the balance experiment and the verbal-reasoning tests score.

Factor V loads most heavily on the chemicals experiment and the teachers' estimation of pupils' self confidence.

Factor VI seems largely a specific factor involved in the scores on the social class questionnaire.

Factor VII also appears as a specific factor with its high loading on the moral judgments expressed in response to Question 4(a) on "Ancient Greece".

As the comments of the head and class teachers appear to saturate some of the factors, another Varimax solution was found using only the first twelve variables.

Table XXVI Varimax analysis of twelve features obtained on the second occasion of assessment

Tests	Rotated Factor Loadings			
	I	II	III	IV
1. I.Q.	.5109	.6333		
2. Series and Numerical Analogies		.4702	.4333	
3. N.F.E.R. Sentence Reading Test I		.7308		
4. Ancient Greece	.6890			
5. Mary	.6567			
6. Moving Westward	.7493			
7. Henry 8th and More	.7754			
8. Chemicals			-.5848	.4748
9. Balance	.6007			
10. Moral judgment question 4(a) Ancient Greece				.8713

Table XXXVI (Continued)

Tests	I	II	III	IV
11. Extraversion		.723		
12. Neuroticism			.7357	
Percentage Variance	24.3377	15.4876	10.7245	10.3109

Factor I accounts for 24 per cent of the variance and seems to reflect logical thinking in respect to the historical passages, allied with scores on the balance experiment and the verbal reasoning tests.

Factor II would appear to be a g/v:ed factor with a high loading on extraversion (cf. Eysenck and Cookson 1969, again).

Factor III has a high loading on the chemicals experiment, and this is opposed to the neuroticism variable.

Factor IV loads most highly on the moral judgments in response to Question 4(a) "Ancient Greece".

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CHAPTER 4 : SOME COMMENTS ON THE RESULTS

(1) The grades on the historical stories

It has already been noted (Part II, pp.137-138) that the initial levels of the children's thinking is of increasing importance in acceleration studies. While the children as a whole were at a level between preoperational and concrete thinking across the three stories on their first testing (see Table XXVI, p.260), there were subtleties among the grades of the sub-groups composing this sample (cf. the four phase process described by Wallace, p.138). For example, the mean scores on all three stories for IT boys and IC girls were at a lower level than those of the other sub-groups, while IT girls seemed to be heading towards the concrete operational level. The initial levels of thinking, therefore, were not exactly the same for all sub-groups: this might have affected the results in the statistical analysis in that children firmly at the preoperational or concrete levels might show less evidence of having benefitted from a year's experience in primary school than children at a transitional level.

When the "taught" story of "Mary" is considered, it seems that children rated at level 1 on the first testing were usually able to move into at least level 2 (transitional) after one year. The children rated at the concrete level on the first testing, however, remained within that band of thinking whether they experienced the experimental methods or not. Indeed, as can be seen from the following list of those pupils who were graded at the concrete level for "Mary" on the first occasion, the two pupils from IC who were at that level initially were actually rated lower on the second occasion.

		<u>First Testing</u>	<u>Second Testing</u>
IE	AND	3.0	3.0
	DOB	4.0	4.5
	ALE	3.5	5.0
	HEA	3.0	3.5
IT	GRI	4.5	4.0
	PA	3.0	5.0
	TIL	3.5	3.0
IC	MAC	3.0	2.0
	LCR	4.0	2.5

Only five of the children listed above were considered to be at the concrete level on all three stories at the first testing and only the highly motivated, intelligent PA (I.Q.133) made much more general improvement after one year. And it is conceivable that she might have been under-achieving on the first occasion.

		<u>First Testing</u>			<u>Second Testing</u>		
		<u>Greece</u>	<u>Mary</u>	<u>West</u>	<u>Greece</u>	<u>Mary</u>	<u>West</u>
<u>IE</u>	DCB	4.0	4.0	5.0	4.0	4.5	5.0
	ALE	3.0	3.5	4.0	2.5	5.0	3.5
<u>II</u>	GRI	3.5	4.5	3.5	4.5	4.0	4.0
	PA	4.0	3.0	3.0	5.0	5.0	5.0
	TIL	3.0	3.5	4.5	3.0	3.0	4.0

These children might be considered to be showing effects mainly of consolidation (cf. Wallace 1972, pp.201-202).

The majority of the sample, who were rated at the preoperational or transitional levels on the first testing, did make some progress according to the mean scores on the three stories. This is evidenced by the results shown in Table XXVI. An investigation of those children graded below the concrete level revealed that only two children from IE and three from II could be said to be remaining at the same level, although eight from IC could be included in this category. Possibly the majority of these subjects could be said to be variably receptive to influences aimed at speeding up the initial emergence of concrete operations.

On the second assessment there was a more diverse response both across the stories and among the sub-groups (cf. Friedman's two way analysis of variance Table XXVII, p.259). The general picture can probably best be seen in tabular form.

Table XXXVII The general levels reached on the second occasion of testing (primary pupils)

Sub-group	Levels reached
IE boys	Early concrete on all four stories.
IE girls	Early concrete on the "taught" stories and practically at concrete on "Westward" (mean grade = 2.96)
IT boys	Advanced transitional on both "taught" stories and "Westward".
IT girls	Early concrete on the "not-taught" stories and practically at concrete on "Mary" (mean grade = 2.96).
IC boys	Advanced transitional on all four stories.
IC girls	Transitional on all four stories.

One can note that the fact the children were scoring as highly on "More" as on, say, "Ancient Greece" appears to discount any suspicion that there might have been a "practice effect" on the later scores through the children's having experienced the same passages on two occasions. The import of these results, however, cannot be realised unless they are considered in conjunction with the various analyses of covariance.

Analysis of covariance indicates that both the boys and girls in IE improved significantly against their respective sub-groups in IT and IC on the "taught" story "Mary". While the girls in IE maintained their superiority when the scores on "Mary" and "More" were covariated against the initial scores on "Mary" (see Table XXIX, p.263), the boys of IE lost their advantage against IT but not IC. Certain boys in IT were graded at the concrete level on "More". This type of answer helped HAM to gain a score of 4 (mid-concrete):

4(a) "What is a traitor?"

"He's helping the King and then he goes against him. He helps somebody and then he leaves them; he could fight for a country and then go against the country."

4(b) "Do you think that Sir Thomas More was a traitor?"

"No - because he was - believed in his own Church - his own God."

"His own Church? Which one?"

Roman Catholic

"Which was Henry's Church?"

Church of England.

Despite the more summary treatment of More in the teaching programme with IT (see Appendix E, lesson notes for October 24th for IT, and November 21st, 23rd, 29th for IE), the learning experience may have affected four boys in particular in IT. Their scores on this passage could thus have had some effect on the statistical analysis. Note, though, that between IE and IT boys as a whole the difference between the scores still approached the marginal level of significance at the five per cent level (cf. Table XXIX).

This modified result for IE v IT boys warns against placing too great a stress on the statistical results for "Mary" alone. These must also be given a deeper examination. Were the answers to Question (2), for example, merely "symptom responses" as described by Smedslund (see p.134) since no supplementary questions were posed? They may have been, but the crucial grades used in statistical analysis were the global ones based on the whole range of answers, these answers often having been elicited through supplementary questions. Another area of concern related to the time interval between the teaching of the topic and the second testing. Although there was a respectable distance of four months between the final lesson on "Mary" and the second testing, would the pupils of IE have maintained their advantage, say, one year later? Through other commitments with IC and with the secondary pupils (Part VII), together with the strong reluctance of one class teacher to release the children for more testing, it was not possible to test the subjects individually one year later, but such a delayed assessment would have been an interesting continuation of the research.

At this stage of the discussion the general impression of the results on the "taught" story "Mary" would seem to be that the improvement noted in IE's scores on the second testing probably represents a "Type II" form of behaviour change, limited in effect and susceptible to reversal. Indeed, Bereiter (1970) has argued that one cannot teach Type I structural changes (see pp.93-95). But the crucial criteria, of course, have not yet been considered. How far were the children of IE able to transfer their thinking skills to the "non-taught" stories on "Greece" and "Westward"?

When the average grades on the three stories were covaried against each other, IE boys maintained their lead against both IT and IC while there was no significant difference between the average scores of IT and IC on the two occasions. IT boys were a lively, friendly group, always eager to please. Superficially, IE boys seemed far less responsive, yet their headmaster gave them a better score for their attitude to school and learning than did IT's head for his pupils (4.1 against 3.3). The class teacher rated IE boys as above average on will-power and perseverance, desire to excel and conscientiousness, although IT boys obtained the highest mean score for "Desire to know" (see Table XIX, p.226). IT boys might not have been challenged in their everyday schoolwork because the girls in their class, on the whole, were superior academically and tended to dominate the proceedings. The teaching style of the school might also have favoured those girls and not have been to the advantage of those particular boys. Yet IE boys also showed a significant improvement against IC boys, whereas there was no significant difference over the year between the scores of IT as against IC boys. The boys of IE and IC were in the same school and, presumably, were susceptible to a similar teaching environment. It seems as though an explanation beyond the influence of general teaching style is needed for these results. Possibly a clue lies in the initial levels of responses. The boys of IT started the course at a lower mean score on the three stories (1.67) than did the boys of IE (2.16). Both groups progressed but IE outstripped IT (+1.04 over the year to 3.20 for IE and +0.77 to 2.44 for IT). Possibly IE

boys from the beginning were slightly more ready to benefit from the methods used in teaching history to them. Whatever the reason, the analysis of covariance indicates that the effects of the experimental treatment was superior, the significance being at the 5 per cent level.

This result did not obtain for the girls. While IE maintained its superiority over IC, there was no significance between the mean scores of IE and IT. As can be seen on Table XXVI (p. 260) IT girls entered the concrete period on the "non-taught" stories before the "taught". Their general development seems to be superseding the effect of the content and the teaching methods used with them. It could be argued, perhaps, that the content and methods might even have restrained them: certainly, it seems likely there would have been an improvement in the scores on the "taught" stories if the same methods had been used with them as with IE. When the superior ability of these girls is considered the result is not really surprising. It was noted in Part VI Chapter I that they scored the highest of any sub-group on a number of desirable measures. Among these were:

Mean I.Q. (Verbal Reasoning) (112.0)

Mean N.F.E.R. Sentence Reading (109.5)

Child's speech suggests good language models at home

Attainment in School

Higher scores on items from the Terman-Merrill inventory

The highest mean score on extraversion and the lowest on neuroticism (cf. Eysenck and Cookson 1969)

Possibly it is more surprising that a comparatively short teaching period (nine months including holidays) of two lessons a week had a significant effect on the "taught" stories in favour of IE girls. IE girls also moved further forward over that period when the raw average scores are compared:

Means on three stories

	<u>First Testing</u>	<u>Second Testing</u>	<u>Improvement</u>
IE	2.09	3.07	+ 0.98
IT	2.31	3.06	+ 0.75

Thus, while the analysis of covariance indicates that development was a more important factor than teaching for the girls in these two groups, it does look as though the methods they experienced helped IE girls to compensate for the ability of IT girls, certainly as far as the "taught" stories were concerned.

It was thought that "intelligence" might prove a vital influence in an analysis of covariance against the average scores on the three history passages (second assessment). While the analysis for the boys showed that IE boys maintained their advantage (Table XXXII), the higher mean I.Q. score of IT girls did not lead to a significant difference as against IE girls.

Are there any tentative general conclusions which can be reached on the basis of the statistical analysis? As so often in educational research, there must first be a warning against placing too strong a value on the results with these small numbers of children. It has been noted how the investigation of these three classes of children, superficially similar at the beginning of the research, revealed marked sub-group differences, let alone individual differences. These differences can affect the results of statistical analysis, for example, we have noted how the four boys in IT gaining slightly higher scores on "More" probably affected the analysis of covariance when these scores were combined with those on "Mary". This shows how fluctuations in small groups can modify results. From the analysis of covariance on "Mary" it does seem as though the content and methods of presenting that content did affect significantly the scores of IE boys and girls on the second occasion of testing. It could be argued that this could have been expected from the greater time spent on this topic with IE compared with IT (and, presumably, IC). The more important criterion of transfer to other stories gave equivocal results. Class IE boys' grades were significantly better than those of the other groups but such a result did not obtain for IE girls as against IT girls. The superior ability of IT girls has already been remarked upon, and in the actual teaching situation the differences in overt responses among the girls was noticeable. IT girls were almost over-eager to learn and to please the teacher, hands quivering at

the ready, while some IE girls were easily distracted and a few showed indifference.

A guarded conclusion on these results, then, is that for these children the more challenging approach helped towards improving the thinking skills on the content of the syllabus and seemed to have some effect on the general thinking skills on the stories for IE boys and for IE girls against IC girls. But is the result worthy of the effort since children in Britain are likely to reach the concrete level at least by the early years of the secondary school? (cf. Hallam 1966). The more difficult area for children to traverse seems to be the one between concrete and formal operational thinking (cf. Flavell in Green et al 1971, pp.190-191). Possibly, having reached the concrete level earlier within the content of the history syllabus, the children of IE might have been able to progress more quickly over the ensuing years towards the formal level - but this would depend upon the learning experiences available. In order to test this hypothesis a longitudinal study would be needed, perhaps from 9 to 13 years. It is doubtful whether such a research project could be developed by a single person relying on his own resources since teaching in any one style for even one school year can place severe restrictions on an experimenter's normal teaching methods. It may be that the teaching within a number of middle schools could be assessed, as in the type of research reported by Houston and Pilliner (1974). There "open-ended" and "expository" styles of teaching were investigated within a number of schools. In addition to this approach, the investigator himself might also perhaps teach consciously for the improvement of thinking skills in history within one of the schools.

(2) The Piagetian experiments*

Only moderate agreement was observed between the grades on the chemicals and balance experiments ($r = 0.326$), and factor analysis indicated that the chemicals experiment did not always load the same factor as other measures of the children's thinking. This fairly low type of interitem correlation

Footnote: * All the references will be to the tests of the second occasion.

on Piagetian tasks has been found by other investigators such as Tuddenham (Green et al 1971, pp.64-75). Indeed, Flavell (op.cit. p.80) comments that, "there is no real reason to expect relationships among unrelated tasks". It has been argued that these two experiments are related (see p.23), but this result with these particular children does not seem to indicate the presence of a structure d'ensemble with regard to the chemicals and balance experiments.

It is interesting that the average grades on the three stories correlate a little more highly with the balance experiment ($r = 0.359$) than do the Piagetian experiments between themselves. There is, however, little evidence of correlation between average scores on the three stories and the grades in the chemical experiments ($r = 0.129$). Factor analysis (Tables XXXV and XXXVI) seems to indicate that there is something distinctive about the chemicals experiment. Possibly, certain children were disconcerted by the array of bottles since Factor III in Table XXXVI (see p.270) gives opposite loadings for "neuroticism" and "chemicals". HUL (I.Q.130), for example, some of whose answers on "Greece" have already been quoted (see pp.142-143), seemed to have no system in her approach, ignoring bottle G at times. She could not discover the effects of bottle 4, although during the course of the experiment she had seen this liquid bleach the yellow solution. The teacher rated HUL's self-confidence as "average" on the Terman Merrill Inventory (Appendix B); this was lower than any of her other characteristics on that scale. Her grade on the chemicals was decided to be at substage 1/2A while she was at the concrete level on all the historical stories.

The Series and Numerical Analogies theoretically should have been assessing the same types of thinking skills as equilibrium in the balance, but the raw scores did not appear to show any type of close relationship. They are better considered, however, under the factor analysis discussion.

(3) Factor analysis

The data was submitted to factor analysis in order to try to answer certain questions raised as a result of this and previous research (Hallam 1966). While factor analysis cannot provide conclusive answers it can show which variables correlate with each other, Child (1970) stating that a factor can be loosely defined as the outcome of discovering a group of variables having a certain characteristic in common (op.cit. pp.13-14).

(a) Does factor analysis give any evidence of a connection between the scores on the historical stories and any "emotional" variable?

The Principal Components Analysis (not presented in this thesis) on two occasions showed the historical scores in the same factor as the neuroticism scores: "nervousness", as far as it can be measured by Eysenck's "neuroticism" scale does not appear to be bipolar to the scores on the stories. On the other hand, "neuroticism" does appear as opposed to success in "chemicals" on Table XXXVI, Factor III.

(b) Did there seem any relationship between the children's social background as measured by questionnaires (Appendix B) and their answers on the historical stories?

While it must be realised that there were probably not very wide discrepancies in the children's social backgrounds, and that their background was measured in an indirect manner through questionnaires, "social background" appears as an independent, specific factor on Table XXXV, Factor VI, and thus not associated with the answers on the historical passages.

(c) Was there a relationship between reading skill as measured by the N.F.E.R. Sentence Reading Test I (Appendix B) and scores on the historical stories?

Scores on the Reading Test appeared, as expected, on Factor I of Table XXXV. This factor reflects general scholastic achievement. The N.F.E.R. Test does not appear on Factor IV, Table XXXV, a factor indicating success on the historical stories.

(d) How far were the measures assessing logical thinking grouped together?

If we take the first nine variables as those which reflect intellectual abilities, Factor I of Table XXXVI shows loadings on all except the Series and Numerical Analogies Test, N.F.E.R. Sentence Reading and Chemicals. The same result obtains for Factor IV, Table XXXV, Factor II of Table XXXVI appears to be a g/v:ed factor with loadings on I.Q., Series and Numerical Analogies and the Reading Test. The Series and Numerical Analogies do not appear to be as closely associated with "balance" as do the historical stories but have a loading on those factors which seem to reflect general intellectual ability.

(e) Is there any relationship between moral judgments and logical thinking on historical passages?

