THE CAUSE OF THINGS:

THE EFFECTS OF AGE AND SCHOOLING ON THE DEVELOPMENT OF PHYSICAL AND PERSONAL CAUSALITY IN ZAMBIAN CHILDREN

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A DISSERTATION

PRESENTED TO THE DEPARTMENT OF PSYCHOLOGY

OF THE UNIVERSITY OF ZAMBIA

IN PARTIAL FULFILLMENT OF THE

M.A. IN EDUCATIONAL PSYCHOLOGY PROGRAMME

September 1982

Dedicated to

My parents

Without whom none of this would have been possible

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ACKNOWLEDGEMENTS

I would like to express my gratitude to my supervisors, Dr. P. Kingsley and Ms. C. Westenholz, for their untiring efforts on my behalf. Their advice and encouragement were much appreciated. I would also like to thank the Psychology Department for the research funds which made this research possible. I am very grateful also to the Headmaster and Grade 6 Teachers of Kaunda Square Primary School, and to the children (both in the school and in Kalingalinga) without whose cooperation this research could not have been carried out.

My thanks also go to some very special people - my parents, for the inspiration they gave me; and my friends, Jasmine, Joseph and David, for all their help and encouragement. Special thanks to John, who helped so much with the data analysis, and to Cookie, who helped in every possible way.

I would also like to thank my research assistant Lloyd, for his patient translations, and Ms. Clara Mbulo for doing the typing.

ABSTRACT

This study was designed to:

1. Investigate developmental differences in the development of Physical and Personal Causality;
2. Identify the different stages in the development of Personal Causality;
3. Investigate the effect of schooling on the development of Physical and Personal Causality; and
4. Investigate the relationship, if any, between Physical and Personal Causality.

Sixty Zambian boys from an urban area (Lusaka), were divided into three groups: (a) 6 years Unschooled; (b) 12 years Unschooled, and (c) 12 years Schooled, on the basis of age and schooling. All the boys were selected from the same socio-economic class. The children were tested on measures of Physical and Personal Causality, and their response were classified using a categorisation system developed by the investigat for the present research.

It was hypothesized that developmental differences would be found i the development of Physical and Personal Causality, and that schooling w affect the development of both types of causality in some way. It was expected that stages similar to those identified by Piaget for Physical Causality would be found for Personal Causality, and that there would be relationship between the development of Physical and Personal Causality within each of the three groups.

The Fisher Exact Probability Test, and Spearman's Rank Order Correlation were used for data analysis.

It was found that developmental differences do exist in the perceptions of both types of causality, and that schooling had no effect on the development of either Physical or Personal Causality. Stages similar to those found in the development of Physical Causality were identified in the development of Personal Causality as well. It was found that there was no significant relationship between Physical and Personal Causality within the three groups, but a significant relationship between Physical and Personal Causality was found within the entire sample.

Chapter 1

INTRODUCTION.

"Happy is he who has been able to perceive the cause of things."
(Virgil)

David Hume said that the principles of cause and effect are "to us, the cement of the universe" (Hume, 1888). Indeed, the concept of causality seems to be of central importance for our understanding of the world.

Processes that require the formulation of causal hypotheses are forms of cognitive behaviour that are usually associated with science. According to Segall (1979:125), in the West such a mode of thought is considered by many to be "the ultimate in intelligence". Causal thinking is not limited to the sciences however. Though drawing inferences, "particularly causal inferences .... are highly intellectual activities" (Segall, 1979), yet these processes have to occur in everyday life, as Michotte (1963) states - "terms having a causal significance are used by everyone for the purpose of indicating the varied concatenations of physical events which are constantly to be observed in everyday life" (Michotte, 1963:348).

Even in social and interpersonal situations we are "constantly making inferences about the causes and effects of other peoples behaviour" (Whiteman, 1967:144). As Kelley (1973) puts it ; "Man's concern with reasons for events does not leave him 'lost in thought' about these reasons. His causal explanations play an important role in providing his impetus to action and in his decisions among alternative courses of actions. When attributions are appropriate, the person undoubtedly fares better in his decisions and actions than he would in the absence of the causal analysis" (Kelley, 1973:127).

Thus it is clear that the concept of causality plays a very important and global role in the individual's life, both in the physical and psychological spheres. According to Piaget (1928; in Campbell, 1976:29) - "... every act of socialised intelligence implies not only consciousness of a definite thought direction, but also consciousness of the successive statements of a narrative (relations of implication), or of those between successive images of the object of thought (causal relations)".

Causality has a variety of definitions, but according to Sorokin (1943) all of these fall into two distinct classes:

(i) Causality is seen as a necessary relationship, "either objectively sustained by the variable or subjectively imposed by our minds as an'à priori' category" (Sorokin, 1943:38).

(ii) No necessity is seen in the causal relationship, it is seen as an "empirical, stable, association of two or more variables" (p.38). As David Hume said - "a mere recurrent empirical contiguity and succession of A and B" (in Sorokin, 1943:38).

Nevertheless, each of these concepts of causality involves hundreds of variations in the meaning of causality. As W.K. Clifford remarked "the word represented by cause has 64 meanings in Plato, and 48 in Aristotle" (in Sorokin, 1943:38).

The study of the cause-effect relationship has provoked much interest in such diverse fields as science, philosophy, and more recently, psychology. Since causality seems to play such an integral part in our lives and the world we live in, many researchers have taken a great deal of interest in the development of this concept in children. The way in which children learn cause and effect relationships and the manner in which the learning process varies with age is important not only for learning theory or developmental psychology but also for education. As Ausubel and Schiff (1954:109) point out, the concept of causal relations is "directly

implicated in the learning of school materials related to the physical, biological and social sciences, and is directly involved in the individual's rational understanding of his environment and in his adjustment to situations and persons within it". G.Neal (1959) further stated that "some acquaintance with the basic principles (such as cause-effect relations) which govern so much of our activity in an advanced technical society is desirable as a basis for later understanding, and as an antidote to attitudes of uncritical wonder" (G.Neal,Lunzer, 1960, p.29).

Hart and Honore (1959) stress the point that there may be a cluster of related concepts of causation, rather than one single concept, and that "the common notion of causation may have features that vary from context to context" (in Mackie, 1974:117). According to Mackie (1974), this 'cluster of related concepts consists of two classes:

(i) Ordinary causal statements which assert that "one physical event was caused by another such event or by a human action". This class is referred to as 'physical' by Mackie (p.117). This class is similar to Sorokin's second class (described before), and Piaget's notion of Physical Causality.

(ii) Causal statements that are "statements of interpersonal transactions which involve the notion of a person's reasons for acting", which is referred to by Mackie as the 'interpersonal' class (Mackie, 1974:117).

Although there have been a number of studies on the child's conception of physical causality, relatively little seems to have been done on the child's conception of psychological or personal causality. The term personal causality as used in this research refers to the attribution of causes by individuals for their own behaviour, i.e. intrapersonal events. This idea of personal causality was derived by the present researcher from a study of

Attribution and Self-perception theories, and seems to fit into Mackie's second class of causal concepts, if this can be 'stretched' to include intrapersonal as well as interpersonal transactions.

As a background to some of the theoretical issues which will be raised in this research, a brief outline of Piaget's theory of intellectual development, and his ideas on child physical causality (on which part of the present research is based), is given here. A brief outline of Attribution theory and a rationale for a study of personal causality is also given.

THE DEVELOPMENT OF REASONING ABOUT PHYSICAL CAUSALITY:

Piaget (1971), in his book 'Understanding Causality', suggests an intimate relationship between the development of causality and operations: "Explaining a phenomenon by means of a set of conditions considered as causal amounts to showing, on the one hand, through what transformations it was produced and, on the other, how the new aspects of the result correspond to certain transmissions from the initial stages" (Piaget, 1971:1). According to Piaget, "This dual aspect of production and conservation is characteristic of operational as well as causal transformations." He further states that - "... There must ... be an intimate relationship between these two kinds of actions; otherwise the logico-mathematical constructions of the subject would never meet reality, while reality would modify the subject's operations without his knowing it"(p.2).

In view of this it seems important here to describe briefly the stages of intellectual development proposed by Piaget (which include the development of operations).

Piaget's theory of intellectual development identifies four main stages or periods in which cognitive development is qualitatively different. These periods are:

I. THE SENSORI-MOTOR PERIOD (Birth - about 18 months)

During this period the child learns to co-ordinate his reflexes and responses, to search for hidden toys, etc. Curiosity in novel objects emerges at this stage, as do the strategies of remembering, planning, and the use of imagination.

II. THE PRE-CONCEPTUAL PERIOD (2 - 7 years)

This period has two important sub-stages:

(a) The Pre-Operational Stage (2 - 4 years). - Imagery or the use of "symbolic functions", emerges at this stage. The child's language becomes more fluent, and he engages in symbolic play.

(b) The Period of Intuitive Thought (4 - 7 years). - The child begins to elaborate his concepts, and begins to construct more complex thoughts and images. The child begins to use words in his thinking. The child's thought at this stage is mainly egocentric. "He tends to behave similarly to his elders as if he knew intuitively what life was all about; he exhibits the first real beginnings of cognition" (Maier, 1965:115). Classificatory ability emerges at this stage but the concept of conservation is absent.

III. THE CONCRETE OPERATIONAL PERIOD (7 - 11 years)

At this stage the child begins to "relate different aspects or dimensions of a situation to one another", and "arrives at the notion of conservation" (Mussen, 1963:55). Piaget labels this concept as the "principle of invariance". At this stage the child uses logic and reasoning in an elementary way, but he can only apply them when manipulating concrete objects and not to abstract verbal propositions.

IV. THE PERIOD OF FORMAL OPERATIONS (11 - 12 onwards)

Children at this stage are able to deal with abstract problems and propositions. The child uses rules of logic in reasoning, and his thoughts "concern what is hypothetically possible as well as what is real" (Mussen, 1963:56). This period sees the emergence of what Piaget calls hypothetico-deductive reasoning.

Piaget's theory is structuralistic in approach, and assumes qualitative changes in mental structures over time. According to Piaget, children's thought at any one stage has a characteristic structure - "from the simple system of reversible actions" (Beard, 1969:15), in the sensori-motor period, through the logical operations of the concrete operational period, to the complex and abstract hypothetico-deductive reasoning characteristic of the formal operational period.

Each stage in the child's cognitive growth involves a change in the child's mental structures. The sequence of stages is invariant for all humans according to Piaget; thus, the order of development is constant, and "one structure cannot appear before another in a certain group of children and after it in another group" (Beard, 1969:16). In other words, the pre-operational stage always precedes the concrete operational stage. However, the age at which children reach each stage cannot be fixed absolutely as this development is affected by the environment, which may either help, or hamper development.

According to Piaget (1930), causal thinking develops only during the concrete operational stage, i.e. 7 - 8 years. Pre-operational children do not exhibit causal thought (Beard, 1969; Campbell, 1976). In his work on causality, Piaget started by trying to find out whether connected with mental mechanisms, with animism and with artificialism there is not "a corresponding conception of material force and a system of physics peculiar to the child" (Piaget, 1930:237).

Piaget, in his work on physical causality also brought out the fact that explanations given by children and the nature of these explanations differ from time to time, and are correlated with the age of the child. However other researchers (Johnson and Josey, 1931; Berzonsky, 1971) have shown that causal thought can occur at a younger age. In fact, Berzonsky's (1971) findings of the independence of animism from operational thought, Piagetian-type problem solving, and ability to give causal explanations, lend little support for the unitary nature of intellectual development proposed by Piaget. It should also be kept in mind that the rate of development in the 1930's and the 1980's may be very different as a function of the changing times Furthermore the different cultural environments might also affect intellectual development. Studies similar to Piaget's done by other investigators in more recent times fail to support all the age-stage relationships proposed by Piaget (Donaldson, 1978).

Piaget identified 17 types of causal explanations given by children. A brief description of these 17 types of causal explanations is given below:

1. PSYCHOLOGICAL CAUSALITY - or the motivation type of causality:

This is the most primitive type of causality. Explanations like "God sends us dreams because we did things we should not have done" comes under this type. (According to Piaget it lasts the longest.)

2. PURE FINALISM - this resembles the first type in that there is a hint of Godly plan behind everything - e.g. ducks have webbed feet so that they may swim better. However it is different from the first in that "when the child says that the river flows so as to go into the lake, the river is not necessarily endowed with consciousness, nor the maker of things with a motive." There is a finality about things. Though a divine plan is implicit, it is not made explicit, and therefore according to Piaget (1930: 259) "finalism is to be distinguished from motivation".

3. PHENOMENISTIC CAUSALITY - two facts given together in perception get linked up as cause and effect. It is a very unstable type, because as soon as it is established a phenomenistic relation transforms itself into one that is animistic, dynamic and magical. An example of this type of causality is that a fire lit beside an engine is regarded as the cause of movement (usually around ages four-five).

4. PARTICIPATION - this type is more frequent than it appears at first thought. It disappears after the age of five-six. Under this principle two things between which there subsist relationships of resemblance or general affinity are conceived as having something in common which enables them to act upon one another (even at a distance) and so are looked upon as the cause of the other. Air or shadows in the room emanate from air or shadows outside, dreams are sent by birds "who like the wind" (Piaget, 1930:261).

5. MAGICAL CAUSALITY - is closely related to participation. The child believes that his gestures and his words or even his thoughts are charged with efficacy - because of the relations (participations) he establishes between his gestures, etc., and the things around him. Therefore a certain word acts upon a certain thing; a certain black pebble causes the growth of water lilies; a certain gesture protects one from a certain danger, etc. (Piaget, 1930:261).

6. MORAL CAUSALITY - 'the phenomena are explained through their necessity, but this necessity is purely moral, e.g. the clouds must move in order to make night ... boats have to float, otherwise they would be useless, etc.

7. ARTIFICIAL CAUSALITY - it is a complement to moral causality and appears at about the same time. The event or object is explained as the object of human creative activity.

8. ANIMISTIC CAUSALITY - may also be called "causality by realisation of form" (Piaget, 1930:262). The existence of a character or form is explained by an internal biological tendency that is both alive and conscious - e.g.,the sun is what it is because after having been made by men,it grows; clouds, stars,etc. move because they are alive. This is the complement to artificial causality.

9. DYNAMIC CAUSALITY - is "left over" (p.262) from the preceding types. Once animism has been eliminated, there still remain forces in objects that are capable of explaining their activity and their movements.

10. REACTION OF THE SURROUNDING MEDIA - this is the child's first attempt to explain physical causes in physical terms. Before this the causes of phenomena were sought in superhuman agencies but now they are conceived as starting through animism, and then being carried on by the surrounding physical forces - e.g., projectiles which are supposed to be devoid of spontaneous movement are pushed along by the air which they produce during their flight.

11. MECHANICAL CAUSALITY - this appears between the ages 7-8 years. It is the result of eliminating dynamism. The child begins by attributing movement (e.g., of clouds, bicycles, etc.) to the collaboration of two forces, internal and external, but gradually comes to look at the internal as unnecessary.

12. CAUSALITY BY GENERATION - the movement gets explained by mechanical explanations but still the child has to work out an explanation for the origin of things. He starts by thinking that one generates the other, e.g. the moon comes out of the clouds,and the clouds out of smoke (p.264), or the sound comes out of the whistle.

13. SUBSTANTIAL IDENTIFICATION - These types of explanations are very frequent between the ages of 8-10 years. At this stage bodies that are born out of each other cease to have the power of growing that humans have, e.g., at first the sun is looked on as a living being that gradually grows bigger - later it is regarded as matter resulting from the fusion of other substances (Piaget, 1930:264).

14. CONDENSATION AND RAREFACTION - This type of explanation generates from (13). The child accepts that one product generates from another, and feels the necessity of making a distinction between the source matter and resultant product, i.e. if the sun is a ball rolled out of clouds why the difference in appearance (p.265)? This question is explained by condensation - the clouds have to be thick, or packed close (serres) to make the sun. To begin with the child has no idea of density, his earliest explanations of weight are by the size of the object (Piaget, 1930). The bigger the object, the heavier he expects it to be. By the ages of 9-10 explanations by condensation are evident, e.g. water is light because it is thin, stone and wood are heavier because they are thicker.

15. ATOMISTIC COMPOSITION - is the extension of the previous explanation. When the child comes to believe in objects made out of condensation, the concept that they are made of small atoms loosely or closely set together comes in.

16. SPATIAL - The rise of water level due to an immersed body is seen as connected to the volume of the body. This type of explanation is found between ages 9-10 and is quite an advanced type of explanation which is rarely found in children of younger age levels.

17. LOGICAL DEDUCTIONS - These are the most subtle types of explanations, and increase in frequency after the ages of 10-11. Explanations are made by mere law of reason. All mechanistic, spatial and atomistic explanations appeal finally to this one.

On the basis of these types Piaget distinguished three main stages in the child's development of physical causality. These stages range from Finalism and Magic, through Animism to Logical deduction, of which the former two are characteristic of pre-operational and the latter of concrete operational thought. These stages are:

STAGE I: All explanations are psychological, phenomenistic, finalistic and magical. (Approximately 4-6 years.)

STAGE II: The explanations are artificialistic, animistic and dynamic. (Approximately 6-7 years.)

STAGE III: Explanations of more rational forms emerge. (Approximately 7-8 years onwards.)

However, it seemed that this three-stage system of Piaget's did not differentiate clearly the varying degrees of sophistication in what Piaget calls 'causal' explanations (those given in Stage III, as opposed to the 'pre-causal' explanations of Stages I and II). Therefore, in the present study a categorisation scheme was evolved, based on Piaget's, but with two extra stages, IV and V. In this scheme, Stage III represents the simplest kind of causal answer, with Stages IV and V representing causal answers of increasing levels of complexity. Three Transition stages were also included in this scheme, to account for explanations which fell 'in between' stages, i.e. had elements of both Stage I and Stage II, for example. (A condensed outline of this scheme is presented in Table 1 overleaf.)

Examples of the types of responses which might be expected at each stage were formulated by the investigator on the basis of the pilot study results. The responses of children in the pilot study were grouped according to similarity; and then it was attempted to fit these groups into the proposed categorisation scheme. It was found that nearly all the responses fell into one of the proposed categories.

Table I: A CATEGORISATION SCHEME FOR PHYSICAL CAUSALITY EXPLANATIONS

STAGE	AGE	TYPE OF EXPLANATION
STAGE I	4-6	- All answers are motivational, finalistic, phenomenistic or magical - Answers incorporate elements of Stages I and II.
STAGE II	6-7	- Answers are animistic, dynamic, or use the principle of reaction to the surrounding media.
T 2	--	- Answers incorporate elements of Stages II and III.
STAGE III	7-8	- Answers incorporate principles of mechanical causality, causality by generation, etc. At least one correct, logical cause explaining the phenomenon is given. A partial knowledge of the cause of the phenomenon is displayed.
T 3	--	- Responses incorporate elements of Stages III and IV. The child expands on a Stage III answer, i.e. more than one reason for the phenomenon is advanced, but the complete Stage IV answer is not given.
STAGE IV	8-11	- Completely logical answers of why or how the phenomenon occurs is given. All (or most) of the causes of the phenomenon are identified, and a logical analysis of how the phenomenon occurs is given.
STAGE V	11 & Over	- Completely Physics type (i.e. scientific) answers, identifying principles of refraction, density, etc.

N.B. T = Transition Stage

(The ages given here for each Stage are approximate estimates based on Piaget's (1930) "The Child's Conception of Physical Causality".)

According to Piaget the stage of a child's causal thinking is a reflection of his mental maturity and is therefore related to his chronological age. By the age of 7-8 years the child begins to distinguish between self and the outer world, and becomes more realistic in his approach to problems (Piaget, 1930). Before the age 7-8 years, children tend to take "essential points" for granted because they are ego-centric (Campbell, 1976), and believe others always know what they mean. It is only after ages 7-8 that children verbally express their thinking and display truly causal thinking. In other words, truly causal thought is only displayed by children after they realise the need to explain themselves fully to other people.

Laurendeau and Pinard (1962), replicating an earlier Piagetian investigation, have shown striking differences between the two age groups, 4-7 and 7-11, in their ability to apprehend physical causality. Laurendeau and Pinard's findings that younger children have difficulty in differentiating between the "observed locus of effect and inferred locus of cause", are consistent with Piaget's distinction between the intuitive (4-7) and concrete operational (7-11) child.

Johnson and Josey (1931, in Parischa and Suri, 1956) however, found that six year olds were not egocentric. They took great care to explain themselves and were quite socialised in their thinking and explanations. The level of causal thinking as shown by Johnson and Josey's subjects was arrived at a year earlier than that indicated by Piaget's subjects. Berzonsky (1971) states that his results fail to support Piaget's (1930) claim that children who give non-naturalistic explanations (pre-causal) do so because they are pre-operational in their thinking.

These conflicting findings raise the question of whether or not causal thinking is present in children before the ages specified by Piaget, i.e. 7-8 years, and is an issue which the present study aims to investigate.

Berzonsky (1971) investigated the role of familiarity in children's explanations of physical causality. He found that familiarity with objects or events was a decisive factor in causal reasoning. There were fewer non-naturalistic justifications for events involving objects children could have experienced than for questions about remote, unattainable objects. These findings were consistent with those of Nass (1956) - "Questions about phenomena whose causal agents are not accessible to direct experience yielded significantly more non-naturalistic responses than questions about phenomena whose causal agents were more accessible" (Non-naturalistic refers to what Piaget terms as pre-causal type explanations.) (Nass, 1956:670).

Ausubel and Schiff (1954), in their study on "The effect of incidental and experimentally induced experience in the learning of causal relations by children", found that the ability to learn a relevant causal sequence increases with age, as does the ability to "inhibit" the learning of an irrelevant causal sequence. The rate of growth of this latter ability is greater between ages 8-11 than between ages 5-8.

Ausubel and Schiff also found that the crucial aspect of imputing a causal relationship between two events is a "judgement regarding the relevance of the antecedent event for the consequence" (Ausubel and Schiff, 1954:120). They state two important factors which influence a judgement of relevance:

1. The general framework of causal thinking.
2. The general background of experience or sophistication in a given area.

It has been shown that when adults are required to provide explanations for events totally beyond their sphere of competence "they tend to give answers remarkably similar to those given by children" (Hazlitt, in Ausubel and Schiff, 1954). Thus experience seems to be an important factor in causal thinking. Oakes (in Ausubel and Schiff, 1954), found that when explanations for unfamiliar phenomena given by 77 kindergarten children were compared with those given by adults, the differences were more quantitative than qualitative.

Okonji (1971) in his study on the effects of familiarity on classificatory behaviour,also found that the degree of familiarity with the objects to be classified influenced classificatory behaviour. He found that "when appropriate test materials are used,African children are not qualitatively different from their European counterparts in their abstract attitudes" (Okonji, 1971:39).

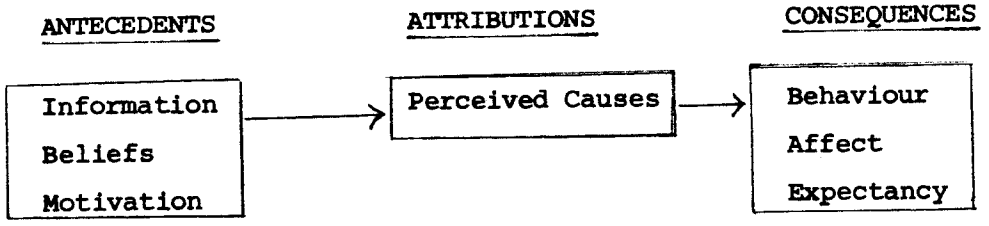
As familiarity with test objects has been shown to be an important factor in testing the development of concepts, and experience also seems to play a major role, tasks for both personal and physical causality were structured using materials which were familiar to the children, and with which they may have had some experience, as far as possible.

THE DEVELOPMENT OF REASONING ABOUT PERSONAL CAUSALITY

During the last decade there has been a great deal of research on the perception of causes of people's behaviour. This research has been conducted primarily within Social Psychology, the focus being on the perceived causes of other people's, and one's own behaviour. Arising out of this research is the currently influential Attribution theory which is concerned with the study of perceived causation in the interpersonal and intrapersonal domain.

Attribution refers to the "perception or inference of cause" (Kelley and Michela, 1980:458). Attribution theory can be simply defined as the study of the 'rules' used by the average person to analyse behavioural causation. Fritz Heider, who is often referred to as the "father of attribution theory" (Berkowitz, 1980), stated the main concern of this theory as lying with "naive" psychology - the cause-effect analysis of the man-in-the-street.

A general model of the Attribution process is illustrated in Figure 1 below:



(From: Kelley and Michela, 1980.)

On the antecedents side, information about behaviour and the circumstances of its occurrence are used by the subject to infer the cause of the behaviour. On the consequences side, subsequent behaviour is affected by the attributions made.

A distinction needs to be made here between Attribution and Attributional theories. The former involves the assessment or manipulation of antecedents while the latter concerns itself with the consequences of attributions and involves the assessment or manipulation of the perceived causes of the behaviour. Researchers interested in the cognitive processes focus primarily on the former, while those interested in the dynamics of behaviour focus on the latter. The present research has its roots in Attribution theory.

According to Kelley, Attribution theory is a theory about "how people answer questions beginning with why?" (Kelley, 1973:117), that is, how they make causal explanations. Attribution theory also concerns itself with the information people use in making causal inferences and how they utilise this information. Kelley states that - " ... as a general conception of the way people think about and analyze cause effect data, attribution theory might have emerged from any of the classical fields of psychology concerned with perception, judgement and thinking" (p.108). In effect, Attribution theory

is concerned with common sense, and Kelley believes that the proper role of Social psychologists is "not to confound common sense, but rather to analyze, refine and enlarge on it" (Kelley, 1973:108). As Paul Valery remarked, "The purpose of psychology is to give us a completely different idea of the things we know best" (in Kelley, 1973:109).

Attribution theory deals with two main issues:

(i) The theory deals with questions of social perception. For example, if a person is aggressively competitive is it because of his personality or is it his reaction to social pressure? The questions raised are concerned with observed behaviour, and interest lies in the causal analysis made by the common man.

(ii) The theory deals with questions of self-perception. The concern here lies in the individual's judgements of his own attractiveness, ability, feelings, etc. Interest in this area originated from Festinger's (1954) theory of social comparison processes, and Bem's (1965,1972) analyses of "the conditions under which one's attitudes are known to oneself" (Kelley, 1973:107).

Attribution theory is also related to the more general field of Psychological Epistemology, which deals with the operations by which a man "knows his world, and, more importantly, knows that he knows" (Kelley, 1973: 107), i.e. he believes in the veracity of his beliefs and judgements.

According to Kelley (1973), there are two distinct classes of information which are available to the attributor for making causal deductions. These are:

(a) Co-variation concepts - where the attributor has information from multiple observations; and

(b) Configuration concepts - where the attributor has information only from a single observation.

In the first case the attributor has to observe and analyse the co-variation between an observed effect and its possible causes. In the second instance, the individual has to consider the configuration of factors which may be plausible causes for the observed effect.

COVARIATION - According to Kelley (1973:108) - "An effect is attributed to one of its possible causes with which, over time, it co-varies". The temporal relations between a cause and its effect are very important in this concept. Michotte (1963) showed that "close temporal relations are essential to a causal explanation ... the unit which moves first is ... more likely to be seen as the origin". And, according to Karl Duncker (1945) "The essential cause of an effect b-or that which leads to b-can be grasped by the abstraction of those further factors which all b-situations have in common, and of those which all comparable non-b situations lack in common. Such an abstracting induction takes place everywhere in the practical life of man and animal, only less systematically than in the sciences" (in Kelley, 1973:109).

Kelley agrees with Heider's view of the common man as an amateur scientist, and argues that we all use a simple version of the Analysis of Variance (ANOVA) method used in science. Though this is a poor version of the scientific one, "incomplete, subject to bias, ready to proceed on incomplete evidence" (Kelley, 1973:109) it still has a number of similarities with the scientific ANOVA.

In the ANOVA model proposed by Kelley, the Independent variable consists of "salient possible causes", and the Dependent variable is the effect. There are three classes of possible causes - Persons, Entities and Times, and the co-variation of these with the effect is what has to be analysed by the attributor.

The importance of the ANOVA concept lies mainly in what Kelley calls the Phenomenology of Attributional Validity. Using the Person, Entity, Time

framework the person knows his response is valid if:

(a) the response is associated DISTINCTIVELY with the stimulus;

(b) the response is similar to those made by others to the same stimulus. There is CONSENSUS;

(c) the response is CONSISTENT over time.

The subjective validity of an attribution is based on these three criteria.

CONFIGURATION - Kelley himself admits that the attribution process implied by the ANOVA model is rather idealized, and is a context within which only "some limited and small sample of observations is interpreted" (Kelley, 1973:113). It is not always, nor indeed often, possible for an individual to make multiple observations, therefore he may make causal attributions on the basis of a single observation. However, according to Kelley, even when this is the case, the individual is not acting in complete ignorance because he has usually observed similar effects in the past, and has some idea of the possible causes for a given effect.

In such situations, Kelley suggests that attributors use what he calls the Discounting Principle. This principle states "The role of a plausible cause in producing a given effect is discounted if other plausible causes are also present" (Kelley, 1973:113). Thibaut and Riecken's (1955) experiment demonstrates this principle. In this study the subject had to persuade (a) a low status, and (b) a high status person to grant a request. Each person's compliance could be attributed to:

1. Internal attitude/disposition; or
2. External pressure applied on him by the request for help; or
3. Both.

It was found that the low status person's compliance was attributed more to (2) than to (1), and vice-versa for the high status person.

Kelley (1973) notes that in using configuration concepts, an effect is always attributed to a cause with high external justification. Only if there is little external justification for the effect are internal causes seen to be responsible for the effect.

Kelley (1972:2) describes a causal schema as "the way a person thinks about plausible causes in relation to a given effect". The present research aims to identify the types of causal schemas used by children to explain success or failure, and to see whether these schemas vary with age, but more will be said about this later.

Kruglanski (1980) proposes that, though different attribution models concern themselves with different areas of knowledge, they share the same "epistemic process". He states that "the formulation of an epistemic problem may be understood as a motivated behaviour, prompted by an interest that a knower may have in a given bit of knowledge" (Kruglanski, 1980:71). This interest may either be intrinsic, as when a child is prompted by sheer curiosity to find out how his toy car works, or it may be extrinsic, as when a student tries to find out where his next lecture is.

Kruglanski agrees with Kelley's and Heider's view of the common man as a naive psychologist - "an amateur scientist analysing available information to infer cause" (Tillman and Carver, 1980:19). According to Kruglanski, people process information in accordance with "its relevance to their intuitive hypotheses and theories" (p.72). Kruglanski identifies three central notions of what he calls the "lay-epistemic process". These are:

(1) Relevance - "Two cognitive elements are mutually relevant if and only if either is believed to entail the other, or the negation of the other".

Entailment referring to an if-then relation, e.g.if it is five, then a reliable watch would indicate five o'clock.

(2) Consistency - "Two relevant propositions are consistent if and only if their conjunction is compatible with their relevance relation", e.g. if it being 5 p.m. entails that a good watch would indicate this, then the two cognitions, it is five o'clock, and a reliable watch is indicating five are mutually consistent.

(3) Non-common Deducibility - "An implication is non-commonly deducible from a set of propositions if the state of affairs it affirms is consistent with some of the propositions and inconsistent with the remaining propositions" (Kruglanski, 1980:72)

These notions are extensions of Kelley's (1973) concepts of the attribution process, but, as Kruglanski points out, non-common deducibility evidence and covariation evidence need not be synonymous. Though a 'knower' may use non-commonly deducible logic, it is not necessary that this will lead to an interest in co-variation evidence on his part, in fact "no particular interest in covariation is expected ... when the epistemic problem involves a choice among non-causal propositions (Kruglanski, 1980:73).

In his review of Attribution theory Kruglanski finally notes that "various attribution models differ in the particular epistemic problems they feature" (p.78), both causal and non-causal. People are capable of generating innumerable epistemic problems, and the problems ensconced in Kelley's ANOVA formulations are just one variety of possible causal problems.

Kruglanski also attempted to determine whether problems in "current attribution models may claim a special significance for the layman versus constituting a more or less arbitrary collection of no unique distinction" (p.78). He came to the conclusion that any such attempt would be "a priori bound for failure", since "any epistemic problem could be of interest to someone in some circumstances, and the extent to which it is recurrent ... might vary widely with the particular life vicissitudes of persons or groups" (Kruglanski, 1980:78).

Though the last decade has seen numerous investigations about attributions and the attribution process, these studies have dealt primarily with the antecedents and consequences of attributions. Very little seems to have been done on the development of the attribution process in children.

The question raised in the present research is whether, parallel to the stages proposed by Piaget (in the development of reasoning about physical causality), there are discrete stages in the development of reasoning about intra-personal causality, namely personal causality.

An attempt was made to identify stages similar to those of Piaget's for physical causality, for personal causality. A pilot study was carried out to test the relevance of these stages, and a set of stages in the development of personal causality, based on Piaget's stage system and the pilot study results is shown in Table II, overleaf.

According to Kelley (1973) simple causal schemas have a "developmental precedence over complex ones" (p.121). A simple causal schema is one which has "linear" or "main effect" patterns, such that all variations in effect are associated with one type of cause. These patterns correspond to attributional stereotypes such as - "A child who disobeys his parents is a bad child"(Kelley, 1973:121). Personal properties are inferred directly from behaviour,and no account is taken of the situational factors in which the behaviour occurs. Thus, "affective similarity provides the basis for linking cause and effect. The good act is caused by the good person, the bad act by the bad person" (Kelley, 1973:121). This principle is integrated in the idea of the psychological/motivational type explanation given in Stage I., e.g. "I failed because I was naughty".

Heider (1958) states that "Impersonal or physical causality forms the primary basis for attributions. Personal causality, with a consideration of intentions in relation to anticipated consequences plays little role". According to this description of personal causality, in Stage III, intentions are taken into account under the ego-centric label, e.g. "I succeeded because I tried. I tried because I wanted to do it", etc. It should be noted, however, that this description of personal causality as a consideration of intentions is not the definition of personal causality in the present research.

Table II: A CATEGORISATION SCHEME FOR PERSONAL CAUSALITY EXPLANATIONS

STAGE	AGE	TYPE OF EXPLANATION
STAGE I	4-6 years	- Answers are of the motivational, phenomenistic, and magical types.
T 1	- -	- Answers incorporate elements of Stages I and II.
STAGE II	6-7 years	- Answers are of the animistic and dynamic types and contain implications that objects possess feelings or powers.
T 2	- -	- Answers incorporate elements of Stages II and III.
STAGE III	7-8 years	- Answers are characterised by ego-centric answers and rationalisations.
T 3	- -	- Answers contain an element of logic, from the child's point of view - but this is not a totally objective assessment of the reasons for success or failure.
STAGE IV	8-10 years	- An attempt is made at logical deduction. One or two logical reasons for success or failure are advanced, but not the complete reason.
STAGE V	11 & Above	- An analysis of all the possible reasons for success or failure is made. The reason for ease or difficulty of items is identified (unlike Stage IV), and the notion of chance is present.