When calculating the median from the point of view of the phi-coefficient the responses on two of the questions set to assess moral judgments had to be rejected since the distribution was so markedly skewed towards the lower end of the scale. The responses on Question (4)a of "Ancient Greece" formed a more normal distribution and loaded separately from the scores on the historical stories in both analyses (Tables XXXV and XXXVI). For this question only, then, the grades on the moral judgment scale stand apart from the grades derived from the scale for logical thought.

PART VIITHE RESEARCH PROJECT WITH THE PUPILS
IN THE SECONDARY SCHOOLSCHAPTER I : THE RESEARCH PROGRAMME(1) THE AIMS

The major aims of the research project were:

- (a) To assess the level of logical thinking in respect of passages concerned with history,
 - (i) at the end of the pupils' second year in secondary education (12-13 years),
 - (ii) at the end of the pupils' third year (13-14 years).
- (b) To attempt to accelerate the development of thinking skills through the teaching of history with one class of children (henceforth to be called 3E - experimental) while adopting what will be called traditional methods with another class (3T henceforth). In order to compare taught classes with a non-taught group, classes of children of the same age range in co-educational schools were also assessed twice at a yearly interval. One class (3C) acted as the general control group, the other (3C(2)) was the control group for the "taught" passage on the "The Russian Revolution".
- (c) To compare the average level of responses on the passages with those obtaining on two typical Piagetian experiments, namely, equilibrium in the balance and the combination of colourless liquids.
- (d) To examine the level of written as compared with spoken responses, 3C writing their answers on "The Russian Revolution", 3E and 3T on "Slavery" (see Appendix A).
- (e) To investigate certain variables which might be associated with the levels of logical thinking such as scores on a verbal reasoning test (Manchester General Ability Test (Senior) 2.); personality factors measured through Eysenck's inventory and certain items of the Terman-Merrill personality questionnaire (Appendix B);

attitudes as assessed by the Osgood Semantic Differential Test and the Aberdeen Academic Motivation Inventory (Appendix H); social class as reflected through the father's occupation (Registrar-General 1961).

(2) THE SCHOOLS AND THE TEACHERS

The research into the thinking of secondary school pupils was carried out in the same northern area mentioned in Part VI. For this part of the research project pupils were needed whose thinking skills in history at the beginning of the teaching programme were (hopefully) at the upper end of the concrete operational range and possibly intermediate between the concrete and formal levels. From previous research (Hallam 1966) it was anticipated that most secondary modern pupils would be entering the fourth year of school before such a stage was reached and that an investigation with such pupils would be impossible since it would interrupt their preparation for public examinations. Pupils in secondary grammar schools, however, should be at the advanced concrete stage during their third year in secondary school. The headmaster of the only co-educational grammar school in the district was therefore approached and he gave his permission for two third year forms to be tested and taught for one year by myself. Before meeting the children the headmaster assured me that the two classes were equal in respect of their mean scores on standardised verbal reasoning tests. Upon inspecting the records compiled on their entry to the school, however, it was obvious that the children had been streamed on the basis of the eleven-plus marks. I had been given the top two forms out of four. In order to try to avoid any results being attributed to the higher measured ability of the children in the top class, the less able group was taken as the experimental one (3E), with the more able group following traditional methods (3T).

The two classes were taught on Tuesday and Thursday afternoons from September 10th to June 19th (inclusive) at these times:

Tuesday:	3E	2.00 p.m. to 2.40 p.m.
	3T	2.40 p.m. to 3.20 p.m.
Thursday:	3T	2.00 p.m. to 2.40 p.m.
	3E	2.40 p.m. to 3.20 p.m.

The school expected the pupils in 3E and 3T to complete one History homework a week; this was intended to occupy the pupils for about 40 minutes on average.

In so far as any institution can be called "typical", the school seemed a typical grammar school. The timetable was divided into a number of subject periods, the academic subjects being taught by a graduate staff. Children or staff moved at the end of every forty minute period. The staff were not asked to describe their teaching methods but the predominantly didactic methods used during the research with 3T caused no overt surprise while the more challenging approach initiated with 3E seemed to worry a number of the girls in that class. Homework was an integral part of school life; there was never any trouble over having it presented for marking at the correct time. Extrinsic rewards, chiefly in the shape of "Merit Cards", were a regular feature of the school life, as were the annual examinations for all the classes.

The staff were extremely helpful in all respects. They seemed interested in the research, provided most convenient facilities for testing, and asked at regular intervals about any progress or tentative results. The two history teachers whom I replaced appeared different types of men. One seemed rather apprehensive and had had troubles with the boys of 3T when they had been in the second form while the other, a younger man, was more easy-going and had maintained agreeable relationships with the pupils of 3E. During the third year both forms followed the same history syllabus, chosen by the head of department. Three forms of the third year in all studied the history of Russia, the U.S.A. and Africa, one form taking each country for a term. The work of each term was based on one text-book (see Appendix K), the books being exchanged with the other forms at the end of each term.

A control group was not available from within the school through time-table difficulties. The appropriate age group from the nearest co-educational grammar-type school was therefore used as the control group. This school was in pleasant surroundings in the country and the children were most friendly and co-operative. Most of them had entered the school as a result of passing the eleven-plus examination but some were fee-payers who had failed that examination. The headmaster and history teacher, who was also the form-teacher, made me very welcome and provided useful facilities for the testing sessions. Class 3C followed a different history syllabus from 3E and 3T, studying British history of the seventeenth and eighteenth centuries together with aspects of the British constitution during the Summer Term. The history teacher, a dynamic person, tended to talk to and with the class, then make notes on the topic being studied. She believed in project work but this type of learning was limited through a lack of resources. She did not do very much group work because of its time-consuming nature; hence the children worked mainly on their own. To a question on the value of posing problems to the pupils, she replied that they tended to pose their own problems. This occurred, she said, in that they queried her remarks, especially if she was dealing with more modern history. In all, this teacher appeared to have a lively, easy relationship with the class using methods which were basically teacher-directed.

(3) THE CHILDREN

There were between 30 and 36 children in each class but in order to equate the numbers of boys and girls the final sample was restricted to 13 boys and 13 girls in each sub-group. This meant that while every pupil in each class was tested individually on the historical passages and the Piagetian experiments, a number had to be eliminated from the final analysis by the use of random sampling numbers (Lindley and Miller 1968, pp.12-13).

As was to be expected, these children were of above average intellectual ability when measured on the Manchester General Ability Test (Senior) 2. Their mean I.Qs are as shown in Table XXXVIII(a).

Table XXXVIII(a) Mean I.Q. scores for the Secondary groups

	3E		3T		3C	
	I.Q.	S.D.	I.Q.	S.D.	I.Q.	S.D.
Boys	127.4	7.66	130.4	8.96	116.8	11.15
Girls	121.8	5.40	133.0	7.69	114.9	9.56

There were significant differences between each pair of sub-groups as is indicated in the second part of this table. Analysis of covariance (Chapter III), however, allows for the adjustment of each sub-group's average scores on the historical passages for variations in intelligence quotients.

Table XXXVIII(b) Levels of significant difference between the paired secondary groups

				P
<u>BOYS</u>	3E	v	3T	<.01
	3E	v	3C	<.001
	3T	v	3C	<.001
<u>GIRLS</u>	3E	v	3T	<.001
	3E	v	3C	<.001
	3T	v	3C	<.001

Socially, by far the largest percentage of the pupils came from Classes II and III (88.45%) but numerically 3E had fewer parents in Class II (7) than either 3T (18) or 3C (17).

Table XXXIX Classification of the secondary pupils according to their fathers' occupations (Registrar General 1961)

		Class I	Class II	Class III	Class IV	Class V
3E	Boys	1	4	8		
	Girls	1	3	6	3	
3T	Boys		9	3	1	
	Girls	1	9	3		
3C	Boys	1	8	4		
	Girls		9	3	1	

Table XXXIX (continued)

Total	4	42	27	5	78
Percentage	5.12%	53.84%	34.61%	6.41%	99.98%

In the same manner as the primary pupils (Part VI, Chapter I), these secondary pupils were rated by their form teachers on selected items of the Terman-Merrill Inventory. The ratings took place towards the end of the pupils' third year in secondary schools. This meant the teachers of 3E and 3T had been the form-teachers of those pupils for three years while 3C had had the head of history as form teacher for two years. While warnings were given verbally about a possible "halo effect", and about the grammar school pupils at least being atypical as far as intelligence was concerned, it might be considered that the teachers of 3E and 3C were grading too tightly towards the mean (Table XL). Certainly, the pupils of 3T were rated as well above average on all the traits while the scores of 3E and 3C centred more around the norm for their age group. It is interesting to note that the girls of 3E were marginally the lowest of any sub-group on such "motivational" traits as "will-power and perseverance" and "desire to excel", judgments which seemed borne out during the teaching programme (see, for example, the comments on January 16th, Appendix K, p.275).

Table XL. Average ratings on the Terman-Merrill Inventory (secondary pupils)

	3E		3T		3C	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
Self-confidence	3.8	4.0	5.3	5.0	4.0	4.0
Will-power and perseverance	4.4	3.7	5.2	5.6	4.0	4.5
Desire to excel	4.8	4.3	5.3	5.5	4.2	4.8
Conscientiousness	4.8	4.3	5.3	5.8	4.4	4.8
Desire to know	4.9	4.4	5.5	5.4	4.5	4.5
Originality	4.8	4.3	5.5	5.3	4.3	4.3
Common-sense	4.8	4.5	5.3	5.9	4.2	4.4
Intelligence	4.9	4.6	5.7	5.9	4.1	4.7

The Junior Eysenck Personality Inventory was answered by the secondary pupils as well as by the primary (Part VI, Chapter I) with results as in Table XLI.

Table XLI The mean scores for extroversion and introversion (secondary pupils)

BOYS (14 years of age)	Extroversion	S.D.	Neuroticism	S.D.
Eysenck's norms (1973)	17.836	3.798	10.847	4.826
3E	15.769	5.181	10.615	5.723
3T	17.077	3.749	9.692	3.749
3C	17.385	3.476	11.154	5.376

Table XII (continued)

GIRLS (14 years of age)	Extroversion	S.D.	Neuroticism	S.D.
Eysenck's norms (1973)	17.471	3.715	13.920	4.811
3E	20.231	3.332	13.231	3.945
3T	16.077	4.376	13.154	4.564
3C	17.303	2.919	13.154	3.676

Despite the small numbers in each sub-group, the means generally resemble those obtained by Eysenck (1973). There was no significant difference among the average scores on the neuroticism variable for the two sexes, but 3E girls scored significantly higher on the extroversion variable than either 3T girls ($P < .02$) or 3C girls ($P < .05$). It will be remembered (see p.227) that Eysenck has opined (1972, p.96) that it is introversion which seems to favour good performance at secondary school.

The teachers' assessments of motivational traits on the Terman-Merrill Inventory seem supported by the results on the Aberdeen Academic Motivation Inventory. From his own investigation Entwistle (1968, pp.181-188) explains that the scores on the inventory were found to correlate more closely with school attainment than with reasoning ability as measured by standardised verbal reasoning tests. "This result suggests that the inventory is measuring a non-intellectual trait independently related to school attainment" (op.cit. p.183). Furthermore, while academic motivation scores are related to social class, this does not occur "to any great extent" (op.cit. p.186). The results with the pupils in the present research as shown in Table XLII reveal that the average scores of all the sub-groups other than 3E girls were higher, or similar to, those found by Entwistle. Within the same sex groups the only significant difference ($P < .05$) was that between the scores of 3E girls and 3T girls.

Table XLII The mean scores on the Aberdeen Academic
Motivation Inventory

BOYS (14 years of age)	Mean Score	S.D.
Entwistle's norms* (11-13 years)	15.55	4.54
3E	17.538	2.678
3T	18.538	3.543
3C	16.077	4.992
GIRLS (14 years of age)	Mean Score	S.D.
Entwistle's norms* (11-13 years)	16.65	3.91
3E	14.466	5.002
3T	18.384	2.761
3C	16.308	3.969

* Entwistle 1968, p.183.

On the measures considered so far in this section it appears that the girls of 3E had characteristics which differentiated them from the other female sub-groups, especially from 3T. They scored significantly lower on the verbal reasoning test than did 3T girls ($P < .001$), were graded lower on the Terman-Merrill Inventory, had more parents in Social Classes III and IV of the Registrar-General's scale (nine in total), were significantly more extroverted and significantly less motivated than the girls of 3T. The boys of 3E, on the other hand, did not stand out so markedly from their peers. They were significantly less intelligent than 3T ($P < .01$) and made lower mean scores on the Terman-Merrill and Aberdeen Inventories but these were not significant. Their mean score on

extroversion was lower than 3T's but, again, there was not a significant difference. If these results had been known before the teaching programme began, the forecast might have been that the girls of 3E were less likely to appreciate the experimental situation than any of the other three sub-groups to be taught during the year.

Whereas the attitudes of the primary school children were thought to be still too changeable to be capable of useful measurement, it was decided to assess the secondary school pupils' attitudes on the "semantic differential" devised and developed by Osgood et al (1957). The differential consists of a number of bipolar adjectives such as "important - unimportant" (Appendix H) against which the subject is asked to judge a particular concept or phrase. In the present case all the words used were associated with history and the teaching of history (Table XLIII). Osgood (op.cit. p.67) deduced 50 bipolar scales in which three major groups could be identified. These indicated judgments of value (evaluative), strength (potency) and activity. The evaluative factor is by far the strongest, Nunnally (1970, p.439) commenting thus: "In some studies it is so strong that little common variance is left to define other factors. The evaluative is prominent because nearly all adjectives imply negative and positive characteristics. Actually, it is difficult to think of bipolar pairs of adjectives that do not hint at evaluation." In the present study thirteen pairs of bipolar adjectives were given to the pupils (Appendix H) but only nine evaluative pairs were used for statistical analysis.

There has recently been some concern over the validity of the semantic differential. Nunnally (op.cit. pp.441-442) explains how the interaction of scales with concepts places a limit on the extent to which individual scales can be interpreted in the same way when applied to different concepts. Nunnally's example is that "tough tender" and "valuable worthwhile" cannot be applied meaningfully both to "steak" and "sports car". Nunnally does allow that less scale-concept interaction is likely to occur when all the concepts in a particular study

are from the same domain of discourse - which is what happened in the present research. Another problem occurs regarding the internal agreement of scores on various evaluative scales. In a study of ten agoraphobic married women Presley (1969) has shown how there were on occasions low correlation coefficients between the scales on a concept such as "Children" (op.cit. p.111). Despite such doubts about the semantic differential as a means of measuring attitudes, Nunnally's (1970, p.443) final decision is that it is "probably the most valid measure of connotative meaning available", "connotative" implying the meaning that the concept has for the pupil. In the present research the pupils assessed the concepts shown in Table XLIII at the end of their second and third years in secondary school. The nine evaluative bipolar adjectives were summed for each concept and a 't' test carried out in order to ascertain if there had been a significant shift in the children's attitudes over the year.

Table XLIII The mean scores on the Osgood Semantic Differential
for the two occasions of testing

		HISTORY IN SCHOOL			THE HISTORY TEACHER		
		Second Testing	First Testing	Level of Significance	Second Testing	First Testing	Level of Significance
3E	Boys	4.163	3.923	N.S.	3.846	3.896	N.S.
	Girls	4.435	4.003	N.S.	4.273	4.238	N.S.
3T	Boys	4.113	3.289	<.002	3.745	3.188	N.S.
	Girls	4.505	4.343	N.S.	4.257	3.889	N.S.
3O	Boys	3.461	3.513	N.S.	4.025	3.615	<.01
	Girls	3.768	3.983	N.S.	4.025	3.992	N.S.
		HISTORY FOR UNDERSTANDING LIFE TODAY			CLASS DISCUSSIONS IN HISTORY		
		Second Testing	First Testing	Level of Significance	Second Testing	First Testing	Level of Significance
3E	Boys	3.824	3.718	N.S.	4.273	4.016	N.S.
	Girls	3.872	4.078	N.S.	4.503	4.232	N.S.
3T	Boys	3.975	3.743	N.S.	4.342	4.166	N.S.
	Girls	4.256	4.453	N.S.	4.224	4.307	N.S.
3O	Boys	3.685	3.462	N.S.	3.769	3.650	N.S.
	Girls	3.814	3.864	N.S.	3.863	4.043	N.S.

Table XLIII (continued)

		HISTORICAL DOCUMENTS			VISITING HISTORIC PLACES		
		Second Testing	First Testing	Level of Significance	Second Testing	First Testing	Level of Significance
3E	Boys	3.846	4.152	N.S.	3.992	4.093	N.S.
	Girls	4.453	4.682	<.05	4.612	4.453	N.S.
3T	Boys	4.1453	4.0430	N.S.	4.291	3.778	<.002
	Girls	4.043	4.512	N.S.	4.574	4.660	N.S.
3C	Boys	3.829	4.266	<.05	4.154	4.350	N.S.
	Girls	4.027	4.085	N.S.	4.335	4.110	N.S.
		NON FICTION (HISTORY)			FICTION (HISTORY)		
		Second Testing	First Testing	Level of Significance	Second Testing	First Testing	Level of Significance
3E	Boys	3.625	3.993	N.S.	3.829	3.623	N.S.
	Girls	3.584	3.961	N.S.	3.941	3.867	N.S.
3T	Boys	4.180	3.998	N.S.	3.188	3.115	N.S.
	Girls	4.275	4.188	N.S.	3.435	3.700	N.S.
3C	Boys	3.718	4.009	N.S.	3.478	3.378	N.S.
	Girls	3.531	3.555	N.S.	3.718	3.821	N.S.
		FILMS AND PLAYS (HISTORY)					
		Second Testing	First Testing	Level of Significance			
3E	Boys	4.034	4.222	N.S.			
	Girls	4.402	4.308	N.S.			
3T	Boys	3.770	3.702	N.S.			
	Girls	3.983	4.376	N.S.			
3C	Boys	4.078	4.257	N.S.			
	Girls	4.112	4.026	N.S.			

Table XLIII reveals a general lack of movement at a statistically significant level over the two periods of assessment. It is true that the boys of 3T showed a significant improvement at the .002 level with regard to "History in School". This result possibly reflects the fact that it was known that they had a poor attitude to history in the previous year due to an approach unsuited to them. A reasonable conclusion on the results of the Osgood Semantic Differential would seem to be that while the pupils remained in general favourably disposed towards all the concepts relating to aspects of history teaching, the methods deliberately adopted with the two taught groups led to little significant difference in their attitudes.

(4) THE ASSESSMENT PROCEDURE

The historical passages used with the secondary pupils consisted of "Ancient Sparta and Athens", "The Norman Conquest", "The Russian Revolution" and "Slavery" (Appendix A). Of these, the first had been used with the primary pupils, the second in previous and other research (Hallam 1966, Stokes 1970), while the last two related to the syllabus to be followed with 3E and 3T. In the same manner as with the primary pupils (Part VI, p.230) the aim was to discover whether the children would reveal evidence of any improvement of responses from having been taught in different ways. One means of assessment was through the scores on passages connected with the year's syllabus and the other was through the average scores on three historical passages. Some critics of the earlier research (Hallam 1966) have suggested that the subjects might have presented higher level answers if they had been allowed to write rather than speak their responses. Therefore, in the present research the children of 3E and 3T wrote their answers on "Slavery" while the pupils of 3C wrote their answers on "The Russian Revolution". This meant that the grades given to 3E and 3T on their replies to "The Russian Revolution" had to be analysed against a control group which had also talked about the questions. Hence, on that passage only, another control group was used, called from now on 3C(2). These pupils

were in the "A" stream of a two stream entry country grammar school in the North of England following a syllabus which involved predominantly British history.

The procedure with the pupils of 3E, 3T and 3C followed the lines already developed with the primary pupils. The head of history at the grammar school and the form teacher of 3C introduced me to the pupils. The children were tested individually on three historical passages and also on the two Piagetian experiments used with the primary subjects. The passages were given in this order: "Ancient Greece", "The Norman Conquest" and either "The Russian Revolution" (3E and 3T) or "Slavery" (3C). The children of 3E and 3T thus wrote their answers on "Slavery" while the children of 3C answered questions on "The Russian Revolution" in that manner. Having the pupils write their replies proved a very time-saving method. The Piagetian experiments were often tackled during the lunch hour or after school had finished. After the scripts resulting from the individual interviews on the historical passages had been transcribed the answers were graded separately by the same external assessor who had marked the primary scripts, using the same nine point scale (Part VI, pp.257-258). The answers on the Piagetian experiments were assessed by one of the experienced experimenters mentioned in Part VI, and by myself. Any discrepancies in respect of grades on either the historical passages or the Piagetian experiments were resolved by my supervisor.

One year after the initial testing, the children were assessed again on the same passages and experiments. For 3E and 3T there was, therefore, an interval of about three weeks between the final lessons of the course and the second session of testing. There were, however, longer intervals between the final lessons on the U.S.S.R. (December 29th for 3E and March 27th for 3T), although revision occurred on many aspects of the history studied during the year during the final week of the teaching programme (Appendix K). After the second batch of scripts had been transcribed they were moderated in the same manner and by the same people as on the first

occasion. The following figure may help to illustrate the major pattern of the research and teaching programme:

Figure III

The pattern of the testing and teaching programme
in the secondary schools

Testing of 3C on 3 passages and 2 Piagetian experiments. Written answers on "The Russian Revolution"	June
Testing of 3E and 3T on 3 passages and 2 Piagetian experiments. Written answers on "Slavery"	July
Teaching history to 3E and 3T from September 10th to June 19th (inclusive) on Tuesday and Thursday afternoons.	September to June
Testing of 3C on 3 passages and 2 Piagetian experiments. Written answers on "The Russian Revolution"	June
Testing of 3E and 3T on 3 passages and 2 Piagetian experiments. Written answers on "Slavery"	July

(5) AN ANALYSIS OF THE QUESTIONS ON THE FOUR HISTORICAL PASSAGES

The general pattern in devising the passages with the primary pupils (see Part VI, pp.232-233) was also followed with the passages intended for the secondary subjects. The questions, however, were aimed at eliciting answers at the formal or nearly formal levels as well as the concrete and preoperational levels.

Ancient Sparta and Athens

These questions have been discussed earlier (see Part VI) and examples given of answers at the preoperational and concrete levels (Appendix C). While most of the secondary pupils were graded globally at the concrete or intermediate concrete/formal levels on the two testings, there were

instances when these children showed that they could not operate at these levels on individual questions. Examples of their answers are given in Appendix I.

The Norman Conquest

Question 1(a) and (b) was intended to assess the children's ability to handle classes and sub-classes (cf. Question (1) on "Ancient Sparta and Athens", Part VI, p.233), while Question 1(c) required them to put the invaders into a series based on some logical criterion, whether from the passage or from their historical knowledge. For success, Question (2) needed a comprehension of the peculiar meaning of "just" within the context of the soldier's statement and also some understanding of the soldier's emotions.

Question 3(a) could have been answered at the level of concrete operations by detailing the events as described in the passage (cf. Elton's (1967) "simple details of accurate historical geography), or at a hypothetical level. Answers at the formal level might have depended on prior learning ("referring the phenomena causally to previous phenomena" (Peel 1971)) whereby the children instanced such reasons as William's need for a barrier of "burnt earth" to stop Scottish invasions or the need to teach the English never to rebel again. Question 3(b) appears initially to be a question needing only a moral judgment response but it can be answered at the hypothetical level. For example, a subject could discuss what is meant by "right: from whose point of view are we judging whether it was "right"; did the destruction succeed in its objective, and so on. Here is how OR (13:7; I.Q.124) replied. He started with a possibility, referring implicitly to the evidence, and his answers seem to lie within the range intermediate between concrete and formal since his suppositions are not always based on evidence.

"Probably he did it in a fit of rage and probably he regretted it a bit afterwards. I doubt it, though (that is, whether it was right); it is not very good to kill ordinary country people who probably did not have much to do with it."

"What do you doubt?"

"I doubt if he would have done it - he was probably very mad at the time or else very cruel with the leaders of the Danes but not the ordinary country people who probably didn't know about it."

Question 3(c) also required some form of realistic hypotheses; CR managed to produce this suggestion:

"Hm - he could have rounded up all the leaders of people who rebelled against him and then executed or thrown them in prison or something."

"Anything else he could have done?"

"No"

Question (5) asked the children to discuss the question of bias in contemporaries' reports: "the weighing of evidence, the detection of bias" (I.A.A.M. in Sturley 1969). Question (5) could be answered by extrapolating from the evidence available; by attention to immediately observed features such as the fact that much of Northern England was "waste" (concrete), or by postulating a number of reasons for the Domesday Survey.

The children had to deduce that it was likely that Tadcaster had been spared from devastation by noting the comparative values of Tadcaster and Seacroft from 1065 to 1086 (Question 6(a)). This question could also be considered as one requiring the manipulation of a 'whole' (North of England) and 'parts' (Tadcaster and Seacroft). Through undue concentration on the description of devastation in the North, children might fail to realise there might have been exceptions. For the second part of this question they had to put forward hypotheses to explain Tadcaster's increase in value.

Question (7) was placed last, whereas it was the first question in the 1966 research. The position was altered because it had been suggested since 1966 that subjects might be helped in answering this question if they worked their way through the passage. Even some of these intelligent children, however, still centred on one of the two aspects of William's policy mentioned in the passage, usually on the devastation of the North.

Many were able to compare and contrast the two pieces of evidence but few were able to hypothesize at any advanced level (see Appendix I).

The Russian Revolution

The questions on this passage were set chiefly to discover whether the children would answer from the information within the passage or if they could postulate hypotheses and envisage possible explanations. Reference to Table IX (see pp.189-191) may show that the answers may be able to be graded on criteria devised by a number of writers. For example, most of the answers designated at the concrete level in this research can be regarded from the criteria devised by Peel (1965 and 1971) and Coltham and Fines (1971). Furthermore, it does not seem to be stretching the proposed relationship too far to see in the concrete answers quoted here and in Appendix I the comment by Kitson-Clark that, "The historian's first duty is careful observation to use the evidence to get as near as is practicable to an accurate account." (1967). Answers at the formal level seem to reflect Peel's (1971) "Comprehensive - Imaginative" standards and Coltham and Fines' (1971) "extrapolation forwards or backwards from collected evidence, interpretation from own fund of knowledge and experience" - though, it has to be stressed again, Coltham and Fines do not make any attempt whatsoever to place the educational objectives in any sort of hierarchy. The quotations selected at or near the formal level also seem to reveal something of Elton's consideration of "the probable and possible as well as the obvious" (1967) and the I.A.A.M's "weighing of evidence the distinguishing of truth from falsehood, or at least the probable from the impossible" (in Sturley 1969). Since it can be argued that children would have performed better if they had been acquainted with the material before the interviews, all the examples given here and in Appendix I are taken from the second group of answers which were given after the children of 3E and 3T had studied the history of the Russian Revolution of 1917.

Question 1(a) could be answered fully from the passage, or the child could put forward arguments, possibly based on previous but assimilated learning, that Russian society was so anachronistic that revolution was almost inevitable, that the only way any form of popular participation in the government could occur was with the removal of the Tsar, and so on. Similarly, 1(b) could be answered in a simple manner such as "Because most people lived there", or at a more developed level, suggesting that the concentration of people in a city might increase misery which would fuel anger, but also conspiracy is easier in a city than the countryside, and so on. Here is how OG (13:11, I.Q.129) answered on the second time of testing:

"Because it was the capital of Russia at that time and most of the factories - most of the workers went to work in the factories in Petrograd."

"Why would these facts make Petrograd the centre of the revolution?"

"Most of the workers were there and unlike the peasants who had to work else they wouldn't get any food at all, the workers didn't have to work for food and they could strike and the peasants couldn't (strike) in villages." (Intermediate between concrete and formal)

The subjects could explain in reply to Question (2) that the Tsar and his family were murdered because the people hated them (forecasting a result from the evidence available and hence concrete), or they could postulate a number of reasons (formal). Karl Marx's famous slogan in Question (3) could be interpreted with concrete-type imagery visualising the peasants as "tied" to the landowners. On the other hand, the essential metaphorical and world-wide implications might be appreciated. Question 3(b) enabled the pupils to repeat some truism culled from parental opinions and/or the news media, or to analyse the whole conception of private property, putting forward an argument, counter-posing another, and reaching some form of conclusion.

The reason for Lenin's return to Russia (Question 4) could be deduced from the passage as intended to make trouble or overthrow the provisional government (concrete) or, the value to Germany in the event of a Russian collapse of fighting on only one front could be realised. In order to reach the formal level proper, however, some consideration of the implications of the German policy were needed. Question 5 was able to be answered directly by following the passage: "This was a bad mistake for them as most Russians" It also gave a chance for the subjects to analyse some of the implications in the provisional government's decision. The meaning of the first two words in Lenin's slogan, "Peace, land and bread" (Question 6) could be gained directly from the text and "bread" is a type of intuitable data: this question was, therefore, marked only at the concrete or lower levels.

Question 7 could be answered thoroughly by using the information given but also gave the chance for the pupils to realise the political and even ideological implications of the Allies' help to the "White Armies". NORM (14:3, I.Q.119) seemed to be approaching or at the formal level with this answer:

"Didn't want them to stop the war with Germany."

"So - why would they help the White Armies attack the Bolsheviks?"

"If they managed to overthrow the Bolsheviks the White Armies would be in power so they could carry on with the war then."

"Any other reasons why France, Britain and the U.S.A. helped them?"

"Might not have wanted Karl Marx's ideas to spread into such a big place."

"Which ideas?"

"Everything owned by the State and couldn't inherit things."

"Why would France and the other countries not want such ideas to spread?"

"France, Britain and America were - er - they had land owned by rich people."

"Any other ideas why they supported the White Armies?"

"Because Russia had cancelled all the money that they owed and they might want it back."

While it could be argued that this boy was possibly merely making use of material learnt during the Autumn Term, then if this is what he was doing, he was doing so in an intelligible manner. Although supplementary questions had to be used to elicit the arguments, his reply can be contrasted with that of an intelligent, interested girl in the same group who could give only a limited, uncertain answer. LO (14:6, I.Q.129)

"Because they didn't agree with the peasants owning land."

"Why would Britain, France and America help the White Armies then?"

"They thought they should have their own land - a bit of privacy."

"Any other ideas or reasons?"

"No" (Intermediate preoperational and concrete).

A defence of Question (8) as demanding more than mere repetition of data from the mass media has already been made (see Part I, pp.61-62): while a child may seem to be only using "ideas in the air", at the formal level he must do so in an informed manner, putting forward ideas and referring them causally to previous phenomena and generalisations (Pool 1971). It was noticeable on the second testing how many of the children on this question either could not suggest one feasible result or could merely iterate: "Russia is Communist today".

Slavery

Questions 1(a) and (b) aimed to discover if the pupils could handle classes and sub-classes, or, in Pool's words (1971, p.25), give responses based solely from the given content of the passage. Question 2 allowed the pupils to make use of a clue in the text where it was explained that the African chiefs had slaves who had certain rights and also to put forward their own theories (see, for example, CRAW's answer in Appendix I, p.222). Relevant information from the passage could be used in reply to Questions 3(a) and (b); the children could also give their own explanations.

Question 4(a) required them to realise what might appear the "works of the Lord" to an eighteenth century captain; while 4(b) needed the ability to appreciate Newton's stance from an eighteenth century point of view. Question 5 also gave the pupils the chance to use information derived from the passage or to postulate additional explanations. Questions 6(a)(b)(c) asked the subjects to negate the statements and/or put forward compensatory arguments. Question 7 continued the discussion on the defence of slavery, allowing them to suggest other possibilities. Question 8 is very similar to Question 8 on "The Russian Revolution" and is open to the same criticisms and justifications which that question raises.

(6) THE PIAGETIAN EXPERIMENTS

Following a similar pattern to that described in Part VI (pp.235-9), the secondary school pupils were tested twice on two Piagetian experiments, the combinations of colourless liquids and equilibrium in the balance (Appendix D), with results as shown in Tables XLIV and XLV.

Table XLIV The Combinations of Colourless Liquids

(a) Results on the first testing

Substage	1A	1AB	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	9	
3E	Boys				7	5	1			13
	Girls		2	1	2	6	1	1		13
3F	Boys				5	5	1	2		13
	Girls			1	8	2	2			13
3G	Boys			1	9	3				13
	Girls	2		2	5	4				13
Totals	2		2	5	35	25	5	3		78
Percentages	2.56		2.56	6.41	46.15	32.05	6.41	3.85		99.99%

Table XLIV The Combinations of Colourless Liquids

(b) Results on the second testing

Substage	1A	1AB	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	9	
3E	Boys			1	8	1	2	1		13
	Girls		2	3	4	3	1			13
3T	Boys			2	2	3	5		1	13
	Girls			2	5	3	3			13
3C	Boys			2		3	5	3		13
	Girls			1	3	5	2	2		13
Totals			2	11	22	18	18	6	1	78
Percentages			2.56	14.10	28.20	23.08	23.08	7.69	1.28	99.99%

At the end of their second year in secondary school the great majority of these subjects were thus within the concrete level on the combinatorial experiment (80.61%). While there was little change one year later in the responses of the pupils of 3E and 3T, there was quite a leap forward in 3C with twelve children graded at, or entering, the formal level. Not one had been so graded at the end of the second year. When one remembers that the boys and girls of 3C on average were of lower ability than their respective sub-groups in 3T and 3E (see p.287), this improvement appears even more remarkable. No reasons can be adduced for the difference in improvement since the science teaching within the schools was not investigated.

Hughes' subjects (1956) found the balance experiment more difficult than the combining of the colourless liquids. As can be seen, however, from Table XLV(a) while more of the present subjects' grades were allocated to the lower end of the scale on the balance than the chemicals experiment, yet 26.92 per cent of the replies were graded beyond the concrete level during their second year. Within this sample there is an

Table XIV Equilibrium in the Balance

(a) Results on the first testing

Substage	1	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total	
Quantification	1	2	3	4	5	6	7	8		
3E	Boys		1		3	2	2	4	1	13
	Girls			3	4	1	2	2	1	13
3T	Boys	1	2	3	5			1	1	13
	Girls		4	1	3	1	2	2		13
3C	Boys		1	3	5	1	2	1		13
	Girls	1	2	2	7	1				13
Totals	2	10	12	27	6	8	10	3	78	
Percentages	2.56	12.82	15.38	34.62	7.69	10.25	12.82	3.85	99.99%	

interesting difference between the scores of 3E, 46 per cent of whom were beyond the concrete level, and the scores of 3T, only 23 per cent of whom were rated at that advanced level. Yet both the boys and girls of 3T scored significantly higher on the Manchester General Ability Test (Senior) (see p.237). Furthermore, while the three sub-groups 3T boys, 3E boys and 3T girls made a similar total score on the Series and Numerical Analogies Tests (173, 175 and 176 respectively), the girls of 3E scored only 151 correct answers from a possible total of 203 for that test. Both classes had been taught the principle of the law of moments during the three weeks preceding the first testing session, although by different teachers. From their answers it seemed that the teacher of 3E had helped many of the children to comprehend the rule through the use of apparatus and relevant advice such as, "Multiply the weight by the number of the hole". On the other hand, many of the able children of 3T seemed confused when asked questions on the equilibrium experiment. In particular, the concept of "ratio" seemed to puzzle them.