N.B: T = Transition Stage.

(The ages for each Stage are predicted estimates based on Piaget, and the pilot study results.)

Personal causality here refers to an objective assessment of logical causes for effects (success/failure), in much the same way as for physical causality.

The proposed stages for personal causality are based on the assumption that in a structured situation, with no high ego-involvement or stress, children will use past experience as well as some sort of logical analysis of the present situation in making causal explanations.

According to Bem (1972:2), "individuals come to 'know' their own attitudes, emotions and other internal states partially by inferring them from observations of their own overt behaviours, and/or the circumstances in which the behaviour occurs". Bem bases his self-perception theory on B.F. Skinner's radical behavioural analysis of private events. Skinner states (in Bem, 1972:4), that "most of the time a child must still be explicitly taught how to describe his internal states, in the same way he is taught to describe his outer environment".

If the above statement is true, then it follows that a child's description of his internal states will differ in accordance with experience, i.e. a thirteen year old's description of his internal state will differ qualitatively from an eight year old's. In making attributions or finding causes for his behaviour, the child has to make certain statements about his internal state, e.g. "I failed because I did not want to do it". If, as Skinner's analysis suggests, we have no "direct, unerring knowledge" of our internal states until we have been explicitly trained, then it follows that training or experience is also important in making causal attributions for personal events (such as success or failure), and that older, more experienced children will give more evidence of experience in their causal attributions than will younger children.

Piaget draws a basic distinction between the pre-operational stage (4-7) and the concrete operational stage (7-11). According to Piaget (1950), and Flavell (1963), there is a major revision in the child's thought at about 7 years of age which enables him to conceptualise certain types of relations and classes. As stated before, Laurendeau and Pinard showed striking

differences between these two age groups in their ability to apprehend physical causality. Whiteman (1967), showed that both concepts of physical and psychological causality develop with age.

According to Kelley (1972), causal schemas are"derived from experience in observing cause and effect relationships, from experiments in which deliberate control has been exercised over causal factors and from implicit and explicit teachings about the causal structure of the world ... The mature individual ... has a repertoire of (such) abstract ideas about the operations and interactions of causal factors. These conceptions (enable him to make) economical and fast attributional analysis by providing a framework within which bits and pieces of relevant information can be fitted in order to draw reasonably good causal inferences" (Kelley, 1972:2).

Baldwin and Baldwin (1970), in their study on developmental levels in the attribution process showed the "increasing complexity of attributional assumptions with increasing age" (p.29). In the Baldwins study children were asked to judge a boy's kindness on the basis of a story about his actions, the circumstances in which the actions took place, and the consequences of his actions. The subjects ranged from kindergarten children to college students. They found that significant age differences occur for all the situations given, and that children acquire an understanding of different aspects of kindness at different ages. Almost all 8th graders and college students made judgements of kindness that took the circumstances into account. Kindergarteners, however, did not take account of the circumstances, they did not distinguish between the presence or absence of other causes for behaviour, and seemed to make judgements on the basis of affective similarity, i.e. a good action indicated a good person. (This is consistent with Kelley's simple causal schema conception.) The Baldwins' (1970) study also offered support for Piaget's claim that there is a change in "the maturity of cognitive understanding" (Baldwin and Baldwin, 1970: 47), between the ages of 5 and 7 years. The Baldwins found that in five of the ten kindness situations "significance increases in the movement towards adult like judgements come at this age" (Baldwin and Baldwin, 1970:47).

Cohen et al. (1981), examined developmental differences in causal reasoning among kindergarten, third and sixth grade children and college age adults. The subjects were asked to make attribution about the behaviour of story characters. The results showed differences in the attributions made by kindergarten and older children, indicating a developmental difference in the attribution process.

The studies by Cohen et al. (1981) and Baldwin and Baldwin (1970), seem to provide some support for the assumption made in this research, that there should be a difference in the types of attributions made by children of two different age groups.

The studies quoted above deal with attributions of cause for other peoples' behaviour. I have not yet come across any studies dealing with the development of personal causality, which focuses on the actor's assessment of himself, done on children. It is felt that such a study would be theoretically relevant because it has been found that actors'and observers' attributions for the same event differ significantly from each other (Kelley and Michela, 1980). Thus, in the present study, the actor's attributions for his own behaviour, are the ones under investigation. It is proposed that children will be asked to attribute causes for their success and failure on certain tasks. Different age levels will be tested in order to test for developmental differences in the attribution of cause.

Research on the attribution of causality to success and failure outcomes by children and adults (Miller and Ross, 1975; Fry and Ghosh, 1980),has shown that "we are prone to alter our own perceptions of causality so as to protect or enhance our self-esteem" (Hastorf et al., 1970:73).

Frieze and Weiner (1971), presented the effect of success or failure to subjects in different informational contexts. They found that when the information was given that a subject experienced the same outcome, e.g. success, on a task and on similar tasks in the past, while other people did not it resulted in high ratings of causal factors WITHIN the person (ability,effort

etc.), and low ratings of external causal factors such as luck or task. This finding offers support for the self-enhancement theory. When the information given was that the individual had passed similar tasks in the past, but along with others failed the present one, the failure was judged to be due to factors that were, like McArthur's (1972) "particular circumstances", unstable and fleeting, i.e. external factors like bad luck, or task, or internal factors like lack of effort.

On the basis of their results Frieze and Weiner suggested that people are biased to attribute behaviour with good consequences to internal factors and behaviour with bad consequences to external factors. Because the pattern was general to both experienced and observed outcomes, it was seen as a bias towards positive attributions, the positivity bias, rather than a self-serving bias, which is only applicable to actors' evaluations of experienced outcomes.

Tillman and Carver (1980) tested the predictions from Kelley's ANOVA model,and the self-serving and Positivity bias formulations on adult subjects. They found no support for the first two hypotheses in their data, but found that regardless of attributor role (actor/observer), "subjects attributed success more to internal than external factors" (Tillman and Carver, 1980:26). This is an issue which will be investigated in the present research.

Miller and Ross (1975) also found that the effect of self-serving bias seems to be greater in group situations (Streufert and Streufert, 1969), than for individual or personal attributions. "Studies in which the outcomes of the participants were individual [i.e. the outcomes were attributed to an individual and not to the group] yielded no indication of self-serving biases in interpersonal attributions" (Miller and Ross, 1975:222).

Ghosh and Fry (1980) also showed that individuals will "assume more personal responsibility for success and less for failure, under high than low, ego- involvement situations. High ego-involvement occurs when individuals are led to perceive a task as being very important and are expected to assume personal responsibility for the task outcome. In this state, people attempt to defend the ego and resort to "all kinds of rationalisations, protective

adjustments, and to selective modes of thinking" (Sherif and Cantril, 1947: 100). Individuals who do not perceive a task as threatening are "less prone to manipulate things, persons, memories and ideas in a selective way" (Sherif and Cantril, 1947:100).

Thus, in the present study, a low ego-involvement situation will be structured, i.e. the tasks will not be presented as threatening to the child, but more as games. It is felt that in such cases less ego-defence mechanisms will be used in making attributions.

Whiteman (1967) found that though the concepts of psychological and physical causality both develop with age, the relationship between the two is limited, and points to "independence in the rate and timing of their respective development within the individual child" (Whiteman, 1967:154).

Berzonsky (1973) identified an independent psychological causality factor in his study of the child's conception of physical causality and his understanding of psychological phenomena. However, his findings on the independence of psychological and physical causality lend support to Piaget's view that the origin of these two types of causality are separate. It is an aim of the present research to establish the relationship if any, between the development of physical and personal causality.

Greenfield (1966) suggests that schooling is very important in affecting the course of cognitive development. According to Greenfield, Reich and Oliver (1966) "Schooling is the single most powerful factor in the stimulation of abstraction". However, Goodnow and Bethon (1966) report conflicting findings, i.e. that there is no direct relationship between the development of abstract thought, and Western-type schooling. Thus, in the present study both schooled and un-schooled children will be tested on measures of physical and personal causality to assess whether or not schooling plays a role in the development of causal reasoning in these two areas.

It is felt that schooling will have a greater effect on physical rather than on personal causality, as schools place a greater emphasis on training children in the scientific method, which incorporates cause and effect relations. However it does not necessarily follow that schooled children will do better on both physical and personal causality measures. As Whiteman and Berzonsky have shown, physical and personal causality are relatively independent of each other, and thus, it does not follow that schooled 12 year olds will do better than unschooled 12 year olds on personal causality measures as well as on physical causality measures. On the contrary, it is expected that unschooled 12 year olds may do better on the personal causality measures because they are exposed to more unstructured (as opposed to structured and controlled school situations), social interaction situations with peers, relatives, elders and siblings. These children are also under the 'traditional' influence of their homes to a greater extent than schooled children as they are exposed to fewer, novel, western-oriented values from school to combat the home influence. In traditional societies, a great deal of emphasis is placed on interpersonal relations, and there are greater opportunities for wider social interaction. This leads to greater experience in learning through observations and even sayings of elders, about one's own as well as other people's motives and behaviours.

A problem that was expected to arise in this research lay in the area of language and communication. It was expected that language and communication problems might arise if the children were tested in English, especially with words like "why" and "how", and that this might lead to the children being "linguistically handicapped", as Kamara and Easley put it (in Dasen, 1977), when giving responses or even in understanding questions. Therefore a Nyanja speaking research assistant accompanied the investigator on all her interviews. All the children were interviewed in Nyanja, and not in English as it was felt that otherwise "subtle variations of structural significance" (Kamara and Easely), would be lost both in understanding questions and interpreting answers.

AIMS OF THE PRESENT STUDY

The present study was designed to:

(i) Investigate developmental differences in the perceptions of physical and personal causality.

(ii) Identify the different stages in the development of personal causality.

(iii) Investigate the effect of schooling on the development of physical and personal causality; and

(iv) Investigate the relationship, if any, between physical and personal causality.

HYPOTHESES

It is hypothesized that:

(1) Developmental differences will be found in the perceptions of both physical and personal causality.

(2) Stages similar to those of physical causality will be found in the development of personal causality.

(3) (a) Schooled children will perform better on measures of physical causality than unschooled children;

(b) Unschooled children will perform better on measures of personal causality than schooled children.

(The comparison being between schooled and unschooled 12-year old children.)

(4) There will be a relationship between the type of explanations given for physical and personal causality items by children of the same age group.

Chapter 2

METHODS AND MATERIALS.

SUBJECTS

Sixty boys from an urban area (Lusaka), were tested on measures of physical and personal causality. The boys were in the age groups of six years, and twelve years - the latter group consisting of both schooled and un-schooled children as illustrated in Table III below. However, it was difficult to find totally unschooled children in the twelve year age group as most of the children had been to school at some time in their lives. Thus the operational definition of unschooled twelve year old boys in this study is - those children who have either never been to school, or have been to school for two years or less. All the six year old children were completely unschooled, i.e., they had never been to school.

All the children came from lower socio-economic backgrounds. The un-schooled children were from Kalingalinga compound, and the schooled children were taken from Kaunda Square Primary School, in Kaunda Square Compound.

Table III: SUBJECTS

SCHOOLING	AGE	GRADE	NUMBER
Un-schooled	6	-	20
	12	maximum 2	20
Schooled	12	6	20

SAMPLING

Non-probability sampling was used. Two types of samples were taken:

(a) An accidental sample - which consisted of the 20, un-schooled (US) 6 year old boys, and the 20, unschooled 12 year old boys.

The investigator and a Nyanja speaking assistant went to Kalingalina compound and tested any 12 or 6 year old children that they came across. The children were tested over a period of several days. The researchers went to different locations within the compound, on different days, to try to avoid a contaminated sample, i.e. to try to avoid testing children who knew about the tests already - as they lived in the same area from which other children had already been tested.

(b) A compulsory sample - which consisted of the 20 schooled (S) 12 year old boys.

These children were taken from two grade 6 classes at Kaunda Square Primary School. They were chosen on the basis of their age, grade and sex (male). Thus, any 12 year old boy in grade 6 was eligible for the sample. It was decided to take 12 year olds from one grade (6), to control for any effects that grade difference might have.

The children within this sample were also selected using the accidental sampling method, i.e. the first 20 of all the 12 year old boys, in the two grade 6 classes (all 12 year old boys in each class were sent by their teachers, to be tested), were selected for the sample.

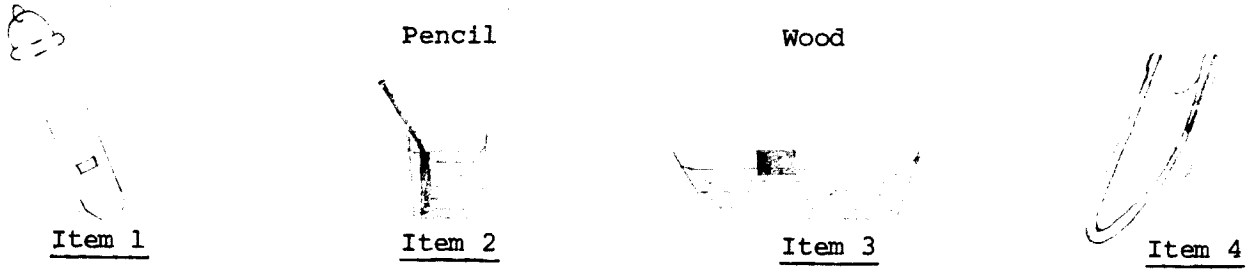
The testing was carried out throughout the day.

MATERIALS

A: Tests of Physical Causality

1. A whistle.
2. A new, unsharpened pencil and a glass of water. The pencil was longer than the glass, so that when it was put into the glass pa of it projected out (as shown in Diagram 1 - item 2).
3. A light object, i.e. a cube of wood (25 mm x 25 mm x 25 mm) and a bowl of water.
4. A catapult.

DIAGRAM 1: Test Items for Physical Causality



The physical causality items were presented in four conditions, as follow

(1)	W P L C	- where -	W = whistle
(2)	P L C W		P = pencil in water
(3)	L C W P		L = light object in water
(4)	C W P L		C = catapult

B: Tests of Personal Causality

1. An assembly task (Koh's blocks).
2. A blindfold game (pinning the tail on the cow).
3. A grid exercise.
4. A bead game.

For each test there were two conditions -

(i) Success
(ii) Failure

Each subject experienced both conditions on each of the four tests.

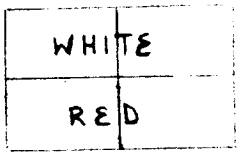
1. Assembly Task

Using the block designs from the WISC and WAIS manuals two assembly tasks were given to the child.

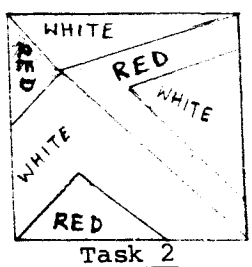
Task (i) was taken from the WISC (the first block design on the test). Four blocks were needed for this design. This was a very easy task and was used for the Success condition.

Task (ii), taken from the WAIS (the last block design on the test) necessitated the use of nine blocks. This was a very difficult task and was used for the Failure condition. (The designs used are shown in Diagram II(a)

DIAGRAM II(a): Assembly Task



Task 1



Task 2

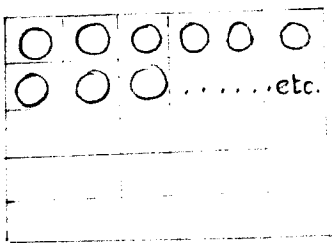
2. Blindfold Game

The outline of a cow was drawn on a sheet of paper 525 mm x 340 mm. The cow was drawn without a tail. The tail was made of a separate piece of paper approximately 175 mm in length. The tail could be pinned to the cow with sellotape which was attached to the tail.

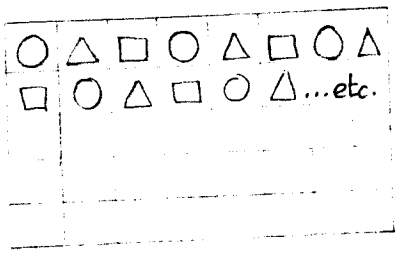
3. Grid Exercise

Each child was given a small piece of squared paper approximately 80 mm x 50 mm, which had about 140 squares on it (approximately 14 squares per line). In the Success condition, Task (i), the child was asked to fill all the squares with green circles (Diagram II(b)(i)). In Task (ii), the Failure condition, the child was required to fill all the grids with a circle in green, a triangle in violet and a square in orange (in that order). (See Diagram II(b)(ii).) Three colour pencils, green, violet and orange were provided.

DIAGRAM II(b): Grid Exercise



(i) Easy item



(ii) Difficult item

4. Bead Game

Two bags of beads were used. Bag A contained red and blue beads (10 red, and 10 blue beads). Bag B contained 20 blue beads.