Table XIV Equilibrium in the Balance

(b) Results on the second testing

Substage	1	1B/2A	2A	2AB	2B	2B/3A	3A	3B	Total
Quantification	1	2	3	4	5	6	7	8	
3E	Boys		2	1	1	3	6		13
	Girls		1	3	1	2	6		13
3T	Boys		4	4	2		2	1	13
	Girls		1	2	3	1	3	3	13
3C	Boys		1	1	4	4	2	1	13
	Girls		1	2	6	3	1		13
Totals		2	12	18	12	13	19	2	78
Percentages		2.56	15.38	23.08	15.38	16.67	24.36	2.56	99.99

Despite their lower level of measured ability, and the lower level of motivation for the girls of 3E (see p.291), it can be seen from Table XLV(b) that these pupils maintained their advantage over 3T when tested at the end of their third year. It would thus seem that the teaching of the principle of moments had been more successful with 3E than 3T. Many of the boys and girls of 3E appear to have assimilated some useful algorithms to use in the particular circumstances of this experiment. Nevertheless, some of the girls of 3E in particular were less successful on the Series and Numerical Analogies problems, a result suggesting that the general scheme of proportionality had not been elaborated.

(7) MORAL JUDGMENTS IN HISTORY

In addition to the two questions used with the primary children ("Ancient Greece", Questions 4(a) and 5(a)) answers to two questions from "The Norman Conquest" were assessed on the moral judgment scale with the secondary pupils.

Question 3(a) "Was it right to carry out such a severe (heavy) punishment?"

This seemed to require various dimensions of moral development such as children's ideas of fairness with regard to the punishment of misdeeds, older children being expected by Piaget to favour increasingly social sanctions as a means of control (1932, p.197); collective responsibility; duty as obedience to authority.

Question 7 "Do you think William of Normandy was a cruel man?"

Here these older children were expected to take account of mitigating circumstances surrounding William's policies such as the uncertainty of his position as a recent conqueror and, possibly, to proceed beyond that level into an appreciation of William's actions against a context of wider, more universal principles.

Kohlberg (1963) has extended Piaget's ideas on the development of moral judgments using stories in which acts of obedience to legal-social rules or to the commands of authority conflict with human needs or the welfare of others. From his research, largely with children aged beyond ten years, Kohlberg has developed a scale of three levels which subsumes six stages. The answers of the secondary pupils were graded both on that scale and on Piaget's. It was found, however, as evidently occurred also with Lydiat (1971, p.203), that Piaget's scale provided a perfectly adequate means of assessment for these questions, and the scores in Table XLVI are derived from that scale.

Table XLVI Mean scores on moral judgments
in history (secondary pupils)

Occasion of testing	Greece 4(a)		Greece 5(a)		Norman 3(b)		Norman 7		
	First	Second	First	Second	First	Second	First	Second	
3E	Boys	2.00	2.11	2.42	2.19	2.12	2.31	2.58	2.50
	Girls	2.15	2.08	2.12	2.31	2.23	2.38	2.31	2.35
3T	Boys	2.50	2.35	2.62	2.38	2.69	2.69	2.85	3.00
	Girls	2.31	2.38	2.31	2.31	2.54	2.46	2.58	2.62
3C	Boys	2.11	2.15	2.31	2.11	2.42	2.58	2.38	2.46
	Girls	2.42	2.19	2.04	2.27	1.85	1.96	1.96	2.46

The following points seem worth making on the basis of these, admittedly, raw and imperfect scores:

(a) Except for one question on one occasion ("Greece" 4(a)) the mean scores of 3T boys and girls were always superior or equal to those achieved in their respective sub-groups.

(b) The boys of 3T consistently scored higher than any other sub-group but even they only managed to reach the level of equality (score = 3.0) on one question on the second occasion of testing.

(c) While these groups were ahead of the primary children, there was not an enormous difference in their mean scores, IC boys, for example, at times achieving a higher mean score than the boys of 3E. This seems surprising when the differences in chronological age and mean intelligence quotients are considered. Piaget has warned, however, that the stages in moral development are not necessarily clear-cut, the appearance of childish features in an adult's mind and adult features in the child's thought rendering "arbitrary any attempt to cut mental reality up into stages" (1932, p.78). He explains that although "we could not point to any stages

properly so called we were able to define processes whose final terms were quite distinct from one another. These processes might mingle and overlap but they marked nevertheless the broad divisions of moral development" (op.cit., p.171); Piaget presumably meaning in the last phrase "moral judgment".

(d) These results, taken in conjunction with the primary scores (Table XXIII), seem to indicate a very slow progress from the heteronomous towards the more advanced level of equality. While it was not a conscious aim of the teaching programme to try to accelerate these pupils' moral judgments, what could be considered as moral judgments in history were met on a number of occasions. These are examples from the lessons with \mathcal{E} :

- | | |
|--------------|--|
| October 22nd | Introductory discussion on how a king should be judged (Appendix K, p.248). |
| February 6th | To discuss the type of democracy established in New Plymouth (Appendix K, p.256). |
| June 3rd | (To query) how are ordinary people injured by the policy of apartheid (Appendix K, p.324). |

From his role-playing and discussion sessions centred on hypothetical conflict situations similar to those used in the Kohlberg tests, Turiel (1969) found that only those subjects exposed to moral judgments one level above their own, rather than two levels ahead, showed any appreciable absorption of his, Turiel's, moral judgments. Evidently, this result was in regard to responses on the problem situations used in the actual experimental treatment. Responses on another six situations not discussed with Turiel were not so clearly affected: "the amount of indirect influence was not as great as that of the direct influence" (op.cit., p.102). The moral issues involved in the teaching of \mathcal{E} and \mathcal{F} might have been too advanced for their developmental levels, possibly at a point which Turiel would typify as a "plus two level" treatment. Certainly, any effect would have been indirect. And it has to be noted that Turiel's post-test took place after only one week (op.cit., p.101) while there was a greater gap of time with these secondary pupils. If the aim of accelerating moral judgments is to be

part of a teaching programme then probably the teacher, after having ascertained "the moral judgments and ideas actually expressed by individual children" (Kohlberg 1966), needs to pose consciously the moral issues involved and teach deliberately for improvement on those moral issues. He would still have to remember, though, the crucial importance of the "match" between the children's developmental levels and the judgments to be encountered.

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CHAPTER 2 : THE TEACHING PROGRAMME

(1) PREAMBLE

The basic dichotomy between the two approaches with the primary children (described in Part VI) was intended with the two taught groups in the secondary school. What could be called "traditional" methods of teaching history at the secondary school would seem to consist of a largely teacher-directed methodology including such things as exposition, note-taking and note-making, reading textbooks and using duplicated sheets of information (see, for example, Booth 1967, pp.123-130 and Bryant 1967 p.7 and p.10). As with the primary children, there seems a firm link between such "traditional" methods and the "expository" approach described by Houston and Pilliner (1974, p.164): "teachers who dominate the classroom environment and generally teach physics as a series of dogmatic statements expository teachers tend to explain beforehand exactly what has to be done. They tend to interact with the class in an expository way, rarely ask questions and only seldom involve pupils' participation". At the other end of the spectrum for Houston and Pilliner are the "open-ended" style teachers. These "expect pupils to draw their own conclusions based on their own interpretation of results" (op.cit. p.165). Within the framework of teacher-chosen topics, this was the approach attempted with the experimental group, 3T.

It was hoped at the end of the teaching year that 2E would show a developed ability to analyse systematically and an increased readiness to start with possibilities which could then be confirmed or otherwise by the data. With the pupils of 3T, on the other hand, it was expected that the basically passive methods employed would have little, if any, effect on their thinking styles one year later.

(2) THE LESSONS WITH 3T

"Figurative" methods were the staple fare of 3T, as occurred also with IT. These meant that there was a great deal of exposition by the teacher and copying by the children. As the teaching programme developed, however, there appeared an important difference with these older, more

intelligent pupils in that some of them wanted to perform in a more active manner than had the children of IT. A small but influential group of pupils, influential on account of their intelligence, linguistic ability and leadership qualities, often asked questions on the topic being studied and were ready to initiate discussions. In general, they tended to act as a provocative means of mental stimulation for the class as a whole, if those less vocal members were able to assimilate the ideas being proposed by their fellow pupils. Thus, among the lesson plans in Appendix K are comments made after particular lessons when certain children had shown a desire to develop exposition into discussion.*

October 31st "If Spoke had Grant with him, wouldn't their two opinions be stronger than Burton's?"

March 13th A number of boys asked questions about Marx and Communism.

March 20th As they copied notes pupils asked such questions as, "When did Russia become the U.S.S.R?"; "Why was Russia fighting Germany?" (see also, for instance, December 12th, February 13th, June 10th).

On occasions, then, although the plan was to use predominantly "figurative" methods, some of the pupils themselves ensured that a more extended question and answer technique developed which led sometimes to what appeared interesting discussions. This was allowed since it was thought that few history teachers, however "traditional" would prohibit such opportunities. Motivational factors also had to be considered: apathy and resentment might have been the result of the teacher's ignoring or forbidding questions. At times, therefore, more questions and answers occurred than had been envisaged. The intentions of the lesson schemes, however, seemed quite specific. Among those schemes (Appendix K) the following terms indicating a "figural" approach occur regularly, either among the behavioural objectives (Mager 1962) or within the plans themselves.

Footnote: * The phrases used here and in the following pages are not always exact copies of those in Appendix K: sometimes paraphrases are used for clarity or brevity.

(a) Teacher to explain/describe/read/comment/give reasons/analyse

To:

- (i) explain some of the major hindrances to development in Africa (September 12th)
- (ii) describe Livingstone's life from 1859 to 1873 (November 7th)
- (iii) read the case for and against apartheid (Sheet VII). These arguments to be copied at home (November 26th)
- (iv) explain the implications of each of the five main points on Sheet X (The Future of Africa) (December 17th)
- (v) explain methods of analysing an "original document" ("The Primary Chronicle") (January 16th onwards)
- (vi) read aloud the Archbishop's speech after Peter's funeral and explain what the various phrases mean (March 4th)
- (vii) comment on some of the implications of the Archbishop's speech (March 6th)
- (viii) explain some of the major reasons for emigration, relating twentieth century reasons with those obtaining in earlier centuries (April 17th)
- (ix) describe the settlement at Jamestown. During the course of the exposition to give reasons why or why not the story of Pocohontas saving Smith might be true (April 24th)
- (x) describe and explain the beliefs of Puritans and the 1604 Conference (May 6th)
- (xi) dictate notes on James I's reasons for desiring uniformity of religious observance (May 8th)
- (xii) make comments on some of the features of the notes on Sheet XXXI ("The Puritans in New England") (May 13th)
- (xiii) explain how we must consider people's beliefs and actions within (the context of) their own period if we ask whether the Puritans were hypocritical (May 15th)

- (xiv) read the beginning of the Declaration of Independence and comment on some of the remarks therein (May 22nd)

(b) Pupils to copy

(i) Notes

On the meaning of "civilisation" and reasons why Egypt developed an early civilisation (September 12th).

Arguments for and against slavery and the slave trade (October 22nd and 29th)

The list of features characterising a king's claim to reputation from the blackboard (February 13th).

A table showing a comparison between two different sets of views on Peter the Great (March 6th and 11th).

In rough books the teachers' ideas on points (5), (6) and (7) on Sheet XXI ("The Communist Manifesto") (March 18th).

The notes from Sheet XXV ("Some reasons for emigrating to the U.S.A.") (April 22nd).

Notes on the teacher's interpretations of aspects of the early settlements in New England (May 13th).

(ii) Maps

From Hatch (1967) p.18 showing the main ethnic groups in Africa (September 10th).

Showing the hindrances to development in Africa (Sheet I) (September 17th).

Showing Moscow's secluded position from Earl (1967) p.24 (February 4th).

Showing Peter's gains in territory (Sheet XVII) (February 27th).

From the map of Early British Settlements in America (Sheet XXVII) (April 24th).

(iii) Time Charts

The history of Africa (Sheet VIII) (November 23th).

From the blackboard showing the major events in Russia's history (February 20th).

(c) The use of the textbooks

The textbooks were used on occasions as a means of supplying material which could form the basis for the teacher's remark or as a means of amplifying the teacher's exposition. Hence these notes occur:

- (i) Critical analysis by the teacher of the paragraph in Earl (1967) p.37, discussing whether Ivan was as cruel as the events described there seem to depict (February 11th).
- (ii) Class to read Earl (1967) pp.41-42, which describe the backwardness of Russia (February 20th).
- (iii) Read the beginning of the Declaration of Independence (Hooper (1968) p.27) and take rough notes from the teacher's exposition on certain statements within the Declaration (June 3rd).

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The lessons were not intended, however, to be an exclusively unilateral progression: again, it was felt that even "traditional" history teachers might introduce a topic by asking the pupils what they already knew about the subject or allow them to volunteer an opinion occasionally. Thus, the lesson plans also contain the following phrases:

Ask the children for their definition of "civilisation" (September 12th)

Ask the children what they know about South Africa (November 12th)

Ask for any opinions on whether Peter deserved his title "the Great"

(March 11th)

Ask if they can think of people in the world today to whom these (Communist) ideas would seem attractive (March 13th).

Ask what is the meaning of "emigrant"; who has relatives who have emigrated. (April 17th)

Both 3B and 3T had revisionary periods and it may be considered that the children of 3T were being provoked into more mental activity than a strictly figurative approach should have allowed, since questions were posed by the teacher, the pupils answering from memory or through reference to their own notes and the appropriate textbook (see, for example, October 15th). Possibly under a "traditional" mode the pupils should have revised merely through

silent contemplation of their books. The pupils of JE, however, seemed to be asked for more mental activity than were JT during revision periods as they had to formulate and pose their own questions, explaining their reasons for accepting or refusing an answer. (see p.324)

Finally, the process of note-making was not always confined to mere copying. The pupils of JT had to make their own notes but this generally entailed little more than selecting and summarising from already prepared information either in the textbooks or on duplicated sheets. Again, this is the type of activity which a "traditional" teacher might allow in his classroom. For example:

(After an oral description by the teacher) Write a short account of what you consider to have been the most important features in the history of Ancient Egypt. Use Hatch (1967) pp.9-12. (September 17th)

After an exposition on Ivan the Terrible's achievements, pupils to use their rough notes and Earl (1967) pp.36-39, to make their own notes. (February 13th)

Using Earl (1967) pp.43-44, class to write their own notes on Peter the Great: (a) Peter's youth and (b) The German suburb. (February 25th)

Pupils to find (from an atlas) appropriate place-names indicating the settlements of six different nationalities within the U.S.A. (April 17th)

(3) THE LESSONS WITH JE

As with IE, the basic aim with this class of children was that they should be "active doers", but the emphasis of that activity now was to be much more in the mental than in the physical sphere. Sullivan (1967, p.29) quotes Duckworth's (1964) comments that the child should be presented with situations in which he himself experiments, "manipulates symbols, poses questions, reconciling what he finds at one time with what he finds at another, and comparing his findings with those of other children specifically, we are considering the mechanisms for transition from concrete to more abstract stages of development as seen in his (Piaget's) theory".

Lovell (1966, pp.54-55) also thinks that children need to act on the environment and verify their findings. He considers that all secondary school pupils need opportunities to discuss with adults and among themselves viewpoints relating to varied themes. "The greater the need to question and find out about the environment, to struggle for solutions to problems and to commit oneself to possibilities, the greater it seems the likelihood of formal thought developing (op.cit.p.55). And later in the same article Lovell states: "There is every suggestion that restructuring of thought is more likely to be brought about by the child actively operating on his environment, than by repeatedly carrying out the instructions of the teacher in a teacher-directed situation" (op.cit. p.57). These contentions seem derived from Piaget's insistence that fundamental knowledge is acquired through action upon and interaction with the environment. "The teacher must provide the instruments which the children can use to decide things by themselves. Children themselves must verify, experimentally in physics, deductively in mathematics. "A ready-made truth is only half a truth." (Piaget in Ripple and Rockcastle 1964, p.5). Hence, in the history lessons with 3E, there was nothing of the physical activities described in Part VI. Rather was the type of activity envisaged that described by Kamii (Schwebel and Raph 1974, p.203): "(Piaget) pointed out that the criterion of what makes an "active" method is not the external actions of the learner. He said, for example, that Socrates used an active method with language and that the characteristic of the Socratic method was to engage the learner in actively constructing his own knowledge. The task of the teacher is to figure out what the learner already knows and how he reasons in order to ask the right question at the right time so that the learner can build his own knowledge."

Before examining the types of methods used with 3E it needs to be noted that at times exposition and explanation were deemed necessary. To take three examples from one term's work:

Explanation, with reference to Earl (1967), on how these factors helped in the progress of Moscow:

- (a) the policy of the princes,
- (b) the fall of Constantinople. (October 10th)

Description (by the teacher) of the beginnings of the Bolshevik Party. (December 3rd)

Explanation of the terms of the Treaty of Brest - Litovsk 1918. (December 12th)

Throughout the year's course there was teacher organisation and control of the content, a policy not forbidden by Piaget: "Teaching means creating situations where structures can be discovered; it does not mean transmitting structures which may be assimilated at nothing other than a verbal level" (Ripple and Rockcastle 1964, p.3). Thus, the lesson notes indicate that there were certain fairly specific goals behind group or class activities. Hence:

Class discussion on Question 1 of Sheet V ("The Acceptance of Christianity") during which these points must be elicited:

- (a) Accuracy: are the monks writing from their own point of view? note the date of the Chronicle; how far is this extract true to the original account?
- (b) Writers prejudiced? - the seemingly biased versions of the three religions.
- (c) Invention? - impossible to say. (October 1st)

Class discussion on what makes a king a worthwhile one, a "good" one, aiming to have at least three features covered: justice, the prosperity of the country, the reputation of the country. (October 29th)

In general, though, the major trends running throughout the lesson notes can be considered under the two global headings of activity and social collaboration.

(a) Activity(1) Active intentions

To analyse through discussion the main reasons for emigration.
(January 7th)

To discuss the type of democracy established in New Plymouth.
(February 6th)

Through class and group discussion to analyse some of the statements in the Declaration of Independence 1776.
(February 27th)

(11) Asking the pupils*Their opinions on:

Questions (3) and (4) (Sheet V "The Primary Chronicle"), which are to be developed by discussion and explanation.
(October 3rd)

What is meant by the word 'democracy'. (November 21st)

Which groups of people would object to the Bolsheviks taking power.
(December 12th)

What they observe:

About the geography of the U.S.S.R. (September 10th)

About South Africa in the news. (April 22nd)

For explanations:

Of the four concepts (Capitalist, etc.) in Question (1) on Sheet X. (November 25th)

Why the Americans needed to be united after 1783; what differences there were among the states; how these differences could be reconciled. (March 4th)

Of the reasons for British actions in the 1899-1902 Boer War.
(June 10th)

Footnote: *All the sessions were permeated with questions and answers.

Questions were also posed with 3T but there were differences between the two classes. There were far more questions and answers in 3E, the questions often coming from the teacher. In 3T, however, many of the questions came from the pupils.

(iii) Written work

Discussion on how to plan a "newspaper" contemporary with the events of 1917 (December 5th) followed by the writing of a "reporter's" account of the Revolution and an "editorial".
(December 10th)

In groups, which had been constituted either by sociogram analysis (see later p.326) or by choosing a partner directly, pupils to discuss Question (1) on Sheet XIII:

"Try to think of four or five reasons why the colonies were not successful until 1610. With these in mind, write a set of rules which might have been useful in a new colony such as Roanoke or Jamestown. Explain why you have chosen those rules."
(January 9th)

Write a dialogue between a Northerner and a Southerner over the rights and wrongs of slavery.
(March 11th)

The writing of a film script to illustrate the movement westward through the adventures of an imaginary family. (March 15th, 20th, 25th)

Sheet XXXV A British reporter has been sent to the Transvaal after the Boer War of 1899-1902. He is interviewing one of the original settlers who went as a boy on the Great Trek of 1836, discovering a typical Afrikaan's attitude to the events which led to the War and the War itself. Try to cover the following points in the interview

(June 10th)

(iv) Use of the textbook

Class discussion on Ivan, referring to relevant pages in Earl (1967) when necessary. For example, the reference to his living in an age of "the terror of Bloody Mary" (op.cit. p.37) will be examined. (see Appendix N)

(October 29th)

Selection of the major factors from Earl (1967) in order to put the events of 1917 into some form of historical perspective.
(November 21st)

Use of the photostat copy of the Declaration of Independence as printed in "The Pennsylvania Evening Post" (Hooper 1968, p.25) to read and discuss certain words and phrases used in that Declaration (see Appendix N). (February 27th)

Sheet XXIII Reading of pp.30-31 in the textbook (Hooper 1968) and the finding of two references to federal authority. Children to describe in each case how the federal authority over-ruled the State's authority in the 1950s. (March 11th)

(v) The examination and evaluation of data

To help the pupils deduce the influences of geographical factors on the history of the U.S.S.R. (cf. Bruner 1960, pp.21-22) (September 10th)

To write answers to these questions:

- (a) What makes a country backward?
- (b) Why were Moscow and Russia backward in the seventeenth century?
- (c) How can a country be made more developed? (November 5th)

To answer questions on "The Mayflower Compact" of 1620, including the following:

Question 5. The Puritans were very religious yet they allowed slavery.

- (a) What do you think of the law in Massachusetts which starts: "There shall never be any slavery among us" ?
- (b) Does this law make you think that the Puritans were hypocrites, that is, they said one thing but did something quite different?

Question 6. The Puritans allowed wars against the Indians.

Can you think of any reasons why they were ready to kill the Indians? (February 6th)

After having received an envelope containing Sheet XX cut into 40 separate sections, the pupils are then to classify the pieces of paper (e.g. into dates, settlements) and then place them into

the correct formation, thus:

"Pilgrim Fathers" 1620 New Plymouth To worship freely

Pupils to say which are the correct solutions and each child to check his own arrangement. (February 13th)

(To) draw a timeline (on the history of the U.S.A.) from 1600 to 1900. Pupils to enter the events which they think are the most significant in the history studied this term. (March 25th)

After having examined Sheets XXVII and XXVIII which contain information on the different aspects of the geography of Africa, pupils to try to answer this question:

"Why has most of Africa failed to develop as quickly as Britain, the U.S.A. and other areas of the world?"
(April 22nd and 24th)

Pupils to select Barrett's main arguments (contained in an imaginary speech, Sheet XXXII), take the arguments in turn and ask for rejoinders. (May 15th)

Pupils to examine Sheet XXXIV which contains some headlines in connection with South Africa aimed at leading to an assessment of the policy of apartheid and the attitudes of people from outside South Africa. (June 3rd)

(vi) Revision

This question to be answered in small groups and with reference to the text and exercise books:

"What effects has Russia's geography had on her history?"
(October 15th)

Pupils to be asked for their comments on such a remark in the text of October 17th as, "The mountains are a barrier and the Russians have to climb over them". (October 22nd)

Pupils to design fifteen questions on last term's course on Russia for a revisionary session on January 23rd. (January 21st)

(vii) Equilibration - equilibrium

While all the activities with \mathcal{E} had the essential aim of stimulating and developing thought processes in relation to history, possibly certain lessons can be listed most aptly under the global heading of "equilibration - equilibrium".

In these sessions can be seen most clearly an attempt to give opposing views on a character or event and then to ask the pupils to try to make some resolution of the conflict.

Pupils to select from Sheet VII those four changes of Peter the Great's which they consider to have been the most important. Individuals to report on which changes they chose. Class discussion on why those were important, were there more important ones on the sheet?

A pupil to read aloud the Archbishop's speech (Sheet VIII) ...
(November 12th)

To try to lead the pupils into forming a balanced opinion of Peter by considering opposed contemporary views of his character and achievements ...

Class to divide into groups of 4 or 5 pupils to consider Question 3 (Sheet IX) and their opinion of Peter, whether he deserves to be called "the Great". (November 14th)

Pupils to read to themselves the imaginary letter from America (Sheet XII), then class discussion on the questions. (For instance, Question 4. "Write a short letter from the imaginary character John putting the viewpoint of the English Parliament about the (trading) laws. Try to make it imaginative, for example, by sympathising with his sister"). (February 25th)

After an examination of the two types of slavery described in Hatch (1967, pp.34-35), to answer the following question (Sheet XXI)

"Write a short dialogue between an African captured in war

and working on an American plantation and one of his previous African captors who has since been made into a slave also and sold to the same plantation owner. Bring out the reasons in this dialogue why Africans were ready to sell other Africans."
(May 8th and 13th)

(b) Social collaboration

There were numerous attempts to organise the lessons in accord with Piaget's insistence upon the need for children to discuss issues with their peers (see Part III and Part VI, Chapter 2). During the first term's work on the history of the U.S.S.R. there are thus references in Appendix K to such group activities as the following:

Division into groups (of their own choosing) for discussion of the remaining questions on Sheet II. Rough notes to be made of their ideas and answers to be written up for homework (September 12th).

Groups of 4 or 5 pupils to be formed to discuss the features that should be taken into account when judging a king. (October 22nd)

Class to divide into groups of 4 or 5 pupils to consider Question 3 on Sheet IX and their opinion of Peter, and whether he deserves to be called "the Great". (November 14th)

In groups, pairs, or on their own, as they wish, to think of arguments which (a) a pro-Bolshevik and, (b) an anti-Bolshevik, would put forward on the value to Russia of the 1917 Revolution. (December 17th)

"This form would not have supported the Bolsheviks". To be discussed initially in small groups, then volunteers to face each other and argue for and against the motion. (December 19th)

After the rather ad hoc arrangements of Term I it was decided to try to organise discussion groups on sociometric principles (cf. Evans 1962). The sociogram which resulted from the pupils' first choice of one child with whom they would like to discuss the historical problems is shown in Appendix K (January 16th). The groups formed according to this sociogram, however, did not last long since those chosen often did not want to work with those choosing them. For instance, a boy popular with the girls

(Number 1) said that he much preferred working with an all-male group while a "star" MAM (Number 23) refused to work with anybody (see the comment for January 30th, Appendix K). By February 27th the groups, though loosely based on the results of the sociogram, had become more teacher organized (see, also, the comment for February 27th, Appendix K).

Group and class discussion continued throughout the final two terms, as the following examples indicate:

Division into groups for discussion and answering of the questions on Sheet XVI (an examination of James I's remarks at the Hampton Court Conference 1604. For example, Question (4):

"Find out what 'democracy' means. Do you think that these ideas on Church government might have led to some kind of democracy among the Puritans? Give reasons for your answer." (January 30th)

To discuss the intolerance in New England in the seventeenth century. (February 11th)

Division into teacher-organized groups to discuss these questions:

"What do you think about these points from the Declaration (of Independence):

(a) All men are created equal,

(b) All men have been given certain rights by God

(February 27th)

In small groups or individually, to think of some of the results of slavery and the slave trade today. (May 15th)

In groups of their own choosing, to answer the revisionary questions in Sheet XXXVI, each group reporting back to the class on their suggestions. (June 5th)

CHAPTER 3 : AN ANALYSIS OF THE RESULTS WITH THE
SECONDARY SCHOOL CHILDREN

(1) The grades and criteria for the historical stories

The responses of the secondary pupils were graded on the same scale (Table XXIV in Part VI, pp.257-258) and in the same manner as the replies of the primary school children (see Part VI, p.254). Examples of individual replies considered at various developmental levels are given in Appendix I.

(2) Friedman's two way analysis of variance was used to ascertain if the grades came from the same population of grades (Siegel 1956, pp.166-172). The groups 3E and 3T had to be considered separately from 3C since the spoken answers were given on the different stories "The Russian Revolution" and "Slavery" (see Part VII, Chapter I).

Table XLVII The Friedman two way analysis of variance
on the historical passages (secondary pupils)

<u>First Assessment</u>	<u>3 stories</u>
3E and 3T (combined)	.2 > P > .1
3C	.5 > P > .3
 <u>Second Assessment</u>	
3E and 3T (combined)	.01 > P > .001
3C	.8 > P > .7

These results indicate that there was little difference in the level of the replies across the three spoken stories on the first testing for either group as indicated in Table XLVII. On the second testing, however, while the replies came from the same population of replies as far as the children of 3C were concerned, in the case of 3E and 3T (combined) the null hypothesis has to be rejected. These subjects answered at a higher level on "The Russian Revolution" than on the other two stories, where the average scores were very similar.

The means of the average grades on each historical passage (Table XLVIII) give the following information:

Table XLVIII Mean scores for logical thinking on the
historical stories (secondary pupils)^{*}

Occasion of testing	Ancient Greece		The Norman Conquest		The Russian Revolution		
	First	Second	First	Second	First	Second	
3E	Boys	4.46	4.23	4.23	4.54	4.19	4.96
	Girls	3.65	3.92	3.27	3.73	3.62	4.12
3F	Boys	4.46	4.73	4.42	4.77	5.04	5.38
	Girls	4.00	4.19	3.77	4.35	4.31	4.62
3C	Boys	4.15	4.46	4.42	4.54	4.50	4.62
	Girls	3.77	4.31	3.50	3.73	3.69	3.88
3C(2)	Boys					4.15	4.58
	Girls					3.00	3.77

(a) The boys of every sub-group were firmly at the concrete operational level at the first assessment with the boys of 3F being at the advanced concrete level on "The Russian Revolution". The mean scores, of course, conceal the fact that some individuals were entering the formal level on some of the stories.

(b) The girls were lagging behind the boys at the first assessment on these stories. Only the girls of 3F approached the boys' level of grades. And 3E girls, although scoring significantly higher on the Manchester General Ability Test, scored lower than 3C girls on two of the three stories.

(c) There was a slight but remarkably regular improvement in the mean scores for all sub-groups, boys and girls, on the second occasion of testing

Footnote: ^{*} An average score of 3 denotes the beginning of the concrete operational stage in relation to these passages. An average score of 5 denotes the attainment of the advanced concrete operational stage.

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(apart from 3E boys on "Ancient Greece"). These improvements on taught and non-taught stories are presumably reflecting some aspect of intellectual growth.

(d) The boys of 3E showed a bigger movement on "The Russian Revolution" (+ .77) than did either the boys of 3T (+ .34) or 3C(2) (+ .43); the difference, however, was not significant as the analysis of covariance will show (See Table LI).

(e) The girls of 3C(2) made the largest improvement (+ .77) on "The Russian Revolution" compared with 3E girls (+ .50) and 3T girls (+ .31); again, no difference was significant according to the analysis of covariance (see Table LI).

(f) The mean score of 3T boys on "The Russian Revolution" was slightly higher at the end of their second year in school than was the score of 3E boys at the end of their third year; the same was true of 3T girls when compared with 3E girls.

Since both the boys and girls of 3E improved on "The Russian Revolution", a 't' test for related pairs was carried out to discover whether there was a significant improvement for the children of 3E on that story compared with the non-taught stories. There was a significant improvement at the .02 level of significance on comparing "The Russian Revolution" against "Ancient Greece" but there was no significant difference against "The Norman Conquest". This result was no doubt caused by the slight deterioration in the average score of 3E boys on that passage (see Table XLVIII, p.329).

(3) Kendall's coefficient of concordance "W"

In order to discover if the levels of responses were stable across the stories, Kendall's coefficients of concordance were calculated for each sub-group. "W" indicates the degree of association between a number of sets of ratings (Siegel 1956, pp.229-239).

Table XLIX Kendall's coefficient of concordance(historical stories)

		<u>First Assessment</u> (3 stories)	<u>Levels of significance</u>
3E	Boys	.801	P < .01
	Girls	.662	P < .05
3T	Boys	.499	.20 > P > .10
	Girls	.683	P < .02
3C	Boys	.665	P < .05
	Girls	.850	P < .01
		<u>Second Assessment</u> (3 stories)	
3E	Boys	.720	P < .02
	Girls	.835	P < .01
3T	Boys	.533	.10 > P > .05
	Girls	.553	.10 > P > .05
3C	Boys	.778	P < .01
	Girls	.809	P < .01

Two conclusions seem indicated by these results:

(a) The thinking remained relatively stable across the three stories on both occasions of assessment apart from the boys of 3T (both testings) and the girls of 3T on the second testing. In those sub-groups the pupils tended to react somewhat more differently on the various stories.

(b) Values as large as the various coefficients of concordance indicated did not arise by chance except in the cases of those sub-groups mentioned above.

(4) Spoken versus written answers on the historical passages

As was mentioned in Chapter I of this section (see pp. 296) it has been suggested that subjects might gain higher grades if they are allowed to write the answers rather than talk to the investigator. The average grades on the three spoken stories were therefore analysed against the written scores on one story ("Slavery" for 3E and 3T; "The Russian

Revolution" for 3C). The results are given in Table L.

Table L. Differences in performance on spoken
versus written answers

		<u>First Assessment</u>	<u>Second Assessment</u>
3E	Boys	N.S.	P < .001
	Girls	N.S.	N.S.
3T	Boys	N.S.	P < .01
	Girls	N.S.	P < .001
3C	Boys	P < .01	N.S.
	Girls	N.S.	N.S.

The spoken and written replies are, of course, confounded with differences of content. Within the limits of this confusion there is no evidence that the written replies were better than the spoken. Indeed, all the significant results of Table L favour an oral response. It might be by the time of the second occasion of testing that the taught pupils, apart from 3E girls, had gained in confidence and ease of communication through having known the investigator as a teacher. The non-taught boys of 3C, whose spoken replies were significantly better than their written on the first but not the second occasion, might have become more self-conscious with a comparative stranger as they grew older. These are, however, merely speculations.

(5) The analysis of covariance

As with the primary pupils, it was decided to use covariance analysis in order "to effect adjustments in final or terminal scores which will allow for differences in some initial variable" (Garrett, p.295). While strictly speaking, the data fed into the analysis of variance should comprise equal interval scales, it must be said that the use of analysis of variance is in widespread use where these assumptions are not strictly fulfilled. It is admitted that this is the case in the present study. With this provision in mind, the null hypothesis is that the apparent treatment effect

is due to error. This can be confirmed or rejected at different levels of significance by reference to tables of F ratios.

Table LI Analysis of covariance adjusting the post-scores on
"The Russian Revolution" for the initial scores

		SS	df	V	F	P
<u>BOYS</u>						
(a)	3E v 3T	0.15 11.85	1 23	0.15 0.52	0.29	N.S.
(b)	3E v 3C(2)	3.39 8.97	1 23	3.39 0.39	8.69	< .01
(c)	3T v 3C(2)	1.51 9.59	1 23	1.51 0.417	3.62	N.S.
<u>GIRLS</u>						
(a)	3E v 3T	0.19 7.89	1 23	0.19 0.34	0.56	N.S.
(b)	3E v 3C(2)	0.04 6.84	1 23	0.04 0.297	0.135	N.S.
(c)	3T v 3C(2)	0.44 9.07	1 23	0.44 0.39	1.13	N.S.

In contrast to the results obtained from the primary children, here the content of the teaching programme did not lead to any significant improvement apart from when 3E boys were compared against the boys of 3C(2). Further discussion of this result will be left until Chapter 4.