The Personal causality items were presented in eight conditions as shown overleaf:

(1)	Kp	Cf	Gp	Bf	- where	-	K = Assembly task
(2)	Cf	Gp	Bf	Kp			C = blindfold game
(3)	Gp	Bf	Kp	Cf			G = grid exercise
(4)	Bf	Kp	Cf	Gp			B = bead game
(5)	Kf	Cp	Gf	Bp	and	-	p = pass
(6)	Cp	Gf	Bp	Kf ...etc.			f = fail - (on the first trial)

These items were presented in eight conditions because if only four conditions were used the children would always pass first on a certain item, e.g. K., and always fail first on another item, e.g. C. The personal causality items were presented in such a way that half the children experienced the Failure condition on their very first task, on the first trial, while the other half experienced the Success condition on the first trial of their first task. This was done in order to control for any effects initial Success or Failure might have on the child's further performance and judgements.

PROCEDURE

Half the subjects experienced Condition A - Tests of Physical Causality first, while the other half experienced Condition B - Tests of Personal Causality first. This procedure was carried out to control for any effects (presentation order effects) that might have occurred if either condition was always presented first.

CONDITION A - Tests of Physical Causality

Each subject was interviewed by the investigator with the help of a translator. Each item was demonstrated to the child, and after each demonstration the child was asked how the phenomenon occurred. The child was asked to elaborate on any unclear responses. Each child was asked to identify all the phenomena before the testing was started, and they were all able to do so.

When the child had correctly identified the items (whistle, pencil, water, etc.) the following procedure was used for each item:

Whistle

The Experimenter blew on the whistle twice or thrice. The child was then asked what had made the noise, and how the noise was produced.

e.g., "Where does the noise come from?"

"How is the noise made?" .... etc.

(For further details on questioning see Appendix I(a).)

Catapult

The Experimenter demonstrated the use of the catapult once or twice. The child was then asked how the catapult worked.

e.g., "How does it work?"

"How is the stone thrown out?" .... etc.

(For further details see Appendix I(a).)

Pencil-in-Water (Refraction)

The child was shown the pencil (unsharpened) and asked whether or not it was straight. He was then told to watch the Experimenter carefully. The Experimenter then slowly lowered the pencil into a glass half full of water. The child was then asked whether or not the pencil was still straight. He was then asked what had happened and how.

e.g., "What has happened to the pencil?"

"Why is the pencil bent?"

"How does the water make it bend?" ... etc.

(For further details see Appendix I(a).)

Floating of Wood

The child was again asked to watch the Experimenter carefully. The Experimenter then dropped the block of wood into a bowl almost full of water. The child was then asked to describe what had happened to the block of wood, and why ...

e.g., "What happens to the block of wood when it is put in water?"
"Why does it float?" ... etc.

(For further details see Appendix I(a).)

A list of basic, standardised questions were asked of all the children, but, as aforementioned, if the child's responses were unclear or uncategorisable further questions were asked. The standardised question format is shown in Appendix I(a).

All the responses given by each child were recorded, and these were later categorised by the investigator and another scorer to control for Experimenter bias in categorisation.

The responses were scored in two ways:

(a) Using the categorisation scheme proposed by the present researcher (which is outlined later); and

(b) By grouping all similar responses together to form categories in an effort to see whether any new categories emerged, or whether any of the proposed categories could be collapsed.

CONDITION B - Tests of Personal Causality

Each subject was interviewed by the Experimenter with the help of a translator. The children were asked to identify all the items before the testing started. A few children had never seen blocks before, but most of them could identify the blocks. All other items were easily identified.

The children were given two trials (one successful and one unsuccessful) on each of the four tasks. For each task the child was asked to give

reasons for both Success and Failure.

Once it was ascertained that the children recognised all the items on the test, the following procedure was used for each item:

Assembly Task

The child was given nine Koh's blocks for each trial. The design used in the Success trial necessitated the use of four blocks, while the design used in the Failure trial necessitated the use of nine blocks. For each trial the child was told he would be given three minutes to complete the design. In actual fact, the child was given as much time as he required to complete the design on the Success trial, but was only given three minutes on the Failure trial. This was necessary in order for the child to perceive his Success/Failure on each trial.

At the end of each trial the child was asked to attribute reasons for his Success or Failure.

e.g., Success: "How did you get it right?

Failure: "Why didn't you get it right? .... etc.

All the children were able to do Task (i) (Success condition), but none were able to do Task (ii) (Failure condition).

(For details of Questions, see Appendix I(b).)

Blindfold Game

Each child was shown the picture of a cow without a tail by the Experimenter. The picture was pinned onto a wall at such a height that each child could easily reach to pin the tail on. They were then given a detachable tail and the Experimenter requested the child to indicate where the tail should go. The child was then blindfolded, and asked to walk up to the cow and pin the tail onto the cow. On the Success trial, if the child did not place the tail in the right position by himself, the Experimenter moved it to the correct position (while the child was still blindfolded).

On the Failure trial, if by chance the child placed the tail in the right position the Experimenter moved it to a wrong position.
The child was asked to give reasons for his Success or Failure (as appropriate) after each trial.

e.g., Success: "How did you put the tail in the right place?"
Failure: "Why didn't you put the tail in the right place?"..etc.

(For details of Questions, see Appendix I(b).)

Grid Exercises

The child was given a grid for each trial. In the Success trial he was asked to fill it with circles. In the Failure condition he was asked to fill it with a circle, a triangle, and a square, in that order, and with each shape drawn in a different colour.
The Experimenter filled the first line on each grid to show the child what was required. The children were told that they would be given three minutes to complete each task, but were given ample time to finish in the Success, but NOT in the Failure condition. This was done so that the child could assess for himself whether he had succeeded (i.e. completed the task) or failed (i.e. not completed the task).
After each trial the child was asked to give reasons for his Success or Failure.

e.g., Success: "How did you finish in time?"
Failure: "Why didn't you finish in time?"

(For details of Questions, see Appendix I(b).)

Bead Game

Two bags of beads were used for this item. Bag A contained Red and Blue beads of equal numbers, but Bag B contained only Blue beads. In the Success condition the children were shown Bag A. The bag was then shaken, out of sight of the children. Then they were given Bag A and

asked to pick out some RED beads without looking into the bag. The same procedure was followed in the Failure condition, except that during the shaking Bag B was substituted for Bag A. The children were again asked to pick out some RED beads. The children were not aware of the existence of Bag B. Bag B was substituted while Bag A was being shaken, out of sight of the children.

After each trial the child was asked to give reasons for his Success or Failure on the trial.

e.g., Success: "How did you manage to pick the red beads without looking?"

Failure: "Why didn't you pick any red beads?"...etc.

(For details of Questions, see Appendix I(b).)

All the responses were recorded exactly as for Condition A (Tests of Physical Causality), and the same scoring system was used, i.e. the responses were scored in two ways, as described for Condition A. The same procedure (as in Condition A) was used to control for Experimenter bias in categorisation. The order of testing which was followed for both Physical and Personal Causality items is shown in Table IV, under the section on Research Design (page 50).

The categorisation schemes for both Physical and Personal Causality responses (which were formulated by the present researcher), are outlined in the following pages:

CATEGORISATION SCHEME: PHYSICAL CAUSALITY

STAGE I: Responses are Phenomenistic and/or Magical in character.

e.g.,

Whistle - The whistle makes a noise because of magic.

The whistle makes a noise because you moved your hand over the top.

Pencil - The pencil looks bent because the water is shaking.

Wood - It(the wood) floats because the water is shaking.

The wood floats because you did something to it to make it float.

Catapult - The stone is thrown because you made it go (by magic).

The stone is thrown because the wind is blowing.

TRANSITION 1: (T_1) - Responses incorporate elements of Stages I and II.

e.g.,

Whistle - The noise is made because you moved your hand over the top and the air wants to come out.

Pencil - The water pushes the pencil and bends it, because the water is shaking.

Wood - The wood floats because it has the power to float and because the water is shaking.

Catapult - The stone is thrown because the stone wants to go out when the wind is blowing.

STAGE II: Responses are Animistic/Dynamic in character.

e.g.,

Whistle - The noise is made because the air is crying to come out.

Pencil - The pencil is bent because the water is pushing it.

Wood - The wood floats because it has the power to float.

Catapult - The catapult throws out the stone because it is strong.

TRANSITION 2: (T_2) - Responses incorporate elements of Stages I and II, and may include attempts at rationalisation.

e.g.,

Whistle - The noise comes because you are blowing and when you blow the air starts crying to come out.

Pencil - When you put a pen in water, the shadow of the pen is bent, and that is what makes it look bent.

Wood - The wood cannot reach the bottom because there is a lot of water.

Catapult - The stone is thrown because when you pull the bands the catapult becomes strong.

(NB: At this stage some attempt is made to find a rational explanation of the phenomena, but this explanation is not a truly causal one. It is just a simple hypothesis made by the child to explain observed phenomena.)

STAGE III: A truly causal explanation of the phenomena is given, i.e. the basic cause is identified.

e.g.,

Whistle - Responses indicate that blowing is the cause of the noise.

Responses are of two types:

(a) Only blowing is identified as the cause of the noise, e.g., when you blow the noise is made.

(b) Responses indicate that a stone/marble inside the whistle is responsible for producing the noise - but only when you BLOW. In other words, the fact that blowing is responsible for the production of the noise is identified.

e.g., When you blow the round thing inside the whistle hits the walls of the whistle and makes the noise.

Pencil - The real cause of the pencil looking bent is identified, i.e. because it is in water; but the reason why water makes things look bent cannot be explained.

e.g., The pencil looks bent because it is in water.

Wood -- A truly causal reason for the wood floating is given, i.e. because it is light. The reason why light things float is not identified. It is assumed that all light things float, and that all wood floats.

e.g., Wood floats because it is light. All light things float. All wood floats.

Catapult - A simple cause-effect explanation is given; i.e., just the description of the operation that leads to the ejection of the stone. However the child is unable to explain the mechanics of the ejection.

e.g., You pull the bands and let go and the stone is thrown.

TRANSITION 3: (T_3) - Responses are more comprehensive than the basic causal answers of Stage III, but are not as comprehensive as Stage IV answers. (Non-scientific causal answers.)

e.g.,

Whistle - Responses indicate that it is when the air is blown into the whistle, and it comes out of the openings that the noise is made.

e.g., Air is pushed into the whistle, when it comes out through the holes the sound is made.

Pencil - Responses incorporate some reason as to why water makes things look bent.

e.g., The pencil looks bent because it is in water. When water is in a glass container it makes things look bent. If it is in a plastic container it does not make things look bent;

or Water makes the pencil look bent because the part in water looks bigger than the part in air.

Wood - Responses identify the fact that wood floats because it light. It is recognised that all light things do not float and/or all wood does not float,but no adequate reason is given for this.

e.g., Wood floats because it is light. Not all light things float. All wood floats;

or Not all light things float. Not all wood floats.

Catapult - No T3 answer identified for this item.

STAGE IV: Responses identify the basic cause of things, e.g., water makes things in it look bent, and the reason why this occurs is also given, as in T3. However, Stage IV reasons are more physics type, or science-oriented than T3 reasons.

e.g.,

Whistle - Answers try to incorporate the idea of air pressure being responsible for the noise, but the reason for the pressure is incorrect and/or the change in pressure is not mentioned.

e.g., Air is squeezed through a small hole when you blow. When air is squeezed it makes a noise;

or When you blow the air goes to the bottom of the whistle; when you continue blowing there is a pressure formed because the air at the bottom collides with the air at the top, because they are both trying to go out of the holes at the same time. This pressure pushes the air out and the sound is made.

Pencil - Answers indicate that light changes when it passes through water and that this causes objects to look bent, but the nature of the change (in what way light changes), and why this change affects the appearance of the pencil cannot be explained.

e.g., The pencil looks bent because of refraction - because when light passes through water it changes and makes things look bent.

(NB: The word 'refraction' need not be mentioned in order for answers to be classified as at this stage.)

Wood - Responses are similar to T3, but an explanation is given either for the statement that wood does not always float, or for the statement that all light things do not float.

e.g., Wood floats because it is light. All light things float/do not float. All light things do not float, because if light things like paper become wet they become heavy and sink.

Catapult - Responses indicate that the stretching and subsequent contraction of the bands is what ejects the stone, but no adequate reason of how stretching and releasing the bands ejects the stone is given.

e.g., When you pull the bands and let go the elastic, the bands snap back and this pushes the stone out.

STAGE V: Completely physics type (scientific) explanations are given for the phenomena, identifying principles of refraction, density, etc.

e.g.,

Whistle - Responses indicate that it is the change in air pressure that causes the noise, i.e. the compression and subsequent release of the air.

e.g., When you blow in the air is pushed/squeezed into the whistle, and as you blow it is forced out of the small holes, and the noise is made.

Pencil - Responses indicate an elementary knowledge of refraction. The fact that light bends when it passes from air into water, and that this phenomenon is what is responsible for the pencil looking bent is mentioned.

e.g., The pencil looks bent because of refraction. Light bends in water, so it makes things inside water look bent.

Wood - Responses identify the fact that wood floats because it is light, but it is stated that (i) not all light things float and (ii) not all wood floats. Reasons implying some knowledge of density are given for these statements.

e.g., Wood floats because it is light. Not all light things float. If they are heavy inside, like a coin, they sink.
Not all wood floats. If wood gets wet it becomes heavy and sinks.

Catapult - Responses are similar to Stage IV, BUT responses indicate an awareness that it is the force of contraction that ejects the stone.

e.g., When you pull the elastic/bands you create a force, and when you let go this force pulls the bands back and the stone is thrown.

STAGES I-II: Were considered as the Pre-causal stage (on the basis of the Piagetian system).

STAGE T_2: Was considered as a Peri-causal stage as it lies between the Pre-causal and Causal stages.

STAGES III-V: Were considered as the Causal stage (T_3 included).

CATEGORISATION SCHEME: PERSONAL CAUSALITY

STAGE I: Responses are Phenomenistic, Motivational or Magical in character.

NB:
((S) = Success condition responses;
(F) = Failure condition responses.)

e.g.,

KOH's - (S) I could do it because the bricks are red and white.

(F) I could not do it because there is too much noise outside.

COW - No possible response was identified for either success or failure.

GRID - (S) I could finish in time because the pencils are nice.

(F) I could not finish because there is too much noise.

BEADS - (S) I got the red beads because you shook the bag.

(F) I did not get the red beads because you shook the bag.

*T 1: Responses incorporate elements of Stages I and II.

(No possible responses were identified for this stage on the basis of the pilot study results.)

STAGE II: Responses are Animistic or Dynamic in character.

e.g.,

KOH's - (S) I got it right because the bricks want to match the picture. (i.e. the design given)

(F) I did not get it right because the bricks do not want to match the picture.

*(NB: T. = Transition Stage in this Section.)

COW - (S) I got it right because the tail wanted to go to the right place.

(F) I did not get it right because the tail did not want to go to the right place.

GRID - (S) The red beads just came (by themselves).

(F) The red beads went away.

T_2: No possible responses were identified for this stage.

STAGE III: Responses are characterised by ego-centric answers which contain a causal element, and seem logical to the child.

e.g.

KOH's - (S) I could do it right because I used my brains/because I am clever.

(F) I could not do it right because I did not use my brains.

COW - (S) I put the tail in the right place because I tried hard/ because I looked at the picture carefully first.

(F) I could not put the tail in the right place because I did not know the place/because I was not trying.

GRID - (S) I finished in time because I am fast.

(F) I could not finish this time because I was slow.

BEADS - (S) I got the red beads because I was trying to get red ones.

(F) I did not get red beads because there were no red ones where I put my hand.

T_3: Responses identify a logical reason for success or failure, e.g. the ease or difficulty of the task. However, in giving reasons for this ease/difficulty a reversion to Stage III type reasons or rationalisations are made, or no reason is given.

e.g.

KOH's - (S) I got it right because I tried and it is easy.

(F) I did not get it right because it is difficult. It is difficult because I can only do part of it/because some of the blocks are missing.

COW - (S) I put the tail in the right place because I'm doing it for the second time, so it is easy.

or It is easy because I felt the place.

(F) I could not put it in the right place because I did not know where to put it. (The fact that he could not see because of the blindfold is not mentioned.)

GRID - (S) I finished in time because it was easy and I was fast.

(F) I did not finish because I was too slow and it was difficult.

BEADS - (S) It is easy to get red beads because there are many red beads.

(F) It is difficult to get red beads because there are too many blue beads.

STAGE IV: Answers are characterised by one or two completely logical reasons for Success or Failure. The ease or difficulty of the task is mentioned, and can be explained logically.

e.g.,

KOH's - (S) I could do it because it is easy. It is easy because there are only four blocks/because the pattern is easy to copy.

(F) I could not do it because it is difficult. It is difficult because the pattern is confusing (complicated).

COW - (S) I just guessed where to put it/I put the tail in the right place by chance/luck.

(F) I could not put it in the right place because I could not see/because my eyes were tied/because of bad luck.

GRID - (S) I finished in time because there is only one shape to draw and it is easy to draw circles.

(F) I could not finish because it is difficult as there are too many shapes to draw/because I have to change colours.

BEADS - Responses do not mention the idea of chance, but it is implied.

e.g.,

(S) I got red beads(without looking)because the beads are mixed.

or I just picked them.

(F) I could not get red beads because I did not look in the bag.

or Because the beads are mixed.

STAGE V: Most of the logical reasons for either success or failure on any task is identified. The idea of chance is clear, and the reason why the phenomena occurred by chance is explained/identified.

e.g.,

KOH's - (S) I got it right because it is easy. There are only four blocks and the pattern is simple to copy.

(F) I could not do it because it is difficult. The pattern is complicated and there are a lot of blocks.

COW - (S) I put the tail in the right place by chance/by accident because my eyes were closed.