Since the results on the "taught" passage were not significant, it may be anticipated that the results on the related passages are not likely to be significant. Apart from one result, this was indeed so, as can be seen in Table LII.

Table LII Analysis of covariance adjusting the post-test average scores on the three stories for the initial average

		<u>scores on these stories</u>				
		SS	df	V	F	P
<u>BOYS</u>						
(a)	3E v 3T	0.18 2.21	1 23	0.18 0.096	1.89	N.S.
(b)	3E v 3C	0.89 5.80	1 23	0.89 0.25	3.56	N.S.
(c)	3T v 3C	1.37 3.23	1 23	1.37 0.14	9.79	<.01
<u>GIRLS</u>						
(a)	3E v 3T	0.26 5.81	1 23	0.26 0.25	1.04	N.S.
(b)	3E v 3C	0.02 8.97	1 23	0.02 0.39	0.051	N.S.
(c)	3T v 3C	0.05 11.26	1 23	0.05 0.49	0.10	N.S.

The final analysis of covariance adjusted the average scores on the three history passages (second assessment) for variations in I.Q. As can be seen from Table LIII this analysis of covariance did not lead to any significant results.

Table LIII Analysis of covariance adjusting the post-test history scores for variations in I.Q.

		SS	df	V	F	P
<u>BOYS</u>						
(a)	3E v 3T	1.49 8.11	1 23	1.49 0.35	4.26	N.S.
(b)	3E v 3C	0.02 13.17	1 23	0.02 0.57	0.04	N.S.
(c)	3T v 3C	0.05 10.34	1 23	0.05 0.45	0.11	N.S.
<u>GIRLS</u>						
(a)	3E v 3T	0.90 9.06	1 23	0.90 0.39	2.31	N.S.
(b)	3E v 3C	0.03 19.00	1 23	0.03 0.83	0.04	N.S.
(c)	3T v 3C	0.04 20.06	1 23	0.04 0.87	0.046	N.S.

(6) The Piagetian Experiments

Friedman's analysis of variance was applied to the grades on the chemicals and balance experiments and the average grades on the three historical passages. The results are given in Table LIV.

Table LIV The Friedman two way analysis of variance on the two Piagetian problems and the historical passages (secondary pupils)

First Assessment

3E and 3T (combined)	$P < .001$
3C	$.02 > P > .01$

Second Assessment

3E and 3T (combined)	$P < .001$
3C	$P < .001$

On both occasions the null hypothesis for 3E and 3T (combined) has to be rejected, subjects receiving higher grades on the chemicals than the balance and on the balance than on the historical passages. The null hypothesis for 3C also has to be rejected; these pupils also obtained their highest scores on the chemicals experiment.

A Friedman two way analysis on the scores of all 78 subjects for the chemicals and balance experiments alone also resulted in the null hypothesis being rejected, the subjects on average receiving higher grades on the chemicals than the balance experiment.

First Assessment

3E, 3T and 3C (combined)	$P < .001$
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Second Assessment

3E, 3T and 3C (combined)	$P < .01$
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Kendall's coefficient of concordance was also calculated for the 78 subjects on the two Piagetian experiments and the average grade on the three historical passages. This produced a similar coefficient for both occasions of assessment:

First	$W = 0.420$	$P < .001$
Second	$W = 0.422$	$P < .001$

These coefficients indicate that there was only a modest degree of consistency across the two Piagetian experiments and the average historical scores.

That the historical passages and two Piagetian experiments are not involving exactly the same thinking skills seems supported by the results of factor analysis in the following section. All experience suggests that thinking is likely to be higher in school-based science and mathematics than in respect of history. History, in other words, is a mature subject in which formal or explanatory thinking comes relatively later. In these circumstances one would not expect high correlations between the scores at the ages at which the present subjects were tested. One would, of course, anticipate much higher correlations at, say, the ages of seventeen to eighteen years.

(7) Factor analysis

The data collected from various sources on the second occasion of testing was submitted to factor analysis. Since the data obtained on several of the tasks were markedly skewed, the scores on the variables were split as close to the median as possible and phi-coefficients calculated. Principal Component Analysis was obtained, the factorisation being continued only as long as the eigen value was greater than one. Components were rotated to a Varimax solution as indicated in the following tables. The following factors in Table LV were clearly interpretable.

Factor I reflects the teachers' estimates of personality, motivation as revealed by the Aberdeen Academic Inventory, measured intelligence and performance on the Series and Numerical Analogies task. In respect of personality some halo-effect is probably at work.

Factor II is concerned with the verbal passages on history, certain of the questions used to assess moral judgments also loading on this factor (cf. Piaget 1932, p.404 where he affirms that there is a "parallelism existing between moral and intellectual development").

Factor III suggests the ability to carry out combinatorial operations. Both social class and teacher judgment of self confidence have loadings on this factor. Loadings on the chemicals experiment and self confidence are shown also for the primary pupils on Factor V of Table XXXV (see p.269).

The remaining factors appear to reflect specific features of the test variables; only the more interesting of the loadings will be considered here. High scores on the neuroticism variable (Factor IV) seem opposed to high scores on the motivation variable. Extroversion is loaded most heavily on Factor V. For these pupils at least there does not seem to be any loading of intelligence on this factor. The balance experiment has a high loading on Factor VI.

Table IV Varimax analysis of a number of features obtained on the
second occasion of assessment (secondary pupils)

Tests	<u>Rotated Factor Loadings</u>					
	I	II	III	IV	V	VI
1. I.Q.	.5900					
2. Series and Numerical Analogies	.6074					.3979
3. Extroversion					.8398	
4. Neuroticism				.7697		
5. Motivation	.4834			-0.4155		
6. Ancient Greece		.6930				
7. The Norman Conquest	.3069	.6732				
8. Attitude to History in School				.5556		
9. Chemicals			.7263			
10. Balance						.8512
11. M.J.Q.4(a) Ancient Greece		.7482			.4188	
12. M.J.Q.5(a) Ancient Greece		.5082				
13. M.J.Q.3(b) The Norman Conquest		.4422				
14. M.J.Q.7 The Norman Conquest				-0.3509	-0.4327	
15. Social Class			.6406			
16. Position in Family						
17. Self confidence	.4750		.3097	.3143		-0.3273
18. Will power	.7459					
19. Desire to excel	.8031					
20. Conscientiousness	.7702					
21. Desire to know	.7681					
22. Originality	.7457					
23. Common sense	.7197					
24. Intelligence	.8233					
Percentage Variance	22.5823	8.9933	6.0912	6.8725	5.4326	5.7729

To try to avoid any undue influence of the teachers' assessments, another Varimax solution was obtained from fourteen variables.

Table LVI Varimax analysis of fourteen features obtained on the
second occasion of assessment (secondary pupils)

Tests	<u>Rotated Factor Loadings</u>					
	I	II	III	IV	V	VI
1. I.Q.				.7992		
2. Series and Numerical Analogies				.8326		
3. Extroversion						.7427
4. Neuroticism	-0.3150		.6519			
5. Motivation		.7641				
6. Ancient Greece	.6960					
7. The Norman Conquest	.7463					
8. Attitude to History in School			.6456			
9. Chemicals			-0.7357			-0.3298
10. Balance					.8808	
11. M.J.Q.4(a) Ancient Greece						.6124
12. M.J.Q.5(a) Ancient Greece	.7137					
13. M.J.Q.3(b) The Norman Conquest	.5812				.4507	
14. M.J.Q.7 The Norman Conquest	.5249					
Percentage Variance	16.2143	9.9600	10.3002	10.9266	7.9197	

Factor I shows a loading on the verbal passages and three of the questions used to assess moral judgments in relation to history (cf. Factor II of Table LV).

Factor II loads on the Aberdeen Academic Motivation Inventory. Scores on the verbal reasoning test do not load on this factor, providing some support for Entwistle's suggestion (1968, p.183) that, "the inventory is measuring a non-intellectual trait independently related to school attainment".

Factor III loads high scores on the neuroticism continuum and also on attitude to history in school.

Factor IV reflects g/vised components; Factor V scores on the balance;
and Factor VI loads most heavily on extroversion.

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CHAPTER II COMMENTS ON THE RESULTS

(1) The historical stories

While the experimental work with the primary children produced some suggestive results, the findings from the secondary school pupils are less optimistic with regard to the acceleration programme. All the sub-groups had at the least entered the concrete operational period at the time of the first assessment (Table XLVIII) with the boys of 3T at the advanced concrete level on "The Russian Revolution". For some reason, possibly their interest in contemporary events, this small group of thirteen boys seemed to respond particularly well to this passage. Such a response, combined with their significantly higher measured intelligence, would seem to have given the boys of 3T an advantage over the boys of 3E in relation to the topic of the Russian Revolution. While the mean raw grades (Table XLVIII) show that the boys of 3E did improve their scores more than did 3T boys after the year's teaching, this improvement was not at a significant level, according to the analysis of covariance (Table LI). Against 3C(2) boys, however, the analysis of covariance does indicate that the scores of 3E boys were significantly higher after one year's teaching. Can it be assumed that the teaching programme had had some effect when the results are contrasted with those from boys who did not study Russian history within their history lessons during their third year at secondary grammar school^x?

Such a result did not hold for 3E girls. They did not make any significant progress on the taught story against either 3T or 3C(2). These girls were at the earlier stages of concrete operational thinking on their first assessment (Table XLVIII). The type of development to be expected,

Footnote: ^x As it happened, although the history syllabus for 3C(2) did not include Russian history, the pupils had discussed fortuitously the Revolution through an English teacher's historical and analytic perspective on "Animal Farm", a set book for the third year.

perhaps, was that of consolidation at the concrete level (cf. Wallace 1972, see p.138). Research evidence cited in Part V (for example, McNally 1970, Davies 1965, Harvard 1970, de Silva 1969) shows that at the age of 13 to 14 years most children will be at the concrete level on verbal passages. Possibly the style of teaching was too far ahead of their thinking levels for a number of girls in 3E; that is, there was too big a gap between the schemas they possessed and the schemas demanded by the organisation and presentation of the material. In such circumstances, it is likely that pupils will assimilate with distortion or turn away in apathy. In the event, a few of the girls revealed perplexity, confusion and occasional resistance when asked to produce their own ideas on the historical data. More than once the query rose: "Can't you just give us notes to copy?" As was explained in Chapter I of this section the girls of 3E stood out from the other female sub-groups on a number of important measures such as motivation, social class and extroversion (see p.291). Yet, despite seeming disadvantages like these, the girls of 3E did improve their thinking skills over the year. Some individuals progressed very well on "The Russian Revolution" but their movement was from the preoperational to the concrete levels. These included two of the least willing and most vocal of the groups:

	<u>First Assessment</u>	<u>Second Assessment</u>
COL	2.0	4.0
FOX	2.5	4.0

They were presumably lagging behind the developmental level expected of their age group on the first assessment. At the least, the teaching programme did not leave them in that position as far as scores on "The Russian Revolution" were concerned. Not enough girls, however, made similar progress, a number remaining at the same concrete level on the two occasions. Hence, there was a lack of statistical significance when the girls' scores were compared across sub-groups.

The results on the taught story may, therefore, demonstrate the beneficial but seldom statistically significant effects of the teaching programme. As with Miles (1971), the content of the course, possibly in alliance with the methods used, seems to have had some slight effect on the responses of 3E children but this was not sufficient to compensate for the natural development of the pupils in the other sub-groups.

On the more important criterion of thinking on related tasks, there are not even slight grounds for optimism regarding the effects of the teaching programme. The boys of 3T improved their average scores on the three stories against 3C boys but not against those of 3E (Table LII). The boys of 3E, however, did not produce a statistically superior performance against the control group. Not one single analysis was significant for any of the girls' sub-groups.

From these results it seems that we have to agree with Inhelder and Sinclair (1969, p.42) that, "the evolution of operativity is malleable only within certain limits imposed by the laws of development". It also appears that it is more difficult to advance from the concrete or intermediate concrete/formal to the formal level than it is to move from the preoperational or transitional to the concrete levels in history. Stokes (1970) and Miles (1971) have suggested that formal thinking within verbal contexts is evident only after the age of 16 years. It may be that a more suitable age group with whom to try to advance thinking skills in history is the fifth year in English secondary schools. The results with these above-average subjects in their third year at secondary school would seem to provide another proof that the movement towards formal thinking in history is uneven, limited and generally slow.

(2) The Piagetian experiments in relation to the historical passages

Results from the Friedman two way analysis of variance (see pp.335-336) and Kendall's coefficient of concordance ($W = 0.420$ on the first occasion; 0.422 on the second) suggest that while the grades on the three areas of

experimentation did not contradict each other, there is only a moderate degree of support indicated for the existence of a structure d'ensemble. Such a conclusion would seem to be supported by the research evidence of other investigators such as Davies (1965), Bart (1971) and Lodwick (1972) - (see Part V, pp.208-213).

(3) Factor Analysis

Factor analysis of the various features derived from the assessment of the secondary pupils seems to lend some confirmation to the results discussed in the previous sections.

(a) The historical passages load on different factors from the chemicals or balance experiments.

(b) The chemicals experiment loads on factors associated more with emotional and social than specifically intellectual variable. For example, in Table LV Factor III loads chemicals, social class and teachers' estimate of self-confidence; in Table LVI chemicals is opposed to high scores on neuroticism and attitude to history in school.

(c) Unlike the results with the primary pupils (see Table XXXV, Factor IV and Table XXVI, Factor I), the balance experiment loads on factors other than those showing loadings on the verbal comprehension passages.

(d) With these pupils, again in contrast to the primary, the intellectual features such as I.Q. scores tended not to appear on the same factor as scores on the verbal passages. The only other variables loading with any regularity on the same factors as the verbal passages were the questions assessed on the criteria for moral judgments. It has been argued in respect of the previous research (Hallam 1966) that a question such as, "Do you think William of Normandy was a cruel man?" is not assessing an historical judgment but simply demanding a moral response. As far as the results with these secondary pupils are concerned, it would appear that the questions graded for moral judgments are asking both for moral judgments

and logical responses, or that the criteria were not differentiated in a clear enough manner, or that Piaget was correct when he asserted that, "Logic is the morality of thought just as morality is the logic of action" (1932, p.404).

PART VIIIGENERAL CONCLUSIONS¹

The descriptive findings of this research appear to support the argument that, given the present educational and social climate, advanced forms of thinking develop relatively late in a subject such as history. While there was a certain amount of intermingling of levels of answers as between the two age groups studied (see, for example, the contrasted answers in Part II, pages 142-143) the general picture seems fairly clear. On the first occasion of assessment, when the children of average ability were entering their third year in the primary school, the scores in general were at the transitional stage between preoperational and concrete operational thinking (see Table XVI, p.260). On the second occasion, though, while these primary children on average were moving towards the early stages of concrete operational thinking, the boys of 1E were graded at the early concrete level on the four criterion passages, the girls of 1E were similarly graded on the two "taught" stories, while the girls of 1T had entered that period on the two "non-taught" stories. The secondary pupils tended to move gradually within the concrete

Footnote:

- ¹ When reading the following discussion it must be remembered that the same person did the teaching and the post-testing, although the protocols derived from the post-testing were assessed by independent judges as well as the investigator. In a research design such as this, it seems almost impossible for a person other than the teacher-investigator to carry out the arduous task of testing the children who had been taught during the year, especially when clinical-type interviews are used. Obtaining the pupils' replies on the various historical passages took about 15 school days for each of the primary and secondary groups, six school weeks in total. Even if some one had agreed to do this testing, no doubt in return for payment, there still would have been the difficulty of finding a person with the necessary degree of expertise in this field.

period during their third year at secondary school, with the boys of 3T reaching the advanced concrete level on the "taught" story "The Russian Revolution" on both occasions of testing.

When the possible effects of the teaching programmes with the two age groups came to be scrutinised, statistical analysis revealed differences between the measured responses of the primary and secondary pupils. The ensuing discussion will be concentrated on the results derived from the analysis of covariance since factor analysis was used merely as an adjunct and not to examine the data in minute detail. Analysis of covariance indicated that the scores of both the boys and girls of Class 1E improved significantly against the two control groups 1T and 1C on the "taught" story "Mary" (see Table XXVIII, p.262), while there was no significant difference between the scores of the boys of 1T and 1C, and the girls of 1T and 1C. The improvement noted for the girls of 1E held against the girls of both 1T and 1C when the mean scores on "Mary" and "More" together were covaried against the initial scores on "Mary". Such a result did not obtain, however, for the boys of 1E against the boys of 1T. It has already been postulated that such a variable improvement in responses on "taught" stories seems to denote what Kohlberg (1970) has called a "Type II" change (see Part II, p.93 and Part VI, p.276), that is, a structural reorganisation did not occur since it cannot be claimed that the change was general over a field of responses, nor was the question of irreversibility tested. This suggestion appears supported by Strauss' (1972, p.331) distinction between structural elaboration and structural transformations, elaboration being seen in the learning of rules how to apply a structure (see Part II, p.669). Possibly, for example, the children of 1E had "learnt" useful algorithms, albeit in a meaningful manner, with regard to relationships within the Tudor royal family, the number of countries of which Mary was Queen, and so on. This is not to say that such "Type II" changes can have no effect on structural transformation, Kohlberg (1970, p.44) remarking that the "cognitive

developmentalist neither claims, nor has proven, that experiences of content learning have no effects at all upon structural reorganisation". Indeed, he thinks that changes in an "overt response may be composed of various mixtures of Type I structural reorganisation and Type II content learning (op.cit., p.45). While maintaining that a logical structure is reached only through internal equilibration, Piaget himself does not disavow that a particular act of learning may help towards the eventual development of a logical structure, although any immediate learning is restricted to the specific case of training (see Part II, pp.143-144). Majoribanks (1974) also refers to an hypothesis of McCall (1970, 1972) that the absorption of "early environments" may produce "unobservable propensities which are latent until later developmental stages" (op.cit., pp.272-273). Hence, while it is safer to say that the improvements noted through the analysis of covariance were probably a result of these children becoming more familiar with the material and variables used in the questions (cf. Almy 1970 in Part II, pp.117-118, and Miles 1971 in Part V, pp.197-199), the results do not seem to preclude absolutely the possibility that some structural reorganisation may have occurred, especially as Kohlberg (1970) states that "content" and "structure" may be more intermixed in some content areas than others (see Part II, p.95).