(F) I did not put the tail in the right place as my eyes were closed, and I was not lucky/it was an accident.

GRID - (S) I finished in time because it was easy, I was only drawing one figure and using only one colour (and I was fast).

(F) I could not finish it because it was difficult. I had to change shapes and colours (and the time was short).

BEADS - (S) I got the red beads just by chance/luck/accident because I was not looking.

(F) I did not get red beads just by chance/luck/accident since I did not look into the bag.

Stages I-T2 were considered Pre-Causal.

Stages III and T3 were considered Peri-Causal, as the responses classified under these stages showed an attempt at finding a rational cause for success or failure (Stage III), or identified one logical cause for success/failure (T3), but were nevertheless not truly causal and contained elements of ego-centric thought and rationalisations.

Stages IV-V were considered the Causal Stages.

RESEARCH DESIGN

Each subject in each group, 6 years (US), 12 years (US) and 12 years (S) performed under two conditions:

(a) Physical Causality, and (b) Personal Causality, so that the effects of the subject variables would balance out exactly. Furthermore, in the Personal Causality condition each subject experienced both conditions of success and of failure for each item.

To control for order effects a counter-balancing procedure was used as it was felt that order effects should be symmetrical.

The order of testing for both Physical and Personal Causality items is shown in Table IV. below:

Table IV: THE ORDER OF TESTING OF PHYSICAL AND PERSONAL CAUSALITY ITEMS

FIRST CONDITION	ORDER OF ITEMS	SECOND CONDITION	ORDER OF ITEMS
B	Kp Cf Gp Bf	A	W P L C
	Cf Gp Bf Kp		P L C W
	Gp Bf Kp Cf		L C W P
	Bf Kp Cf Gp		C W P L
	...Etc...		...Etc...
A	L C W P	B	Gf Bp Kf Cp
	C W P L		Bp Kf Cp Gf
	W P L C		Kf Cp Gf Bp
	P L C W		Cp Gf Bp Kf
	...Etc...		...Etc...

(Ten children from each group experienced CONDITION B first, while the other ten experienced CONDITION A first.)

DATA ANALYSIS

The data was analysed using two different methods, of which

(a) was a Qualitative type of analysis, and

(b) was a Quantitative type of analysis.

(a) THE QUALITATIVE ANALYSIS

The investigator and an assistant individually carried out a categorisation of each child's responses, for each of the four items on both the Physical and Personal Causality tests. The categorisation was based on the categorisation schemes described in the Methods Section. The level of agreement between the two categorisers, on each item, for each subject, lay between 75-95%.

As mentioned earlier, 4 Stages were proposed in the development of both types of causality. These stages are (in ascending order):

1. Pre-Causal
2. Peri-Causal
3. Causal (level a) i.e. Low causal
4. Causal (level b). i.e. High causal

To determine which causal level each child had attained, all four responses for Physical Causality, and all eight (including responses for both success and failure) responses for Personal Causality, were taken into account, as explained below.

1. Physical Causality

The categorisation scheme described previously, identifies eight categories of responses. The responses in Categories I - II are purely Pre-Causal responses, and can therefore be grouped together. The T_2 Category, falling as it does, between the purely Pre-causal and the purely causal, is a transitional category, semi Pre-Causal and semi-Causal. It could almost be described as a peri-causal category. Categories III and T_3 are elementary causal categories and are usually grouped together while Categories IV and V are more sophisticated causal categories. It was decided that for Physical Causality items any child giving more than two "I don't know" (IDK) responses would not be considered,

as more than 2 IDK answers for these items would seem to indicate either faulty interviewing, or some affective blockage in the child.

The possible configuration of responses for the four items on the test was worked out prior to classification of the children's responses. The types of combinations of responses to be found in each stage was also predicted. First, all the possible configurations were calculated, starting from the lowest possible combination - i.e., 2 IDK + 2 I-II and continuing to the highest possible combination, i.e., 4 V's. Once this was done the types of combinations which could logically be expected to fall into each stage were worked out. Thus, the Pre-causal Stage - would have combinations with mostly/predominantly Pre-Causal responses, or IDK type responses.

The Peri-Causal Stage:- would mainly contain combinations with 50% - Causal responses, e.g., 2 I-II + 2 III/T_3 etc. A combination with 50% IDK responses and 50% Causal responses was also included in this category as there is a strong causal trend, but it is not predominant. A majority of T_2 responses or 50% T_2 and 50% causal responses were also included in this stage, as T_2 may be called a Peri-causal category in itself. For this reason one causal response (III-V) + a T_2 response when combined with two Pre-Causal responses were considered in the Peri-Causal Stage.

Causal (a) Stage:- would have combinations with predominantly causal responses (i.e. 3 out of 4) or at least two causal responses + a T_2 response combined with either an IDK or I-II response. Two high causal responses (IV/V) and two T_2 responses also fall into this stage.

Causal (b) Stage: This being the most sophisticated causal stage it would contain combinations with predominantly IV/V responses, and no Pre- or Peri- causal responses.

The different combinations of responses, and the stages under which they fall are outlined in detail in the following chart:

Table V(a): DIFFERENT CONFIGURATIONS OF RESPONSES FOR PHYSICAL CAUSALITY ITEMS AND THE STAGES UNDER WHICH THEY FALL

Pre-Causal	Peri-Causal
2 IDK + 2 I-II	2 IDK + 2 III/T_3
2 IDK + 2 T_2	2 IDK + 2 IV/V
2 IDK + 1I-II + 1T_2	2 IDK + 1 T_3 + 1 IV/V
2 IDK + 1I-II + 1 III/T_3	1 IDK + 3 T_2
2 IDK + 1I-II + 1 IV/V	1 IDK + 2 T_2 + 1 IV/V
2 IDK + 1T_2 + 1 III/T_3	1 IDK + 1 I-II + 2 III/T_3
2 IDK + 1T_2 + 1 IV/V	1 IDK + 1 T_2 + 2 III/T_3
1 IDK + 3 I-II	1 IDK + 1 I-II + 2 IV/V
1 IDK + 2 I-II + 1T_2	1 IDK + T_2 + III/T_3 + IV/V
1 IDK + 2 I-II + 1 III/T_3	1 IDK + I-II + III/T_3 + IV/V
1 IDK + 2 I-II + IV/V	1 IDK + 1 I-II + 1T_2 + IV/V
1 IDK + 2 T_2 + 1 I-II	2 I-II + 2 III/T_3
1 IDK + 2 T_2 + 1 III/T_3	2 I-II + 2 IV/V x
1 IDK + 1 I-II + 1 T_2 + 1 III/T_3	2 I-II + 1 III/T_3 + 1 IV/V
4 I-II	2 I-II + 1 T_2 + 1 III/T_3
3 I-II + 1 T_2	1 I-II + 2 T_2 + 1 IV/V
3 I-II + 1 III	1 I-II + 2 III/T_3 + 1T_2
3 I-II + 1/T_3 x	3 T_2 + 1 I-II
3 I-II + 1 IV/V x	3 T_2 + 1 III/T_3
2 I-II + 2 T_2	3 T_2 + 1 IV/V
	2 T_2 + 2 III/T_3
	1 T_2 + 2 I-II + 1 III/T_3
	1 T_2 + 2 I-II + 1 IV/V

Causal (a)

1 IDK + 3 III/T_3
1 IDK + 3 IV/V
1 IDK + 2 III/T_3 + 1 IV/V
1 IDK + 1 T_2 + 2 IV/V
1 IDK + 1 III/T_3 + 2 IV/V
1 I-II + 3 III/T_3
1 I-II + 1 IV/V
1 I-II + 2 III/T_3 + 1 IV/V
1 I-II + 1 T_2 + 2 IV/V
1 I-II + 1 III/T_3 + 2 IV/V
1 I-II + 1T_2 + 1 III/T_3 + 1 IV/V
2 T_2 + 2 IV/V
2 T_2 + 1 III/T_3 + 1 IV/V
1 T_2 + 3 III/T_3
1 T_2 + 3 IV/V
1 T_2 + 2 III/T_3 + 1 IV/V
1 T_2 + 2 IV/V + 1 III/T_3
4 III/T_3
3 T_3 + 1 III
1 T_3 + 3 III
1 T_3 + 2 III + 1 IV/V
1 T_3 + 1 III + 2 IV/V
1 T_3 + 3 IV
1 T_3 + 2 IV + 1V
3 III/T_3 + 1 IV/V
2 III + 2 IV/V
1 III + 3 IV
1 III + 2 IV + 1V
1 III + 1 IV + 2V

Causal (b)

1 III/T_3 + 3 V
2 T_3 + 2 V
1 T_3 + I IV + 2 V
4 IV/V

However, it should be noted that these combinations are hypothetical, and therefore some of them are improbable, e.g.:

3 I - II + IT_3
3 I - II + 1 IV/V

because a child giving mostly Pre-causal responses(¾) cannot be expected to give one causal response, especially a highly causal response. In fact these combinations did not occur in the data of the present study. The combinations: 2 I-II + 2 IV/V is also an improbable one because a child cannot be expected to 'jump' from the Pre-causal level to the highest causal level. This combination did not occur in the present data, either.

On the chart on the previous page, the combinations considered improbable by the investigator for the reasons given above, have been marked with a cross (x).

II. Personal Causality

The categorisation scheme for Personal Causality also identifies eight categories of responses. In this scheme the responses in Categories I - T_2 are considered to be Pre-causal, although T_2, being a Transition Stage, is considered to be a low Pre-causal, bordering on Peri-causal, lying as it does between the Pre-causal and Peri-causal categories. The Categories III and T_3 are Peri-causal categories in this scheme because Category III responses contain responses which display an element of logic, but are nevertheless ego-centric. In Category T_3 the response identifies one cause of success or failure (e.g., it was easy), but either cannot give the reason for it (why it was easy), or reverts to Category III type reasons to explain this - e.g., "it was easy becaue I tried". Categories IV and V are characterised by purely causal (i.e. completely logical) responses, with Category IV typifying a lower type of causal response than Category V, which typifies the highest type of causal response.

As the personal causality items test, among other things, the affective response of the child to either success or failure even four IDK responses were considered.

The responses for Personal Causality items were classified into the four Causal stages (Pre-causal - Causal(b)) after both the success and failure responses were combined.

Each child was classified into a Causal Stage on the basis of his response to (a) success, and
(b) failure (i.e. all eight responses).
The two ratings (a) and (b) were combined (as described later) and the child was then classified into one of the four stages Pre-Causal to Causal(b).

The ratings of responses for the success and failure conditions were carried out in a manner similar to that used for Physical Causality. The possible configurations of responses for the four items on the test was worked out (prior to classification) and the types of responses expected in each stage were predicted. Thus:

The IDK Stage: All IDK answers (for either success or failure) but not both success and failure. (Cases with IDK for both success and failure should not be considered.)

The Pre-Causal Stage: Would contain predominantly IDK answers (maximum 3) or 50% IDK answers and 50% I-II, T_2, or III/T_3 answers.

The Peri-Causal Stage: Would contain predominantly Peri-causal responses III/T_3 or 50% Causal and 50% IDK responses, or 50% Pre-causal and 50% Causal responses, as described on page 58. Combinations with 50% T_2 responses and 50% Peri-causal responses also fall into this stage as T_2 borders on the Peri-causal category.

Two Peri-causal levels were identified for Personal Causality. The lower level (i) includes most of the cases described above. The higher level (ii) includes predominantly Peri-causal responses (3 III/T_3) + a T_2 response or 4 III/T_3 responses, as well as combinations such as III/T_3 + 1 IV/V, and 2 T_2 + 2 IV/V (see Table V(b)). (The latter combination is included as it is felt that two borderline Peri-causal responses and two purely Causal responses indicate a Peri-causal trend.)

The Causal(a) Stage: Would include predominantly causal responses or a combination of high Peri-causal (T_3) and Causal responses. Again, two levels were identified in this stage.

Level (i) includes predominantly (¾) Causal responses with one IDK response, as well as combinations such as /2 IV/V + 1 T_3 + 1 I-II/ which is included here as it is felt that since T_3 answers include a causal element, when allied to two causal answers the general trend is a Causal one. Combinations such as 2 III + 2 IV/V are included in this stage as it is felt that Category III answers display some element of logic, and when allied to at least two causal answers they indicate a low causal trend in the child.

Level (ii) combinations include 2 high Peri-causal (T_3) and 2 Causal answers; since a T_3 response includes at least one cause for the phenomenon, when allied to two causal responses, there is a strong causal trend.

The Causal(b) Stage: Would include only Causal answers. (The different combinations and the stages under which they fall are outlined in detail in the chart overleaf.)

Since the Personal Causality test measures, to an extent, the affective reactions of children to success and failure (though an attempt has been made to control for this by trying to structure a low ego-involvement situation for the tests), it may be possible for all (or most of) the predicted combinations to occur.

Table V(b). DIFFERENT CONFIGURATIONS OF RESPONSES FOR PERSONAL CAUSALITY ITEMS AND THE STAGES UNDER WHICH THEY FALL

Personal Causality

1 DK

4 IDK

Pre-Causal

3 IDK + I-II

3 IDK + T_2

3 IDK + III/T_3

3 IDK + IV/V

2 IDK + 2 I-II

2 IDK + 2 T_2

2 IDK + 2 III/T_3

2 IDK + 1 I-II + 1 T_2

2 IDK + 1 I-II + 1 III/T_3

2 IDK + 1 I-II + 1 IV/V

2 IDK + 1 T_2 + 1 III/T_3

2 IDK + 1 T_2 + 1 IV/V

2 IDK + 1 III/T_3 + 1 IV/V

1 IDK + 3 I-II

1 IDK + 3 T_2

1 IDK + 2 I-II + 1 T_2

1 IDK + 2 I-II + 1 III/T_3

1 IDK + 2 I-II + 1 IV/V

1 IDK + 2 T_2 + 1 I-II

1 IDK + 2 T_2 + 1 III/T_3

1 IDK + 2 T_2 + 1 IV/V

1 IDK + 1 I-II + 2 III/T_3

1 IDK + 1 T_2 + 2 III/T_3

1 IDK + 1 I-II + 1 T_2 + 1 III/T_3

1 IDK + 1 T_2 + 1 III/T_3 + 1 IV/V

1 IDK + 1 I-II + 1 T_2 + IV/V

1 IDK + 1 I-II + 1 III/T_3 + 1 IV/V

4 I-II

3 I-II + 1 T_2

3 I-II + 1 III/T_3

3 I-II + 1 IV/V

2 I-II + 2 T_2

2 I-II + 2 III/T_3

1 I-II + 3 T_2

3 T_2 + 1 I-II

3 T_2 + 1 III/T_3

1 T_2 + 2 I-II + 1 III/T_3

1 T_2 + 2 I-II + 1 IV/V

Peri-Causal

(i)

2 IDK + 2 IV/V

2 IDK + 3 III/T_3

1 IDK + 2 III/T_3 + 1 IV/V

1 IDK + 2 IV/V + 1 I-II

1 IDK + 2 IV/V + 1 T_2

1 IDK + 2 IV/V + 1 III/T_3

2 I-II + 2 IV/V

1 I-II + 3 III/T_3

2 I-II + 1 3III/T_3 + IV/V

1 I-II + 1T_2 + 1 III/T_3 + 1 IV/V

1 I-II + 2 T_2 + 1 III/T_3

1 I-II + 2 T_2 + 1 IV/V

1 I-II + 2 III/T_3 + 1 T_2

1 I-II + 2 III/T_3 + 1 IV/

1 I-II + 2 IV/V + 1 T_2

1 I-II + 2 IV/V + III

3 T_2 + 1 IV/V x

2 T_2 + 2 III/T_3 x

2 T_2 + 1 III/T_3 + 1IV/Vx

Peri-Causal

(ii)

1 I-II + 2 IV/V + 1 III

2 T_2 + 2 IV/V

1 T_2 + 3 III/T_3

1 T_2 + 2 III/T_3 + 1 IV/V

4 III/T_3

3 III + 1 IV/V

2 III + 2 T_3

Causal (a)

(i)

1 IDK + 3 IV/V

1 I-II + 3 IV/V

1 I-II + 2 IV/V + 1 T_3

1 T_2 + 3 IV/V

1 III + 2 T_3 + 1 IV/V

1 III + 1 T_3 + 2 IV/V

3 T_3 + 1 IV/V

2 III + 2 IV/V

1 III + 3 IV/V

(ii)

2 T_3 + 2 IV/V

1 T_3 + 3 IV/V

Causal (b)

4 IV/V

Once both the success and failure response combinations for each child were classified into one of the four stages (as described on the previous pages), the child was then classified as being in the Pre-causal, Peri-causal; Causal(a) or Causal(b) Stages, on the basis of the combination of his ratings on the two conditions (success and failure) as shown in the Table overleaf:

Table V1: CAUSAL LEVELS ASSIGNED AFTER COMBINING SUCCESS AND FAILURE RATINGS

Failure Ratings \ Success Ratings	IDK	PRE	PERI(i)	PERI(ii)	a(i)	a(ii)	b
IDK	IDK	PRE	PRE	PRE	PRE	Peri	Peri
PRE	PRE	PRE	PRE	PRE	Peri	Peri	Peri
PERI(i)	PRE	PRE	Peri	Peri	Peri	Peri	Peri
PERI(ii)	PRE	PRE	Peri	Peri	Peri	a	a
a(i)	PRE	Peri	Peri	Peri	a	a	a
a(ii)	Peri	Peri	Peri	a	a	a	b
b	Peri	Peri	Peri	a	a	b	b

NB: PRE = PRE-CAUSAL; PERI = PERI-CAUSAL; a = CAUSAL(a); b = CAUSAL(b), IDK = I don't know.

(b) THE QUANTITATIVE ANALYSIS

The method of analysing the data described in the previous pages helped in classifying the causal stage at which a child was, on the basis of the configurations of his responses to each of the four items on the Physical and Personal Causality tests. However it was felt that no real valid inferential statistical operations could be used to analyse these ratings as they were purely qualitative. It was felt that if the data could be quantified, it would be more viable to use inferential statistics to analyse it.

To this end, an Index of Causality (c) was formulated by the investigator. As no such Index exists (to the researcher's present knowledge), the following method was used to formulate one.

The eight Categories in the categorisation schemes, outlined previously, were placed on a nine-point scale, as follows:

0 - IDK

1 - Stage I (I)

2 - T_1 (T_1)

3 - Stage II (II)

4 - T_2 (T_2)

5 - Stage III (III)

6 - T_3 (T_3)

7 - Stage IV (IV)

8 - Stage V (V)

Using this scale, the minimum possible score a child could obtain would be zero, i.e., 4 IDK responses, while the maximum possible score would be 32, i.e., 4 Stage V. responses. For Personal Causality items, responses for both the success and failure conditions were taken into account, thus the maximum possible score there would be 64, i.e., 8 Stage V. responses.

Thus, it was assumed that:

$$\text{INDEX of CAUSALITY (c)} = \frac{\text{The sum of scores for each of 4 items}}{\text{Maximum possible score}} \times 100$$

(It should be noted that (c) is a percentage.)

For Physical Causality measures, for example, a child with a combination of responses such as IV, III, II, IDK would have a (c) score of 46.875.

i.e.,

$$(c) = \frac{(IV) + (III) + (II) + (IDK)}{32} \times 100$$

According to the nine-point scale this would be:

$$(c) = \frac{7 + 5 + 3 + 0}{32} = \frac{15}{32} = 46.875$$

Therefore, it can be said that for Physical Causality:

$$(c) = \frac{\Sigma \text{ scores for 4 responses}}{\text{Maximum possible score (32)}} \times 100$$

And for Personal Causality:

$$(c) = \frac{(\Sigma \text{ scores of 4 success responses}) + (\Sigma \text{ scores of 4 failure responses})}{\text{Maximum possible score (64)}} \times 100$$

A major advantage in converting the data into (c) scores lies in the fact that this made Physical and Personal Causality scores comparable, i.e., it was possible to compare a child's responses for both types of causality, whereas it was not possible using the qualitative scale as the ratings were not similar for both measures (i.e. Physical and Personal Causality measures).

Once the Index of Causality was established, the index or (c) scores, for each combination of responses (Table V) was computed so that the range of each stage could be identified. The ranges of scores for each of the causal levels (Pre-causal to Causal (b)) are shown in Table VII. below:

Table VII: THE RANGES OF SCORES FOR EACH CAUSAL STAGE, FOR PERSONAL AND PHYSICAL CAUSALITY ON THE QUALITATIVE SCALE

PHYSICAL CAUSALITY	CAUSAL STAGE	PERSONAL CAUSALITY
2-14 (6.25 - 43.75)	PRE-CAUSAL	0-18 (3.125-56.25)
10-20 (31.25-62.75)	PERI-CAUSAL	14-24 (43.75-75.00)
15-28 (46.875-87.5)	CAUSAL (a)	21-29 (65.625)
28-32 (87.5-100)	CAUSAL (b)	28-32 (87.5-100)

It should be noted that:

(1) The scores on top are the sum of scores for each item on the test (before they are converted into (c) scores).

(2) The scores in brackets are the (c) (i.e., index) scores.

(3) All the improbable scores (those marked x on Table V) have been dropped.

Although, by computing the (c) scores for each configuration of responses, the ranges of each stage were identified, it was decided that the Qualitative scale could still not be used to classify the data obtained in the present research. The reason for this was that the ranges on the Qualitative scale

are based on combinations that might theoretically occur, however, some of these combinations might either not occur, or have a very low probability of occurrence in real life.

Thus, it was decided to create a scale for classifying the present data, based on the actual (c) scores of all the sixty subjects tested. To ascertain that one scale would not differ too drastically from the other, an attempt was made to use both the (c) score and the qualitative rating for each subject in evolving the new scale.

THE QUANTITATIVE OR GRAPH SCALE

Method of Formulation:

1. The four responses of each subject, for physical causality, and the eight responses of each subject (including the Success and Failure conditions), for Personal Causality were rated using the Qualitative method proposed in section (a).

2. The (c) scores of each subject (for both Physical and Personal Causality) were computed, using the method proposed in section (b).

3. Two separate graphs showing the frequency of each score were plotted for both types of causality.

4. The Qualitative rating for each score was then plotted onto the graphs. (See Graphs I and II overleaf.)

5. When both the scores and their respective ratings had been plotted, the area of overlap between the different stages was obtained from the graph.

   The range of scores and the overlaps between stages (for both types of causality) are shown in Table VIII.

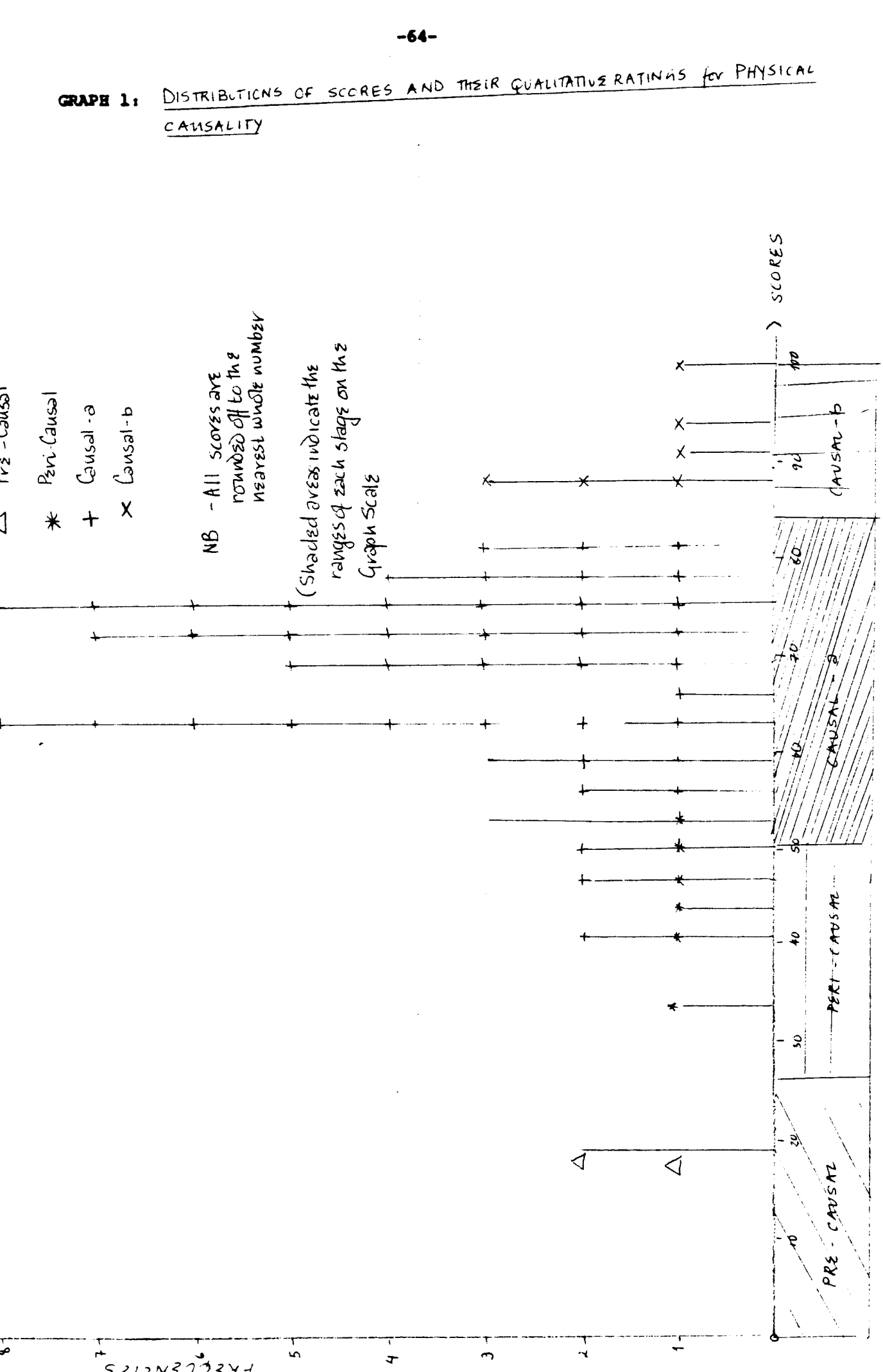
6. Taking into account the areas of overlap and the areas which fell between two stages, the following rating scale was evolved by:

   (i) Extending each stage to the mid-point of the gap between it and the next stage,

   or

   (ii) Finding the mid-point of the overlap between two stages (so that of two overlapping stages, one ended at the mid-point of the overlap, while the next stage began at the mid-point of the overlap).

GRAPH 1: DISTRIBUTIONS OF SCORES AND THEIR QUALITATIVE RATINGS for PHYSICAL CAUSALITY



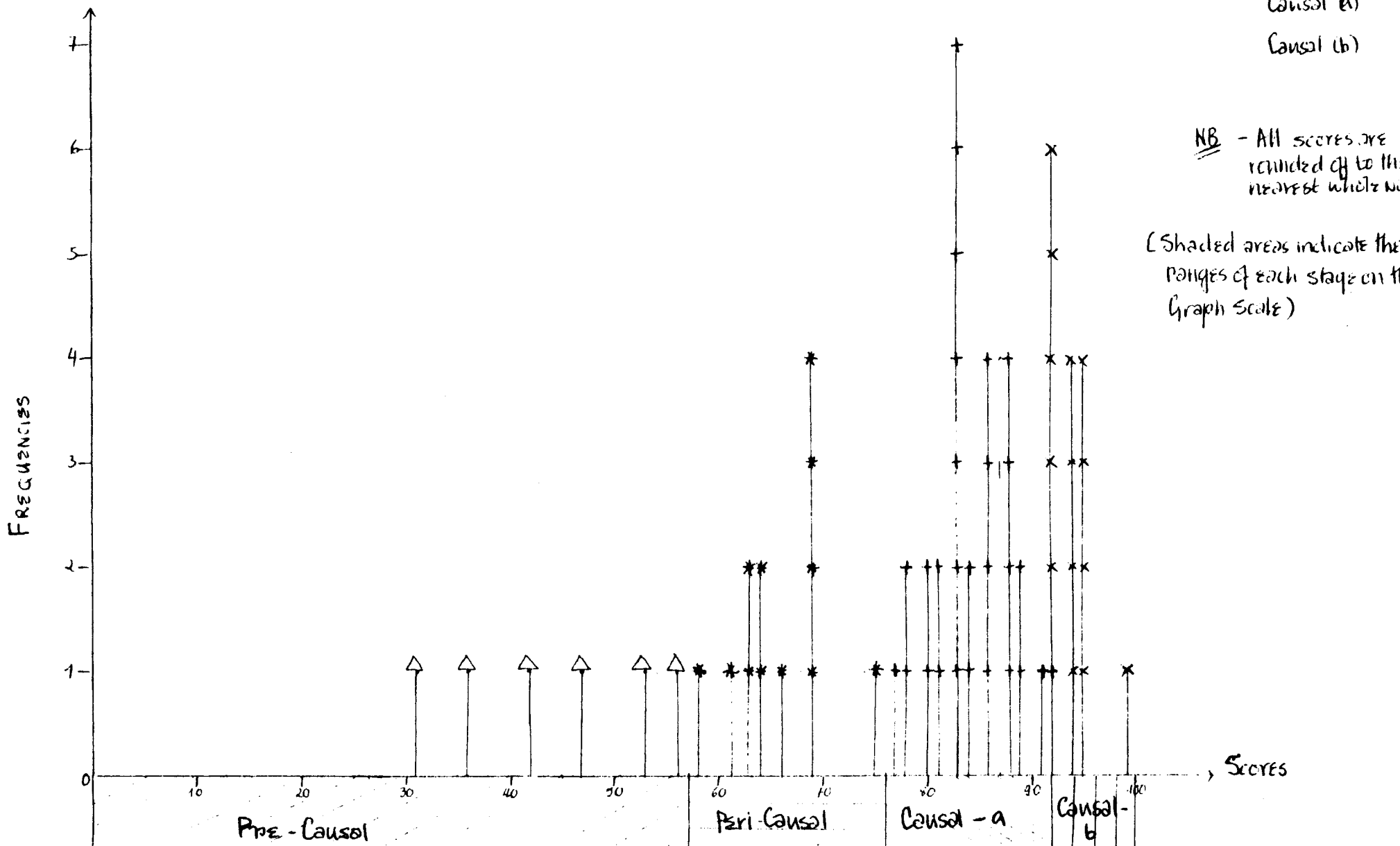

Key:
Pre - Causal
Peri-Causal
Causal (a)
Causal (b)
NB - All scores are rounded off to the nearest whole no
(Shaded areas indicate the ranges of each stage on the Graph Scale)
FREQUENCIES
0
1
2
3
4
5
6
7
10
20
30
40
50
60
70
80
90
100
Scores
Pre - Causal
Peri Causal
Causal - a
Causal - b

Table VIII: RANGE OF SCORES IN EACH STAGE, AND OVERLAPS OF SCORES BETWEEN STAGES FOR PHYSICAL AND PERSONAL CAUSALITY

(For Sample of N = 60)

PHYSICAL CAUSALITY	AMOUNT OF OVERLAP	CAUSAL STAGE	PERSONAL CAUSALITY	AMOUNT OF OVERLAP
0-19		Pre-Causal	0-56	
34-53		Peri-Causal	58-75	
47-81	6	Causal(a)	77-92	2
88-100		Causal(b)	92-100	

The scales for Physical and Personal Causality thus established are shown in the Table below:

Table IX: THE RATING SCALES FOR PHYSICAL AND PERSONAL CAUSALITY

PHYSICAL CAUSALITY	CAUSAL STAGE	PERSONAL CAUSALITY
0-26.5	Pre-Causal	0-57
26.6-50.5	Peri-Causal	57,1-76
50.6-84.5	Causal (a)	76.1-92
84.6-100	Causal (b)	92.1-100

N.B: The figures in each column indicate the range of scores for each stage, for the two measures of Causality.

The scores of each subject were rated using the scale shown in Table IX. The Causality rating of each subject on the Qualitative and Graph scales was then compared. There was found to be 85%-100% agreement between the Graph scale and the Qualitative scale for Physical Causality (see Table X (a)); and 95%-100% agreement between the two scales for Personal Causality (Table X (b)).

Table: X a THE PERCENTAGE OF AGREEMENT BETWEEN RATINGS USING THE QUALITATIVE AND GRAPH SCALES.

ect	6 YEARS (US)			12 YEARS (US)			12 YEARS (S)		
	Index Score	Qualitative Rating	Graph Rating	Index Score	Qualitative RATING	Graph Rating	Index Score	Quali-tative Rating	Graph Rating
	46·88	a	Peri x	78·13	a	a	81·25	a	a
	18 75	Pre	Pre	75·00	a	a	68 75	a	a
	40 63	Peri	Peri	100 00	b	b	87·50	b	b
	53·13	Peri	a x	78·13	a	a	90·63	b	b
	56·25	a	a	65 63	a	a	68·75	a	a
	62·50	a	a	59·38	a	a	81·25	a	a
	62·50	a	a	68·75	a	a	87 50	b	b
	18·75	Pre	Pre	71 88	a	a	68·75	a	a
	53·13	a	a	71 88	a	a	40.63	Peri	Peri
	62 50	a	a	78·13	a	a	62·50	a	a
	62·50	a	a	75·00	a	a	43 75	Peri	Peri
	59·38	a	a	71 88	a	a	75·00	a	a
	62·50	a	a	78 13	a	a	75 00	a	a
	50·00	Peri	Peri	75·00	a	a	93·75	b	b
	46 88	Peri	Peri	71 88	a	a	81 25	a	a
	50·00	a	Peri x	75·00	a	a	62·50	a	a
	59 38	a	a	75 00	a	a	87·50	b	b
	34 38	Peri	Peri	75·00	a	a	56 25	a	a
	59·13	a	a	68 75	a	a	71 88	a	a
	62 50	a	a	71·88	a	a	71·88	a	a

6 Years (US): 15% Difference 85% Agreement

12 Yrs US: 100% agreement

12 Yrs S· 100% agreement

(x indicates a difference ir rating between the two scal-s.)

PERSONAL CAUSALITY

Table: X b. THE PERCENTAGE OF AGREEMENT BETWEEN RATINGS USING THE QUALITATIVE AND GRAPH SCALES.