The problem of the nature of the changes seen in the analysis of covariance is met again when the important criterion of transfer of thinking is considered. Considering the primary boys' scores alone, when the average grades on the three stories of the second occasion of assessment were covaried against those of the first occasion, the scores of IE boys were significantly better than those of either IT or IC, whereas IT boys did not improve against IC boys (see Table XXX, p.264). Could the change on the part of IE boys be structural in nature? The changes appeared general across a variety of passages and also seemed qualitative according to the grades given by the assessors on the two occasions. It has to be

noted, though, (see Table XXVI, p.260) that the average scores of IT boys were the lowest of any sub-group for two of the stories on the initial occasion of assessment. Were these boys lagging behind the developmental level expected of their age group? If this were so, they might have had a more difficult task in developing their thinking skills, Inhelder (Green et al 1971) remarking that the lower the child's initial level, the more that progress tends to be limited to one specific field or even to one specific type of problem (see Part II, p.140).

As has already been described, the girls of IT not only scored higher than any other sub-group on all but one story on the first occasion of assessment (Table XXVI, p.260), but were also of a higher measured intelligence than any other sub-group. Moreover, they scored the highest on a number of desirable motivational, social and personality characteristics (see Part VI, p.224, p.226 and p.228). Hence, while being out-stripped by IE girls over the year on the "taught" stories, their superior abilities meant that they maintained their lead in general. Interaction with particular methods can facilitate improved answers only to a certain extent. It would appear, then, that more developed intellectual structures were assisting the girls of IT, possibly combined with their desire to explore and understand the data. This could have led to some form of cognitive conflict (see Part I, pp.63-64). And this cognitive conflict is intrinsic, Elkind (Green et al 1971, p.25) pointing out that intrinsic motivation resides in the child and not in procedures: "It is the child who must, at any given point in time, choose the methods of learning and the materials that are reinforcing to him" (ibid. p.25).

As far as the primary results are concerned, it would seem that we have reached the conclusion that, while factors outside the particular context of the classroom and school situation will have pervasive effects on thinking in general, teaching a particular body of knowledge in certain ways may lead to improved thinking within that content area and, possibly, in certain circumstances transfer to related tasks of a similar structure,

provided that there are not too great discrepancies between the children on such variables as motivation, measured intelligence and personality characteristics. Do these results have some relevance for the teaching of history to primary school children aged from 9 to 10 years?

During recent years there has been an emphasis placed on the use of the local environment as a basis for the study of history in the primary school. Rogers (1968, p.50), indeed, considers that there has been "an over-emphasis on the near, the local, or if you will, the parochial". He quotes Blyth's (1965) reference to local studies being "an opiate of the peasantry"; often, "Arcadian and bucolic" in nature (op.cit., p.45). If there has been this stress on the local environment, no doubt one cause was the teachers' realisation of the limitations in children's thinking. "The syllabuses (in history) must always be based on the clear assumption that children of junior school age are not logically minded that their attention is of the sensuous and not of the intellectual type, and that it can, therefore, be successfully directed only to objects and not to ideas and beliefs" (Strong 1964, quoted in Rogers, p.35). Rogers attributes the rationale for this approach to the influence of Piaget on the primary school curriculum, stating that Piaget's findings "seem to have had an undue influence leading to overtly simplistic, intellectually undemanding studies emphasising the 'concrete', and (therefore) the nearby, while consistently putting off more challenging approaches that might begin to develop more complex thinking strategies and studies at much earlier age levels" (op.cit., p.40).

In light of Rogers' comments, what can be postulated as the achievements of this research? On the "taught" story "Mary" there was a significant improvement of the experimental group over both control groups, 1T and 1C. This would appear to show that, on average, the pupils of 1E were more able to comprehend the data of a passage dealing with the traditional stuff of history syllabuses, seen in their grasp of relationships within a royal

family tree, inferences drawn from famous events in Scottish history, and simple judgments on the chief character (see, for example, BU's answer on Mary in Appendix C, p.33). It is certainly not claimed, though, that the children appreciated the complicated nexus of events and emotions surrounding Mary's life in Scotland.

The raw average scores (Table XXVI, p.260) show both the boys and girls of IE at the concrete level on the story of More while the boys and girls of IT were moving towards that level. The following would seem to be some of the implications of these results. The children of IE, on average, showed comprehension of simple causation in human affairs, for example, in answering the question, "Why might Henry 8th want a divorce?" (see, for instance, ALE's answer in Appendix C, p.39), or, "Why do you think Henry wanted everyone in England to swear the oath?" Simple judgments were requested on the two main protagonists in the story. The children were asked for explanations of complex concepts such as "oath" and "traitor", and had to place their explanations within the context of sixteenth century England. Classification skills had to be demonstrated with regard to the Christian Church (Questions 2(a) and 2(b)). Referring to a statement such as, "Paris is the capital of France", Furth (1970, p.76) comments that the child of seven years "does not have the spatial, temporal, or social perspectives to place (this) new information on a firm operative basis". Such knowing for Furth is "figurative and low level operative", that is, the child "knows some configurations about a place (the particular name) but he does not understand the nature of the place and its relation to other places". Furth goes on to contend that if such a type of "knowing" is unduly stressed, then it can be harmful since the child will learn to talk by rote (op.cit., pp.76-77). Talking by rote, according to Furth, should be discouraged since the child should be encouraged to talk with

understanding. It is questionable, however, whether it has yet been proved that rote-learning will inevitably handicap later thinking. In relation to what the Flowden Report (1967, p.230) may have meant by the "alphabet" of history, Furth is surely exaggerating the dangers of "knowing" figuratively about places and people? It is likely that many adults function at a low operative level when listening, say, to the news on current events and simply accept that "Paris is the capital of France" without considering "the nature of the place". One wonders also about Furth's contention that only at the age of thirteen years will the child "have a spontaneous intellectual curiosity to remember the name (of Paris), whereas in the younger child the learning of that name will require strong extrinsic motivation" (1970, p.76). It may be that younger children are more willing than the older to learn about the basic data of history - the names of kings and queens, places at which events occurred, voyages, social conditions - provided that the material is interesting and made appropriate to their thinking levels.

The evident ability of the children in LE to perform fundamental operations such as classification on historical data would also seem to have implications for the newer type of history teaching. If children of such average ability could deal with the complications of family trees, divisions of the Christian Church and abstract concepts like "traitor", then presumably they might also be able to study transcripts of, photo-copies of, and, perhaps, even historical documents themselves, provided those documents are relevant to the children's interests, reading levels and general ability. In the light of the present findings, it would not appear to be asking too much of similar children aged 10 years to have them cataloging, listing and classifying, say, carefully selected sections of parish records or council minute books. They might discover, for example, the occupations of

people living in a certain part of a town at two different periods, deduce the type of living conditions there at those times, then contrast such conditions with those existing in their day. Or they might list the ages and causes of deaths in two different parishes, compare and contrast their findings, and possibly begin to try to find acceptable historical reasons for any differences in the death rates. In a concrete manner they would be dealing with present traces of the past and seeing the process of change through time, reflecting two aspects of Elton's (1967) definition of history (see Part IV, pp.164-165). In the latter example, if the children showed that they could make valid connections, rightly based on the evidence available, then they might be starting on the process of historical analysis - "colligation" for Walsh (1967 - see Part IV, p.172). Such interesting work could obviously provide the basis for further valuable research.

While no one method or technique could be adduced from the present research as a means of developing these essential preliminary skills of accurate and careful observation (Kitson Clark 1967, p.36), the following seem reasonable proposals to help to account for the significant improvement on the "taught" story of IE's scores over the year when covariated against the scores of IT and IC.

(a) The children in the experimental group were constantly challenged to try to find their own solutions to the problems met. Whether as a class, in small groups, as pairs or as individuals, they were given the answer only if all else failed; "all else" in this context including such devices as posing questions to other groups or other children, rephrasing the problem, having the children go to reference books or return to the particular page in their own books which contained the relevant information, and so on (see Part VI, Chapter 2 and Appendix E and G). The approach essentially was to try to create conditions of cognitive conflict which might lead to structural change rather than to provide instruction which concentrated on modelling the "correct" response. A conscious and continued effort was made

to avoid being "unilateral" in the methods adopted. There may have been a relationship here to Hodgill's (1974) explanation of Piaget's comments on active methods: "the teacher will be involved in creating situations and constructing initial devices in order to present problems to the child" (op.cit., p.273). Further, he will "provide counter examples which compel reflection and reconsideration of over hasty solutions" (ibid. p.273).

(b) Despite Piaget's affirmation of the importance of social co-operation among children to help in the development of thought, it cannot be proved that this was an essential factor in the present research. In view of Thompson's (1972) conclusion, admittedly concerned with quantitative learning, that co-operation among pupils, whether joint or associative, resulted in neither greater nor less learning, it seems doubtful that the co-operative methods adopted with IE in themselves affected the results. Hodgill (1974), however, concludes from some work by Murray (1972) with children of average mental age of 6;7 years on a number of conservation tasks, that Murray's data emphasises "the educational role of social interaction in the transition from egocentrism to operational thought" (op.cit., p.391). Murray's subjects, however, were retested only seven days after the group discussion sessions, an interval of time which Piaget would not consider sufficiently lengthy. All that can be said on the results with the children of IE and IT is that the children of IE seemed to enjoy working together (cf. Evans 1962, p.74), an impression supported by the response when the teachers of the two classes asked their pupils whether they had enjoyed studying history during the year. All but one in IE said that they had, whereas fourteen of the total number in IT (not necessarily those in the research sample) declared they had not: a result found embarrassing by the teacher of IT who had no idea of the purpose of the research.

(c) From the point of view of those lessons which seemed to give the children of IE the greatest immediate satisfaction, these appeared among the more successful:

	<u>Date</u>	<u>Page in Appendix E</u>
Through discussion on reproductions of some of Leonardo's paintings, to describe the chief events in his life.	October 10th	p.58
and		
To read the dialogue (Sheet I) and discuss the questions on the achievements of Leonardo.	October 12th	pp.58-60
To discuss how various opinions can be held of the same person, relating this to Henry 8th.	October 26th November 2nd	pp.64-65
Through physical movement to show the relationships among members of the Tudor royal family.	November 7th	pp.65-67
To write a play about More and record it.	December 5th, 7th and 12th	p.75
To imagine themselves as commissioners as a means of helping in the explanation of some reasons for the dissolution of the monasteries.	January 9th and 11th	pp.75-76 and Sheet VI p.77
To find out information and explanations through heuristic work.	February 15th, 20th, 22nd, 29th	pp.87-110
To use illustrations of costume as a concrete means of showing some of the differences between life in the sixteenth century and the present day.	March 7th, 12th and 14th	pp.111-113
To learn about the main events in the life of Mary, Queen of Scots and write a play on them.	March 19th, 21st, 26th, 28th. April 2nd and 4th	pp.113-119
To compare and contrast the voyages of Drake and Chichester.	May 23rd	p.130
To learn about the main events of the Armada through an "action map".	May 30th and June 13th	pp.131-132

While these are merely impressions gained through participating with the children in learning situations, it does seem possible to observe some common elements among the lessons such as the appreciation of a story, the discussion of historical characters, imaginative work, heuristic study and physical activities. It should be emphasized, however, that all activities were subsumed to the over-riding aim of having the children act in a logical manner towards the content of the history syllabus.

The general conclusion from the results of the work with the primary children would seem to be that to query, pose problems, challenge and re-phrase questions within the context of a teacher-organised syllabus and teacher-initiated methods does not disallow the possibility of the occurrence of some improvement of thinking skills, at least within the context of the history syllabus being followed. Whether more spontaneous activities, initiated and developed by the children themselves, possibly in relation to simple primary sources, would lead to more profound changes, possibly at the level of structural transformation, is another question which needs to be investigated through further research.

The results from the pupils of secondary age did not show such a clear trend. According to the analysis of covariance, the only results which reached the level of significance were these in favour of 3E boys against 3G(2) boys on "The Russian Revolution"; and 3T boys against 3C boys on the average grades of the three historical passages (see Part VII, Chapter 3, Tables Ll and Lll). The boys and girls of 3T have been noted as being of a superior intellectual ability and rather more motivated towards learning than any other of their respective sub-groups (see Part VII, Chapter 1). The girls of 3T have been shown to be significantly more intelligent and more motivated than those of 3E (see Part VII, pp.290-291). Some of the pupils of 3T operated in a very active manner, querying information in a sensible way (see Part VII, Chapter II). A most powerful teaching programme with 3E would have been needed to overcome such initial advantages,

especially within the relatively short period of teaching time. There may also be other possible reasons for the failure of 3E pupils to overtake 3T pupils over the year. It may be that the methods adopted with 3E and 3T were not different enough, although the lesson notes in Appendix K would seem to indicate that the children of 3T were expected, at least overtly, to be a great deal more passive than were the children of 3E (see, for example, the lesson with 3T on March 20th (Appendix K, p.389) compared with 3E's planning of a "newspaper" (Appendix K, p.263); see also Appendix N). Possibly the syllabus content was more similar with 3E and 3T than it had been with the primary classes, and this could be one reason to help to explain the lack of significant difference in the results. It has to be noted, though, that 3T spent much of the first term on data which was presented in a figural manner and was not used again either for the annual examination or in the criterion tests of thinking. Certainly, a longer time was spent studying the topics of Mary, Queen of Scots and Sir Thomas More with 1E as compared with 1T than occurred with the lessons on the Russian Revolution in the secondary school. Class 3E, however, did spend slightly longer on the "taught" topic than did 3T (December 3rd to 19th inclusive (Appendix K, pp.262-267) compared with March 18th to 27th inclusive (Appendix K, pp.388-390)). Furthermore, Jersild (1946) cites two pieces of evidence which imply that the amount of time spent teaching a topic will not markedly affect the results. For example, in one research two groups of children were given a test on their understanding of time concepts at the beginning of the sixth grade. Then the children in one group had a good deal of emphasis placed on time in their regular classwork while in the other group time concepts were not singled out for emphasis. A test of time concepts was given at the beginning of the seventh grade. "It was found that the two groups made almost the same average score" (op.cit., p.110). In another piece of research the wide fluctuations in the achievement in social studies of over 10,000 sixth grade pupils in Indiana was not

significantly related to the amount of instruction to which the children were exposed. And the children's achievements had little relationship to the amount of time spent on the social studies during the day or week (op.cit., p.112-113). It might be thought that the pupils of 3T were slightly favoured in that they studied the events of the Russian Revolution later than the pupils of 3E. Apart from the emphasis laid by Piaget and Inhelder on what could be called "operative" memory (for example, 1973, p.22), both classes had revisionary periods during the Summer Term. One contrast noted with the secondary as compared with the primary pupils was that there was always an awareness of the necessity to cover as much of the same ground as possible with 3E and 3T, a situation which did not present itself with the primary school children. Another possible cause for the difference between the results of the two age groups could be that the teaching strategies of the schools played a part since 3E and 3T were within the same school while 1E and 1T were in different schools. It has been noted, though, that 1E's scores on the "taught" stories were significantly better than 1C's - and these were classes from within the same school. With the secondary pupils, however, only the scores of 3E boys against those of 3C(2) boys reached the level of significance. If the teaching style of the school had played such an important role, surely the scores of the other sub-groups (3E girls, 3T boys and 3T girls) should have shown significant differences when covaried against 3C(2)? It does not seem likely that the methods of teaching in general are of paramount importance in explaining the discrepancy between the results of the primary and secondary pupils; the answer may lie elsewhere.

It was suggested in Part VII, Chapter 4 (p.342) that the teaching methods might have been inappropriate for a number of pupils in 3E since they were intended to elicit formal-type thinking. If the approach, indeed, was of that nature then the pupils of 3E at the lower levels of thinking in history might not have had the necessary thinking skills to appreciate the

methods adopted with them. Yet, as the following list shows, even those pupils graded at the level intermediate between concrete and formal thinking on the first occasion of assessment, and presumably ready to respond to the methods used, did not always make great gains, whether they were in the experimentally or traditionally taught classes:

Assessment on "The Russian Revolution"

<u>First Assessment</u>		<u>Second Assessment</u>
3E	2 boys at 2B/3A (6) ^m	1 advanced to 3A(7); 1 regressed to 2B(5)
3F	5 boys at 2B/3A(6)	3 remained at 2B/3A(6); 2 regressed to 2B(5)
	1 girl at 2B/3A(6)	Regression to 2B(5)

A similar lack of progress was evident with those pupils in 3E and 3F whose average scores on the three stories were considered approaching the formal level on the first occasions:

<u>First Assessment</u>		<u>Second Assessment</u>
3E boys	5.33	4.33
	5.33	4.83
	6.00	6.00
3F boys	5.67	5.83
	5.33	5.00
	5.50	5.33
3F girls	6.00	5.50
	5.33	4.50

The gains in the average scores over the year noted in Table XLVIII (see p.329) were made by the pupils at the lower levels of thinking. These figures for the more advanced pupils give rise to a number of suggestions.

Footnote:

^m The figures in the brackets represent the quantification of each level (see Table XXIV, pp.257-258).