	6 YEARS (US)			12 YEARS (US)			12 YEARS (S)		
t	Inde-Score	Qualita-tive Rating	Graph Rating	Index Score	Qualita-tive Score	Graph Score	Index Score	Qualita-tive Rating	Graph Rating
	82·81	a	a	78·13	a	a	82 81	a	a
	42·19	Pre	Pre	87·50	a	a	82 81	a	a
	62·50	Peri	Peri	92·19	b	b	68·75	Peri	Peri
	85·94	a	a	95·31	b	b	84·38	a	a
	75·00	Peri	Peri	92·19	b	b	87·50	a	a
	65·63	Peri	Peri	92·19	a	b x	62 50	Peri	Peri
	68·75	Peri	Peri	68·75	a	Peri x	85·94	a	a
	56·25	Pre	Pre	79·69	a	a	92·19	- a	b x
	35·94	Pre	Pre	82·81	a	a	64·06	Peri	Peri
	92·19	b	b	87 50	a	a	95 31	b	b
	81·25	a	a	89·06	a	a	98·44	b	b
	79·69	a	a	82·81	a	a	60·94	Peri	Peri
	85·94	a	a	93·75	b	b	82·81	a	a
	31·25	Pre	Pre	87·50	a	a	95·31	b	b
	46 88	Pre	Pre	93 75	b	b	81·25	a	a
	68 75	Peri	Peri	93·75	b	b	93·75	b	b
	57 81	Peri	Peri	90·63	a	a	89·06	a	a
	76·56	a	a	82·81	a	a	78·13	a	a
	64·06	Peri	Peri	82·81	a	a	92·19	- b	b
	53·13	Pre	Pre	95·31	b	b	84·38	a	a

(100% agreement) (10% Difference. 90% Agreement) 5% difference 95% Agreement

Since such a relatively high degree of agreement (85%-100%) was found between the two scales, for both measures of causality, it was decided that the Quantitative scale could be used for rating the present data. The advantage of using the Quantitative scale for rating the data lies in the fact that if this scale is used, all the statistical analysis can be done using the (c) scores, so the discrepancies which might have arisen from using the (c) scores for certain statistical tests and the Qualitative ratings for others could be eliminated.

STATISTICAL ANALYSIS

1. Fisher Test for Independent Samples - to compare:

   (i) 6 year old and 12 year old (Un-Schooled) children on Physical and Personal Causality measures.

   (ii) 12 year old (Schooled and Un-Schooled) children on Physical and Personal Causality measures.

2. Rank Order Correlation - to compare each group's scores on Physical and Personal Causality measures, in order to discover any relationship between the two.

3. Standard Deviation and Co-efficient of Variation - to check the variability of the distribution of scores between samples.

Chapter 3

RESULTS

(A) PERCENTAGE COMPARISONS

In order to have a general view of the performances of children of different ages and educational backgrounds on Physical and Personal Causality measures, the data was expressed in percentage form for each type of answer.

Table XI: THE PERCENTAGE AND NUMBER OF CHILDREN RATED AS PRE-CAUSAL, PERI-CAUSAL OR CAUSAL IN THREE GROUPS FOR PHYSICAL AND PERSONAL CAUSALITY MEASURES USING:

(a) Qualitative Scale

CAUSALITY RATINGS	PHYSICAL CAUSALITY			PERSONAL CAUSALITY		
	6 Years (US)	12 Years (US)	12 Years (S)	6 Years (US)	12 Years (US)	12 Years (S)
Pre-Causal	10% (2)	-	-	30% (6)	-	-
Peri-Causal	25% (5)	-	10% (2)	35% (7)	-	20% (4)
Causal (a)	65% (13)	95% (19)	65% (13)	30% (6)	65% (13)	55% (11)
Causal (b)	-	5% (1)	25% (5)	5% (1)	35% (7)	25% (5)
TOTAL CAUSAL	65% (13)	100% (20)	90% (18)	35% (7)	100% (20)	80% (16)

NB: (i) US = Un-schooled children

(ii) S = Schooled children

and (iii) The data in brackets indicates the actual numbers of of children in each category.

(i) (ii) and (iii) applies to Table XI(b) and following tables in this chapter.

(b) Quantitative Scale

CAUSALITY RATINGS	PHYSICAL CAUSALITY			PERSONAL CAUSALITY		
	6 Years (US)	12 Years (US)	12 Years (S)	6 Years (US)	12 Years (US)	12 Yea (S)
Pre-Causal	10% (2)	-	-	30% (6)	-	-
Peri-Causal	30% (5)	-	10% (2)	35% (7)	5% (1)	20% (4)
Causal (a)	60% (12)	95% (19)	65% (13)	35% (7)	70% (14)	60% (12)
Causal (b)	-	5% (1)	25% (5)	-	25% (5)	20% (4)
TOTAL CAUSAL	60% (12)	100% (20)	90% (18)	35% (7)	95% (19)	80% (16)

SUMMARY: By comparing Tables XI (a) and (b) it can be seen that there is 85% - 100% agreement between the two scales. Both tables show clearly that a larger percentage of 12 year olds (both schooled and Un-schooled) were rated as Causal thinkers (on the basis of their responses) as compared to 6 year olds. The tables also show the percentage of responses from each age group, in each of the Categories Pre-Causal to Causal, for both Physical and Personal Causality measures.

The next Table compares the Graph (Quantitative) and Qualitative Scales in order to test the adequacy of the Graph Scale.

Table XII: COMPARISON OF CAUSALITY RATINGS USING THE QUALITATIVE AND GRAPH SCALES

CAUSALITY RATING	PHYSICAL CAUSALITY						PERSONAL CAUSALITY					
	GRAPH SCALE			QUALITATIVE SCALE			GRAPH SCALE			QUALITATIVE SCALE		
	6Yrs (US)	12Yrs (US)	12Yrs (S)	6Yrs (US)	12Yrs (US)	12Yrs (S)	6Yrs (US)	12Yrs (US)	12Yrs (S)	6Yrs (US)	12Yrs (US)	12Yrs (S)
Pre-Causal	10% (2)	-	-	10% (2)	-	-	30% (6)	-	-	30% (6)	-	-
Peri-Causal	30% (5)	-	10% (2)	26% (5)	-	10% (2)	35% (7)	5% (1)	20% (4)	35% (7)	-	20% (4)
Causal (a)	60% (13)	95% (19)	65% (13)	65% (13)	95% (19)	65% (13)	35% (7)	70% (14)	60% (12)	30% (6)	65% (13)	55% (11)
Causal (b)	-	5% (1)	25% (5)	-	5% (1)	25% (5)	-	25% (5)	20% (4)	5% (1)	35% (7)	25% (5)
TOTAL CAUSAL	60% (12)	100% (20)	90% (18)	65% (13)	100% (20)	90% (18)	35% (7)	95% (19)	80% (16)	35% (7)	100% (20)	80% (16)

SUMMARY: This Table compares Causality Ratings for Physical and Personal Causality using the Graph (Quantitative) and Qualitative Scales. It was established that the two scales have a high degree of similarity (85%-100% agreement on ratings), and so the graph scale was used for all computations, tables, etc.

As it was established that the qualitative and graph scales have a high degree of similarity (85%-100% agreement on ratings), it was decided to use the graph scale for all computations, and tables, etc.

An attempt was made to analyse whether there were any differences related to age and level of education in the ratings of Personal Causality on Conditions of Success and Failure, as shown in Table XIII following.

Table XIII: THE PERCENTAGE AND NUMBER OF CHILDREN, IN THREE GROUPS RATED AS PRE-CAUSAL, PERI-CAUSAL OR CAUSAL ON SUCCESS AND FAILURE CONDITIONS RESPECTIVELY.
(Personal Causality)

CAUSALITY RATINGS	6 YEARS (UNSCHOOLED)		12 YEARS (UNSCHOOLED)		12 YEARS (SCHOOLED)	
	SUCCESS	FAILURE	SUCCESS	FAILURE	SUCCESS	FAILURE
		(1 IDK)				
Pre-Causal	10% (2)	25% (5)	-	-	-	-
Peri-Causal	40% (8)	25% (5)	-	-	25% (5)	10% (2)
Causal (a)	35% (7)	25% (5)	70% (14)	30% (6)	40% (8)	55% (11)
Causal (b)	15% (3)	20% (4)	30% (6)	70% (14)	35% (7)	35% (7)
TOTAL CAUSAL	50% (10)	45% (9)	100% (20)	100% (20)	75% (15)	90% (18)

SUMMARY: This Table shows the Personal Causality ratings on the Success and Failure Conditions of 6 year olds, and 12 year olds (Schooled and Un-schooled). Six year olds were the only group to have Pre- and Peri-Causal ratings in both the Success and Failure Conditions. The 12 year old Schooled group had Peri-Causal but not Pre-Causal ratings in both conditions.

The Table also shows that while there is little difference (5%) in the total Causal ratings in the Success and Failure Conditions for 6 year old children, and none for the 12 year old Un-schooled Groups. the 12 year old Schooled group seem to give a larger number of Causal responses for the Failure rather than for the Success Conditions (i.e. Success = 75% Causal; Failure = 90% Causal).

In order to have a general view of the varieties of explanations given by children of different ages and educational background the data was converted into percentages for each type of explanation, for both Physical and Personal Causality, as shown in the Table below.

Table XIV: PERCENTAGE (AND NUMBER) OF NO EXPLANATIONS (IDK), NON-CAUSAL EXPLANATIONS AND CAUSAL EXPLANATIONS GIVEN BY THREE GROUPS FOR:

(a) Physical Causality Items

AGE	NO EXPLANATIONS	NON-CAUSAL EXPLANATIONS	CAUSAL EXPLANATIONS
6 Years Un-Schooled	13.75% (11)	20% (16)	66.25% (53)
12 Years Un-Schooled	-	3.75% (3)	96.25% (77)
12 Years Schooled	1.25% (1)	13.75% (11)	85% (68)

Non-Causal explanations are explanations in Categories I - T_2
Causal explanations are explanations in Categories III - V.

(b) Personal Causality Items

AGE	NO EXPLANATIONS	NON-CAUSAL EXPLANATIONS	CAUSAL EXPLANATIONS
6 Years Un-Schooled	14.375% (23)	38.125% (61)	47.5% (76)
12 Years Un-Schooled	1.875% (3)	14.375% (23)	83.75% (134)
12 Years Schooled	1.25% (2)	27.5% (44)	71.25% (114)

(NB: Explanations for both Success and Failure Conditions are included.)

Non-Causal explanations are explanations in Categories I - T_3
Causal explanations are explanations in Categories IV and V.

SUMMARY: Tables XIV(a) and (b) show that for both Physical and Personal Causality measures:

(i) 6 year olds gave a larger percentage of NO explanations than 12 year olds (S and US).

(ii) 6 year olds gave a larger percentage of Non-Causal explanations than 12 year olds (S and US).

(iii) The 12 year old S group gave a larger percentage of Non-Causal explanations than the 12 year old US group.

(iv) The 6 year old group gave a smaller percentage of Causal explanations than both the 12 year old groups.

(v) The 12 year old US group gave a larger percentage of Causal explanations than the 12 year old S group.

(B) STANDARD DEVIATION (Using Index of Causality)

Co-Efficient of Variation (CV)

The Co-efficient of Variation was computed to compare the variability of the Standard Deviations of Physical and Personal Causality Scores.

(a) The total sample (i.e. 60 subjects)

Physical Causality (Ø) CV = 46.44

Personal Causality (P) CV = 25.22

CONCLUSION: The scores of Physical Causality are very much more variable than those of Personal Causality.

(b) 6 Years Un-Schooled

Ø CV = 25.95

P CV = 26.1

CONCLUSION: The scores of Personal Causality are not significantly more variable than those of Physical Causality, in this sample. (However, the Personal Causality scores show more variability than the Physical Causality scores.)

(c) 12 Years Un-Schooled

Ø CV = 21.41

P CV = 10.32

CONCLUSION: The scores of Physical Causality are very much more variable than those of Personal Causality.

(d) 12 Years Schooled

Ø CV = 19.53

P CV = 20.25

CONCLUSION: The scores of Personal Causality are not significantly more variable than those of Physical Causality, in this sample.

Table XV below shows a comparison of the homogeneity of the different groups of children (6 US, 12 US, and 12S) for the two types of Causality.

Table XV: TABLE OF STANDARD DEVIATIONS, MEANS, AND CO-EFFICIENTS OF VARIATION FOR PERSONAL AND PHYSICAL CAUSALITY

AGE AND SCHOOLING	NUMBER	PERSONAL CAUSALITY			PHYSICAL CAUSALITY		
		Mean	S.D.	C.V.	Mean	S.D.	C.V.
6 (US)	20	65.78	17.17	26.10	50.78	13.18	25.95
12 (US)	20	87.42	18.72	10.32	72.22	7.45	21.41
12 (S)	20	82.12	16.63	20.25	72.81	14.22	19.53
TOTAL SAMPLE	60	78.78	19.87	25.22	65.94	30.62	46.44

NB: S.D. = Standard Deviation US = Un-Schooled

C.V. = Co-efficient of Variation S = Schooled

SUMMARY: This Table shows that:

(i) The Variance of the Personal Causality scores of the 6 years (US) group and 12 years (S) group was not significantly higher than the Variance of their Physical Causality Scores.

and (ii) The Variance of the Physical Causality Scores of the 12 years (US) group was significantly higher than the Variance of their Personal Causality Scores.

REASONS FOR USING NON-PARAMETRIC STATISTICS:

Although an Interval Scale of Measurement was used (i.e. Graph Scale), Non-parametric statistics were used because it was felt that all the assumptions for Parametric tests could not be satisfied. Moreover, the ratings on which the Graph Scale is based, are qualitative. In order to establish the Graph Scale as a valid and reliable interval scale, further tests would have had to be done. Thus, it was decided to use Non-parametric statistics, all the assumptions of which could be met. The Fisher Exact Probability Test, and Rank-Order correlation techniques were used to test the Hypothesis.

(A) The Fisher Exact Probability Test

This test was used to test (i) Hypothesis 1, and (ii) Hypothesis 3.

(i) Hypothesis 1 - On developmental differences in the perception of Physical and Personal Causality.

H_0: Un-Schooled 12 year olds, and Un-Schooled 6 year olds showed equal proportions in the kinds of causal ratings that they had.

H_1: A greater proportion of 12 year old Un-Schooled children were classified causal than were 6 year old Un-Schooled children. (Directional)

ASSUMPTIONS

1. The subjects for each group are randomly and independently selected.
2. The groups are independent.
3. Each observation must qualify for only one category.
4. The N is small.

DECISION RULES

Let Significance level = .05

If $P \leq .05$, reject H_0.

If $P > .05$, do not reject H_0.

(a) Physical Causality

1.

	PERI-CAUSAL	CAUSAL
6 Years (US)	A 6	B 12
12 Years (US)	C 0	D 20

US = Un-Schooled
S = Schooled

N = 38

P = 0.0067

P < 0.05

DECISION: Reject H_0

2.

	NON-CAUSAL	CAUSAL	
6 Years (US)	8	12	20
12 Years (US)	0	20	20
	8	32	

Non-Causal = (Pre-Causal and Peri-Causal)

N = 40

P = 0.001638

P < 0.05

DECISION: Reject H_0.

(b) Personal Causality

	PERI-CAUSAL	CAUSAL	
6 Years (US)	7	7	14
12 Years (US)	1	19	20
	8	26	

N= 34

P = 0.00378

P < 0.05

	NON-CAUSAL	CAUSAL	
6 Years (US)	13	7	20
12 Years (US)	0	20	20
	13	27	

N=

P = 0.0000064

P < 0.05

DECISION: Reject H_0.

CONCLUSION: A greater proportion of 12 year old Un-schooled children are rated causal, than are 6 year old Un-Schooled children.

(ii) Hypothesis 3 - On the effect of schooling on the development of Physical and Personal Causality.

H_0: Schooled and Un-Schooled 12 year old children showed equal proportions in the kind of causal ratings they had.

H_1: a) A greater proportion of 12 year old Schooled children were classified causal than were 12 year old Un-Schooled children for Physical Causality measures. (Directional)

b) A greater proportion of 12 year old Un-Schooled children were classified causal than were 12 year old Schooled children for Personal Causality measures. (Directional)

(a) Physical Causality

1.

	PERI-CAUSAL	CAUSAL	
12 Yrs (S)	2	18	20
12 Yrs (US)	0	20	20
	2	38	N = 40

P = 0.244

P > 0.05

2.

	CAUSAL(a)	CAUSAL(b)	
12 Yrs (S)	13	5	18
12 Yrs (US)	19	1	20
	32	6	N =

P = 0.062

P > 0.05

DECISION: Do not reject H_0.

(b) Personal Causality

1.

	PERI-CAUSAL	CAUSAL	
12 Yrs (S)	4	16	20
12 Yrs (US)	1	19	20
	5	35	N = 40

P = 0.147

P > 0.05

2.

	CAUSAL(a)	CAUSAL(b)	
12 Yrs (S)	12	4	16
12 Yrs (US)	14	5	19
	26	9	N = 3

P = .0999

P > 0.05

DECISION: Do not reject H_0.

CONCLUSION: Equal proportion Schooled and Un-Schooled 12 year old children are rated:

(1) Peri-Causal and Causal

(2) Causal(a) and Causal(b)

i.e. Schooled and Un-Schooled 12 year olds showed equal proportions in the kinds of causal ratings they had.

(B) Rank-Order Correlation

Hypothesis 4 - On the relationship between the development of Physical Causality and the development of Personal Causality.

(a) H_0: The scores obtained for Physical and Personal Causality items by - (i) 6 year old, un-schooled children;
(ii) 12 year old, un-schooled children,
and (iii) 12 year old schooled children,

will not be significantly correlated to each other in any way.