Possibly, rather than being at the intermediate level on the first occasion, these subjects might have been in the final phases of the period of concrete operations in history where consolidation was occurring and they were thus unable to give evidence of any learning effects (c.f. Wallace 1972, pp.201-202). Or, it may be that progression through the intermediate stage between concrete and formal operations is a lengthy process with the possibility of regression always evident. Hughes (1965), indeed, in his longitudinal study on four Piagetian experiments found a similar type of uneven development, a few of his subjects even regressing from the formal level one year to the concrete level in a subsequent year (op.cit., p.103 and Table 27, pp.135-136). It may be, of course, that some subjects become bored on a second occasion of testing and give more superficial answers. But it has to be noted here that in the present research the general level of responses improved over the year according to the mean raw scores (see Table XLVIII, p.329). In fact, the pupils who made the most impressive progress over the three stories on a numerical scale were three girls of 3E who had declared during the year's teaching that they had found the general approach difficult to understand (see also Part VII, Chapter 4, p.342 where their scores on "The Russian Revolution" are given for two of these girls):

	<u>First Assessment</u>	<u>Second Assessment</u>
COL	2.17	3.67
FOI	2.50	3.50
WA	1.67	3.00

Such results would seem to support the contention that, whether the methods of teaching were predominantly hypothetico-deductive or not, it is easier to move from the respective preceding level into the concrete rather than the formal operational stage.

These results do seem to show that the general tenor of the research findings with the secondary pupils was not uniformly depressing. Indeed, advances were evident in the two taught groups of 3E and 3F on a number of

criteria. As already noted, the analysis of covariance indicated that on "The Russian Revolution" the boys of 3E improved significantly their scores over the year when compared with the boys of 3C(2). They also made a numerically greater gain than did 3T boys on that "taught" story (+ 0.77 as against + 0.34), but this difference did not reach the level of significance (see Table XLVIII, p.329). The boys of 3T improved significantly over the year on the average scores on three stories when their scores were covaried against those of the boys of 3C (see Table LII, p.334). There was a slight improvement in general in the raw mean scores on various concepts assessing attitudes to history in both 3E and 3T: on occasions this improvement reached a significant level for the boys of 3T (see Table XLIII, pp.294-295). When the content of the course was assessed through an examination which tried to require not only memory but also the ability to evaluate evidence and discern implications within sources (see Sheet XLI, Appendix K, pp.336-341), both the pupils of 3E and 3T did well on average (see Appendix N). Some of the children, indeed, surprised the staff with the relatively high marks gained when compared with the grades achieved in previous years. And it is obviously this type of content learning on which many schools rely and from which they make their judgments on pupils' performances and possible future achievement. While it is agreed that the relation of such learning and development is a relation of content to form (Furth and Wachs 1974), it has already been argued with reference to the primary results that content learning may be helpful at times of future development (cf. Lovell 1971 and see Part I, pp.2-3).

It is impossible to specify precisely which factors helped towards these improvements in the secondary sphere. Possibly both classes responded to courses with a fairly clear pattern and which included some topics either not over-familiar to them or appealing because of their relevance to present-day issues. Class 3E, perhaps, benefitted from being challenged to put forward ideas and to think about the data: the pupils

also seemed to enjoy, on the whole, the group work approach adopted on a number of occasions. The boys of 3T certainly seemed to appreciate a change of teacher and this presumably affected some of their results. Structurally, though, apart from the two isolated results, there was no significant development over the year when the classes were compared against each other or against the non-taught control groups 3C and 3C(2). With these older pupils it was probably over-optimistic to hope for impressive changes in such a relatively short-term teaching programme. The results might have been different had all the staff of all the subjects taught during the year been consciously aiming at improving the children's thinking skills: again, though, this can be but a speculative comment.

It has been stressed throughout this thesis that the major aim of the research with the secondary pupils was to try to help them operate actively on verbal data connected with history; it was not to try to have them "working as historians". Yet, at times, there may have been a relationship between the methods adopted with 3T, Piaget's didacts and historians' observations on the nature of their pursuit. Piaget (Ripple and Rockcastle 1964, p.5), for example, declares that the educational process needs to "form minds which can be critical, can verify, and not accept everything they are offered" (see Part III, p.151). Similarly, once a scholar has immersed himself in his sources, Elton (1967) decides that the historian, above all, must be critical and sceptical (see Part IV, p.168). Fenton (1967) considers that learning to use analytic questions should be a key objective of social studies (see Part IV, p.173) and Elton says that history begins with asking a question (see Part IV, p.165); similarly, Piaget (1964) argues that, "A teacher would do better not to correct a child's schemes, but to provide situations so he will correct them himself" (see Part III, p.160). These quotations would appear to show some resemblance between the demands of history and the development of inferential thinking and also, possibly, indicate a way forward for future research.

work instead of accepting pre-digested knowledge from outside" (1971, pp.158-159). Depending on the topic(s) chosen, the pupils could research for their own evidence from text-books, monographs, printed documents and local sources. As far as possible the emphasis would be placed on the use of original sources in order to link the activities as closely as possible with the "Nuffield" type of history described in Part IV. In all of this heuristic work the researcher-teacher would obviously be available as adviser, guide and provisioner. The crucial criterion tests for the assessment of the movement of thought before the research programme began and at an interval of at least three months after it ended would be the following:

- (a) a test on two historical issues unrelated to the course,
- (b) a test on aspects of the topic(s) studied through heuristic means,
- (c) a test on a topic related to the general context of the course,
- (d) the topics themselves could be assessed separately for levels of thinking displayed and historical skills by an educational psychologist and an historian.

Such a research project might be a means of placing more emphasis on the pupil himself, which is what writers working within the Geneva framework would wish to happen:

"In the Piagetian approach to teaching, children thus have to be given the time and freedom they need to build the prerequisite structures, to figure out their own strategy, to mobilize their entire cognitive organisation (and) Teaching the underlying processes entails refraining from external reinforcement to let the child figure out for himself" (Kamii 1970, p.36)

"Development occurs as the child discovers links between events. The link cannot be imposed upon him; it occurs as a result of his interactions with objects and people" (Schwabel and Raph 1974, p.37)

"To know is an activity of the subject" (Furth 1969, p.15)

"All the emphasis is placed on the activity of the subject himself, and I think without this activity there is no possible didactic or pedagogy which significantly transforms the subject" (Piaget in Ripple and Rockcastle 1964, p.18)

Such an approach might also lead the pupils into searching for evidence, asking questions of that evidence, forming relationships among the various items of information, and coming to an evaluative conclusion: skills which seem to reflect some of the activities of the historian.

Another conceivable approach stems from the ideas on "process learning" suggested by Shroder et al. (1973) who declare with approval that a student should "explore a given environment through questions so that he can acquire a sufficient body of facts to cause hypotheses" (op.cit., p.42). There seems some resemblance here with Kitson Clark's explanation (1967, p.26) of an historian's activity: "The historian's first duty is careful and expert observation"; from which some explanation will follow; and "any explanation must in effect present some hypothesis about the causes which made the sequence of events happen in the way it did" (see Part IV, p.181). There would thus be available a certain amount of basic evidence on, say, the Chartist movement through contemporary speeches, diaries, minutes of meeting, parliamentary debates, statistics of unemployment and price changes, and secondary source material. Essential questions to be addressed to this evidence would be devised by the class, with the assistance of the teacher. These are likely to be similar for any body of evidence and might be of these types:

"Who were they?"

"Why did they have these aims?"

"How did they try to achieve them?"

"How far were they successful in achieving their aims?"

"Why was so little/not more achieved?"

The children would search through the provided material and also for their own evidence to try to answer such questions. It is debatable whether such activities would lead to the formulation of hypotheses or whether the teacher would have to provide them, but the teacher would presumably have such hypothetical questions as these in his mind:

"How far can it be considered that the Chartist movement was a failure?"

"Were the demands of the Chartists too far in advance of their time to be successful?"

The answers to such queries might take the form of evaluative essays which could be assessed both on Piagetian and historical criteria.

Such approaches might avoid the accusation of Dowers and Hollister (op.cit., p.8) that "the greatest instructional fallacy..... is the notion of telling as learning". It might, however, be that the schemas of the pupils would still remain insusceptible to radical modification, and that development does indeed override learning activities. It has been remarked throughout this thesis that the Geneva school emphasises the subordination of learning: "I think development explains learning, and this opinion is contrary to the widely held opinion that development is the sum of discrete learning experiences" (Piaget in Ripple, and Rockcastle 1964, p.8 - see also Part I, pp.147-148). Furthermore, "learning is always relative to the developmental period during which it takes place, and to the intellectual structures which the subject has at his disposal during this period. In the last analysis, therefore, development accounts for learning much more than the other way around" (Piaget in his introduction to Almy 1967, p.v). As has been observed Piaget's emphasis on the importance of developmental factors has led to the accusation that his is a geneticist position. Wohlwill (Sigel and Hooper 1968, p.489), for example, states that Piaget's biological orientation and interest in structure leads him to take external factors for granted and to regard the form which this interaction takes as

largely predetermined from the start, there being left little leeway for the differential manifestation of external conditions. Piaget denies such geneticist assumptions, asserting that his theory is essentially one of interaction (see Part I, pp.72-77). But for any learning experiences to affect significantly the structures of thought, the subjects must be reasoning at a transitional level (see, for example, Morf's results in Part I, p.58). While it was anticipated that pupils aged from 13 to 14 years of above average ability, as measured by standardised reasoning tests, might in general be approaching the formal level in history, in the event this was not so. Thus, while isolated significant improvements were made against the control groups by the boys of E on "The Russian Revolution" and by T boys on the average scores, ontogenetic development seems to have set a limit beyond which children of a given age cannot function (Green et al. 1971, p.96). Experimental evidence from such sources as Kama (1971 - see Part II, pp.123-125) and Miles (1971 - see Part V, pp.197-199) would seem to support these results with the secondary pupils.

If the pre-eminence of developmental factors in intellectual progress are accepted, the question still remains why did the primary pupils in the experimental groups show a significant improvement against the taught and control groups on the "taught" story while the boys of E seemed to give some evidence of transfer to similarly structured stories. Part of an answer may lie in the particular groups used in the research. Statistically, a sample of average ability is more likely to show evidence of improvement than are samples of above average ability (see, for example, Bloom 1964, p.63, where he states that there is a general ceiling effect in which persons with initially high scores tend to make smaller changes than persons with initially low scores). While Bloom's (1964) findings were based on criteria other than those used in the present research - though Vernon (1969, p.140) states that the Piagetian battery in his research, when scored for total errors, mainly acted as a general intelligence test -

Bloom has argued that the period from 2 to 10 years is the one when, "the most rapid changes take place in general intelligence". However, Bloom continues, "in the period ages 2 to 17 the line is more nearly a parabolic function tending to a plateau after age 9" (op.cit., p.64). Bloom then states that "the effects of the environments appear to be greatest in the early (and more rapid) periods of intelligence development and least in the later (and less rapid) periods of development" (op.cit., p.89). Furthermore, "a shift from one environment to another will have greatest possible consequences in a period of rapid normal growth and will have little effect on the individual during the period of least rapid normal growth" (op.cit., p.194). It has to be admitted that Bloom's thesis has been criticised recently. Majoribanks (1974, p.260), for example, says that the environment makes "a small and steady, rather than diminishing contribution to the growth of intelligence", and that, "the Overlap Hypothesis does not take into account the possibility of genetically programmed effects occurring throughout the development of intelligence analogous to adolescence growth spurts and sexual maturation". But a strong body of opinion would seem to support the viewpoint that during the earlier years children's thinking skills are more labile, more open to the effect of environmental circumstances. Elkind (Green et al. 1971, p.24) certainly puts his weight there: "Apparently, therefore, environmental variation during the elementary school period is more significant for later intellectual attainments of the Piagetian variety Like it or not, the years from 6 to 12 are still the crucial ones with respect to later academic achievement".

Related to the actual chronological ages at which they were being taught, another possible reason for the success of IE on the "taught" stories is that the pupils on average were at a transitional level between pre-operational and concrete operational thinking in history. Inhelder (Mussen et al. 1969, p.6) claims, for example, that true progressive development takes place only when children are at an intermediate stage in

their thinking (cf. Part II, p.109 for Hazel's (1972) results). Since the demands made during the lessons were presumably not too far ahead of their thinking levels, these children on average may have been ready for more challenging methods than merely "listen and write". "When the difficulty is not too great, does not seem insurmountable", then the child is motivated to apply his schemes because "the obstacle itself creates a valuation in the form of a need to conquer", that is, there is a "zone of optimal interest for that which is neither too known nor too new" (Piaget in Mischel 1971, p.332).

Flavell's (Green et al. 1971, pp.190-191) analogy of development as a cone seems useful as a means of concluding this discussion on the differential rates of development. "My image of development is a sort of cone or megaphone, with its small end towards birth and its large end towards maturity. The circumference of the walls represents the constraints on what the child can develop into at each age period." Hence, it would seem that less movement is necessary at the younger age levels for progress to be made into, say, the concrete operational period than is needed at the older ages where the constraints are far wider. It has to be remembered, though, that the boys and girls of 13 together improved on only the "taught" story. Thus, while the results with the girls support the argument that verbal instruction will not lead to transfer effects outside the area in which the children are trained (see Part II, p.112), yet the fact that the boys did give some evidence of transfer effects leads to the possibility that there may be methods through which the thinking of a wider group of children may be improved.

It was thought worthwhile to investigate the consistency of both the primary and secondary pupils' thinking skills across the verbal passages and also across the three tasks of verbal passages, equilibria in the balance and the combination of colourless liquids. Empirical research has not tended to support Piaget's notion of "structures d'ensemble" at the

successive stages of concrete and formal operational thought (see Part I, pp.40-43; Part II, pp.144-146; Part V, pp.209-214). If thinking cannot be shown to be stable across a series of problems, then two major types of modification have been postulated. Responses may be more variable during the early stages of a period, becoming more stable during the latter part of that period (cf. Wallace 1967, see Part I, p.42). On the other hand, it may be that structures d'ensemble should be looked at as a family of separate structures, each following its own developmental timetable (Flavell and Elkind 1969, see Part II, p.145).

As the following figures show, the evidence from the present research tends to lend support slightly more to the second of the modifications than the first. When the stability of the scores on the historical passages for the various sub-groups was assessed through Kendall's coefficient of concordance, these figures resulted:

Primary: "W" ranged from .348 to .819 on the two occasions of testing (see Part VI, p.261).

Secondary: "W" ranged from .499 to .835 on the two occasions of testing (see Part VII, p.331).

Research evidence with secondary pupils seems to indicate that individuals have preferences for non-verbal or verbal tests (Davies 1965, Bart 1971, Lodwick 1972 - see Part V, pp.211-214). When Kendall's "W" was calculated for the three different tasks, a moderate level of consistency in the pupils' responses was discovered for both the primary and secondary subjects:

Primary: .477 (P < .001) for the first occasion
(see Part VI, p.267) .487 (P < .001) for the second occasion

Secondary: .420 (P < .001) for the first occasion
(see Part VII, p.335) .422 (P < .001) for the second occasion

The pupils found the questions on the Piagetian experiments easier to answer than those on the historical passages on all occasions.

As far as these figures can be accepted, then, the pupils in general maintained similar levels in relation to each other more for the historical passages than for the more disparate tasks, a finding which Peel (1971, p.40) anticipated: "if the passages do not differ greatly in difficulty, sophistication and area of coverage they will evoke answers from any one person at not too disparate levels" (see Part V, p.214). Writing with regard to the formal level, although it is surely likely to be true for both the concrete and formal levels, both Lunzer and Wason and Johnson-Laird give useful ideas to help account for the less consistent responses across different tasks. Lunzer (in Wollman and Karplus 1973, see Part V, pp.210-211) thinks that operational thought is likely to be elicited when individuals are suitably motivated and have the correct cues, whereas Wason and Johnson-Laird (1972, see Part I, pp.36-37) consider that the familiarity of the tasks is important: "content is vital". Such an emphasis on the nature of the content would surely not violate Piaget's developmental model at least in relation to history in schools. Structures have to be constructed through interaction with the environment (see Part I, p.76); hence appropriate types of experience are essential to allow for the possibility of equilibration taking place.

And such experiences - reading newspapers, discussing political issues, visiting historic sites and museums, reading accounts of historical events, attending particular history lessons - form part of that general development which Piaget emphasises is so important in each person's progress through the various stages. It may be that this is the type of experience referred to by Wohlwill (Ripple and Rockcastle 1964 - see Part II, p.81): "the more generalised the experience that the child gets at an earlier point, the less specific teaching instruction will be necessary later". It must be remembered, though, that a vital aspect of each child's developmental pattern is his ability and desire to regulate the experience for himself: these are also aspects of general development. Thus, while one would not expect teachers

with similar age groups to concentrate exclusively on the improvement of logical thinking in history but rather treat their subject for the many traditional values it has always had - the love of a powerful story, the excitement of the imagination, the extension of cultural limits, and so on - on the other hand, they should always try to be aware of children's developmental levels and of taking the chance to improve their pupils' comprehension and analysis of historical data. If the content and methods are of an appropriate form such attempts should not lead to boredom and resistance; in the present research, for example, there did not seem any significant evidence of dislike towards the more challenging methods used with LE and E. So, while it may be true that "development explains learning" (Piaget in Ripple and Rockcastle 1964, p.8) and that "'serious' history requires some maturity" (Elton 1970, p.221), the results should not be used to support the view that because children are of a certain age nothing can be done and, therefore, nothing should be done. Progress was evident on the "taught" stories with the primary school children and some little progress was noted with the boys in the secondary school. Piaget's theory is one of the interaction of the organism and the environment and the wise teacher will structure the environment so that a suitable interval exists between the children's schemes and the content in order to challenge, involve and possibly improve the pupils' thinking skills in the subject of history.

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