H_1: There will be a significant positive correlation between the scores obtained on Physical and Personal Causality measures, by each of the 3 groups mentioned above.
(Directional)

ASSUMPTIONS

1. The sample is randomly and independently selected.
2. The measurement is at least Ordinal in character.

DECISION RULES:

Let significance level = .05.

As N>10 t is used to check the significance of r_s, and the correlation factor T is used (Siegel, 1956).

(i) 6 Years-Unschooled

$r_s = .381$ $df = (20-2) = 18$

$t_{obs} = 1.748$

$t_{crit} = \pm 2.101$

t is not significant at the .05 level.

DECISION: The H_0 is not rejected.

CONCLUSION: There is no relationship between the scores obtained for Physical and Personal Causality items by 6 year old Un-Schooled children.

(ii) 12 Years-Unschooled

$r_s = .184$ df = 18

$t_{obs} = .794$

$t_{crit} = \pm 2.107$ (at the .05 level.)

t is not significant at the .05 level.

DECISION: The H_0 is not rejected.

CONCLUSION: There is no relationship between the scores obtained for Physical and Personal Causality items by 12 year old Un-Schooled children.

(iii) 12 Years-Schooled

$r_s = -.118$

$t_{obs} = .504$ df = 18

$t_{crit} = \pm 2.107$

t is not significant at the .05 level.

DECISION: The H_0 is not rejected.

CONCLUSION: There is no relationship between the scores obtained for Physical and Personal Causality by 12 year old Schooled children.

Hypothesis 4(b) -

(b) H_0: There will be no significant correlation between the scores obtained on Physical and Personal Causality measures, within the whole sample. (N = 60).

H_1: There will be a significant positive correlation between the scores obtained on Physical and Personal Causality measures, within the entire sample. (N = 60)

$r_s = 0.4149$ df = (60 - 2) = 58

$t_{obs} = 3.48$

$t_{crit} = \pm 2.00$

t is significant at the .05 level.

DECISION: The H_0 is rejected.

CONCLUSION: There is a significant relationship between the scores obtained for Physical and Personal Causality measures within the entire sample (i.e. by 6 Years US, 12 Years US and 12 Years S children).

A: SUMMARY OF RESULTS

The following conclusions were reached on the basis of the results:

1. There was a significant difference between 6 and 12 year old Un-schooled children in the proportions of Causal ratings they obtained on both Physical and Personal Causality measures. (Fisher Test.)

2. There was no significant difference between Schooled and Un-schooled 12 year old children in the proportions of Causal ratings that they obtained on both measures of causality. (Fisher Test.)

3. There was no significant relationship between the scores obtained on Physical and Personal Causality measures within the

   (a) 6 years Unschooled;
   (b) 12 years Unschooled, and
   (c) 12 years Schooled, Groups. (Rank Order Correlation.)

4. There was a significant relationship between the Physical and Personal Causality scores within the entire sample. (N = 60)
   (Rank Order Correlation.)

5. The variance of the Personal Causality scores of the 6 years Unschooled group, and the 12 years Schooled group was not significantly higher than the variance of their Physical Causality scores.
   (Co-efficient of Variance.)

6. The variance of the Physical Causality Scores of the 12 years Unschooled group was significantly higher than the variance of their Personal Causality scores. (Co-efficient of Variance.)

Chapter 4

DISCUSSION

Interpretation of Findings

HYPOTHESIS 1:
On Developmental Differences in the Perception of Physical and Personal Causality

This hypothesis stated that developmental differences would be found in the perceptions of both physical and personal causality, i.e. a larger proportion of Un-schooled 12 year old children (henceforth referred to as 12 US) would display causal thinking as compared to Un-schooled 6 year old children (henceforth referred to as 6 US). The results supported this hypothesis.

The finding that 12 US were significantly more causal than 6 US was in line with Piaget's developmental theory which states that certain concepts, such as causality, develop with age, and that explanations given by children and the nature of these explanations vary with time and seem to be related to the age of the child. These findings are also consistent with those of Baldwin and Baldwin (1970:29), which showed the "increasing complexity of attributional assumptions with age", and those of Cohen (1981) which indicated a developmental difference in the attributional process. Table XIV shows that 6 US gave a larger percentage of non-causal answers on both measures of causality than 12 US. The latter group gave higher percentage of causal answers than the former. It is also interesting to note that the 6 US group gave very few Stage IV/V answers (10%) and none were rated Causal b, while both the 12 year old groups gave large numbers of IV/V answers, and had some Causal b elements.

Although it was found that the 6 US group was significantly less causal than the 12 US group, it should not be assumed that the 6 US group did not contain any, or only a few, causal thinkers. In fact, 60% of the 6 US group were rated causal thinkers, using the Graph Scale. These findings were not

in accord with Piaget's (1930) claim that causal thought only develops after the ages 7-8 when the child begins to de-centralise his thinking. This difference with Piaget's findings may be attributed to a number of reasons, which are outlined below.

1. Test Materials: The testing procedure and the test materials of the present research are very different from those used by Piaget. Whereas Piagetian research concerned itself with questions about familiar, but inaccessible phenomena such as clouds, wind, dreams, etc., the present research was concerned more with reasons for familiar phenomena, directly accessible to the child. The materials used in the present research could have influenced the type of responses given by the children because they were highly structured. The material used was not only familiar to the child, but could have been directly experienced by the child.

Analysis of Test Materials: (Physical Causality)

(a) Whistle - Though it is doubtful whether any of the 6 US children in Kalingalinga owned a whistle, all of them were able to identify it, and most of them (55%) were able to give the basic Stage III reason of how the sound was made, i.e. "by blowing ...". It was established by questioning that the act of blowing air into the whistle, and nothing else, was responsible for the noise. Ten percent gave T_3 reasons for this phenomena and 5% gave Stage IV reasons (see Appendix II). The large percentage of Stage III reasons could have been because of the fact that when a child is first given a whistle (by peers or elders) he is told to blow, and therefore associates blowing with the noise. Thus, it is difficult to establish in this case whether the Stage III response was given on the basis of the child's own deductions (based on his actions and observations), or on the basis of knowledge acquired from elders.

(b) Pencil in Water - This item elicited the least number of causal answers. A majority of pre-causal answers (Stages I - II) were given for this item (60%), and only 25% causal answers (all Stage III) (see Appendix II) were given. The majority of the pre-causal answers could have been a function of the difficulty of the item as children do not have a great opportunity of observing this phenomenon.
Although both the pencil and water are familiar objects, the phenomenon of things 'bending' in water may not have been observed by the child before, and therefore he had not really thought about the reasons for this phenomenon.

(c) Floating of Wood - This item elicited a large number of causal answers (75%), of which 60% were basic Stage III type answers, e.g. Wood floats because it is light (see Appendix II).
The large number of causal responses may be due to the fact that children have had the opportunity to observe pieces of wood floating in puddles or streams. Also, children seem to take a great pleasure out of throwing things into water. The knowledge that wood floats because it is light, or that all light things float, etc., was probably acquired by observations and experimentation. This seems to be especially true of the Stage IV/V answers that were given, as the type of explanations given for why light things do not always float seem to be based on observation rather than learnt by hearsay, e.g. "Paper is light but it sinks when it becomes wet and heavy".

(d) Catapult - This item elicited the maximum amount of causal answers (95%), of which 65% were Stage III answers and 30% were Stage IV/V answers (see Appendix II). This item was the only item which elicited such a high percentage of Stage IV/V answers, and seems to illustrate clearly that items which may have been directly experienced or manipulated are likely to elicit a larger number of sophisticated

causal responses, than objects which were familiar but not directly manipulated. It seems reasonable to presume that almost all, if not all, the children either possessed a catapult, or had at some time handled one.

Thus, in brief, it seems that items such as the catapult, and whistle, could have been directly experienced by the children,as could have been the phenomenon of wood floating in water. However, not many children have any need to put a stick in a glass of water, or have had the opportunity to observe this phenomenon, as it is not involved in any of their games or activities. Therefore, it seems obvious that objects which children may have had an opportunity to manipulate could have elicited more causal responses than others. Since the majority of items on this test were within the direct experience of the child, it might explain the high percentage of causal ratings of the 6 US group, as well as the difference with Piaget's findings (as Piaget questioned children about familiar but inaccessible phenomena).

Berzonsky (1973), investigated the role of familiarity on causal explanations. He found that familiarity with objects or events was a decisive factor in causal reasoning. Children gave fewer pre-causal explanations for objects which they could have possibly experienced than for questions about remote, unattainable objects.

Berzonsky (1971), disagreed with Piaget's (1967) argument that divergence in the results of child causality studies may be due in part, to differences in the modes of analysis. According to Berzonsky, it is factors such as question wording, testing procedure, and familiarity, which influence the type of explanations given by children, and are more likely to explain the conflicting results of child causality studies.

The results of the present study seem to support Berzonsky's (1971) and Nass's (1956) contentions that familiarity with objects plays a significant role in the child's causal reasoning. It should be noted here that although

Piaget also used familiar phenomena in his questions on causality, these were generally familiar phenomena, such as clouds, water, etc. Nass's definition of familiar objects is - "those objects which a child could have possibly, but not necessarily, experienced directly" (Nass, 1956:194): this is the definition of familiarity used in the present research.

It is also possible that the type of questioning techniques used in the present research could have directed the children's responses in a causal direction, as all the questions were structured, e.g. "How does the whistle make the noise?" "How does water make the stick bend?", etc. (see Appendix I).

2. Categorisation of Responses: Piaget (1967) suggested that the divergent findings of child causality could be attributed to different modes of analysis. Therefore it seems necessary to investigate whether the mode of analysis used in the present research could have affected the results.

(a) The Categorisation Scheme (Physical Causality) - was based on Piaget's 17 types of causal explanations. Piaget divided these explanations into three Stages, whereas the present researcher devised an eight Stage scheme based on these explanations (including transition stages). Stages I-II were categorised as Pre-causal,and included animistic, and dynamic types of explanations, similar to Piaget's first and second Stages. T_2 was identified as an intermediate stage between the pre-causal and causal Stages. Stage III was identified as the most elementary causal Stage, including responses which identified only the most elementary causes for the phenomena.

This Stage was identified as causal in the present research because it was felt that children were giving a logical reason for the phenomena, even though they were unable to explain exactly how the

phenomena occurred. It is possible that this Stage (III), may be a borderline Stage between the peri-causal T_2 Stage, and the more causal T_3 Stage. As the majority of causal answers in the 6 US group were Stage III type answers, the children could have been rated causal because of these answers whereas really they ought to have been rated as being peri-causal. However, for the reason given previously, Stage III was taken to be a causal Stage, though a very elementary one. It should be noted that all the causal thinkers in the 6 US group, were rated Causal a, which is a low causal level and reflects the elementary causal answers given by the group as a whole.

The remaining causal Stages were T_3, Stage IV and Stage V. T_3 responses were more complex than Stage III ones in that the child not only had to identify the cause of the phenomenon (e.g. blowing produced the noise), but also had to explain how this caused the noise (i.e. how blowing produced the noise). Stage IV/V explanations involved more scientific types of explanations. It was not surprising that not many IV/V responses were given by the 6 US group as these require acquired knowledge, i.e. they have to be learnt for the most part, and not simply deduced from observation/experience. For the catapult item, the observation of the contraction and expansion of the bands could have led to the deduction that this is what propels the stone, and led to a Stage IV/V answer. However, for the pencil in water item, the principle of refraction could not be deduced simply by observation, but must be taught.

(b) Configuration of Responses (Physical Causality). The Causal(a) Stage contains configurations of responses with a majority of Stage III + one IDK or Stage I-II answer, or a T_2 answer. Combinations with 2 T_2 answers + 2 IV/V answers were also included in this Stage, as were 3 IV/V answers + 1 I-II/T_2.

The inclusion of the 2 T_2 + 2 IV/V configuration may have resulted in Causal (a) being a weaker causal Stage than Piaget's causal Stage. This configuration was included, however, because it was felt that the presence of two complex causal answers indicated a definite causal trend in the child, especially since T_2 answers contain a causal element. However, it should be noted that this configuration did not occur in the present data, and may be an improbable one, but since it seems to be logically possible, it cannot be dropped from the categorisation scheme.

Other reasons for the difference between Piaget's findings and the present ones could be the cultural difference between the two groups of children, as well as the time difference (1930-1982). The fact that the exact ages of the Un-schooled children could not be ascertained might have affected the results as seven year olds or five year olds might have been included in the sample, although it is felt that such age differences are too small to be significant. The reason for the uncertainty about the children's ages arose from the fact that although the mothers were asked the ages of their children,a few were not always sure of the age of their children, and may have given an incorrect age for the child.

Finally, it should be noted that Piaget did not claim that an appreciation of the cause-effect relationship did not exist before the ages 7-8. In fact a child in the sensori-motor Stage displays an understanding of causality when he tries to get his toy off the table by pulling the table cloth. However, according to Piaget, before the age 7-8 the child is unable to express a relationship clearly.

According to Campbell (1976), before the age 7-8 the child tends to confuse logical implications and causal relations "excludes the idea of chance, and draws no distinction between the cause of the phenomena and the psychological or logical motives which might have activated men if they had

been creators of this phenomena" (Campbell, 1976:29). It is only after the age 7-8 that different types of relationships can be clearly distinguished. Thus, the more the child decentralizes, "the greater the importance of the 'because' of logical justification as opposed to the 'because' of purely psychological motivation" (Campbell, 1976:29).

As Campbell (1976:32) emphasizes, "it is not because of lack of knowledge that the child fails to deal adequately with logical justification", the reason is simply that owing to his ego-centrism, he does not realise the need for it. Therefore it is possible that children can display causal thought before the ages of 7-8 if they are socialised in their mode of thinking, i.e. they realise the need to explain themselves fully to others, unlike purely ego-centric children who believe that other people always know what they are thinking, and do not realise the need to explain themselves. It could be possible that due to the greater social interaction, Zambian children experience (because of the extended family system) both with peers and elders, they are more socialised in their mode of thinking than the Piagetan sample, and therefore more capable of giving causal answers.

In summary, it can be said that results show that both concepts of Physical and Personal Causality develop with age, as predicted in the hypothesis. Although a large percentage of 6 US were found to be causal (contrary to Piaget's findings), this finding could be attributed to the differences in test materials, testing procedures, analysis of data, and environmental differences.

HYPOTHESIS 2:

On the Existence of Stages in the Development of Physical and Personal Causality

This hypothesis stated that Stages similar to those of Physical Causality would be found in the development of Personal Causality.

It was found that both on the qualitative and quantitative scales, four distinct Stages, Pre-causal, Peri-causal, Causal (a) and Causal (b) could be identified for both types of causality (Personal and Physical). This implies that Stages simialr to those found in the development of Physical Causality exist in the development of Personal Causality as well, thus confirming the hypothesis.

However, it should be noted that the Stages for the two types of causality are not equivalent, as an analysis of the categorisation schemes of the two types of causality will show:

Analysis of the Categorisation Schemes of Physical and Personal Causality:

Two categorisation schemes, based on Piaget's (1930) 17 types of causal explanations, were drawn up for Physical and Personal Causality respectively. Whereas Piaget classified these categories into three stages, the present researcher evolved eight stages or categories (including Transition Stages), for the classification of a child's response. Both the Physical and Personal Causality schemes had the same number of Stages. In both schemes Stages I-II were regarded as Pre-causal categories. Stage T_2 was regarded as a Pre-causal category for Personal Causality, but was a Peri-causal category in the Physical Causality scheme. Stages III and T_3 were low causal categories, in the Physical Causality scheme, but were Peri-causal categories in the Personal Causality scheme.

The reason for these differences in the schemes was that Stage I-II responses occurred for both measures of causality in the Pilot Study, but it was found that there were a large number of ego-centric responses for Personal Causality items which were at a higher level than the Phenomenistic or Dynamic type answers of Stages I-II, but on the other hand were not objective, causal

answers of the type required for a causal rating. These types of answers were classified as Stage III responses, and T_3 was identified as a Transition Stage between the semi-causal answers of Stage III and the purely causal answers of Stages IV/V. For the Physical Causality measures, however, Stages III-V were identified as causal responses since no responses higher than pre-causal, but lower than causal, were encountered in the Pilot Study. Furthermore, there was a wider range of causal responses in Physical causality as compared to Personal Causality, ranging from the extremely elementary Stage III response to the more complex, science-oriented response of Stage V. The examples of the types of responses to be found in each Stage (given in Chapter two), were based on the researcher's predictions and the Pilot Study results. Although no T_1 answers were identified for both types of causality, and no T_2 answers were identified for Personal Causality, it was felt that these two Stages should be retained in the categorisation schemes as the absence of these types of answers could have been due to the limited sample size.

A further point of difference between the two Causality scales arises from the ratings of the different configurations of responses. A look at Tables V(a) and V(b) (Chapter II), will show that a configuration of responses rated at a certain stage for Physical Causality, need not be rated at the same stage for Personal Causality, and vice-versa. This applies to the Graph Scale ratings as well.

Thus, in summary, although similar Stages were found in the development of Physical and Personal Causality, it should be kept in mind that these Stages are not equivalent.

HYPOTHESIS 3:
On the Effect of Schooling on the Development of Physical and Personal Causality

This hypothesis stated that schooling would have some sort of effect on the development of both Physical and Personal Causality. However, the results indicated no significant difference between the Schooled and Unschooled 12 year old children in the proportions of causal ratings they had, for both Physical and Personal Causality.

A comparison of the percentages of non-causal and causal explanations given by 12 US and 12 S (schooled) children showed that 12 S children gave a larger percentage of non-causal responses (13.75%) for Physical Causality than 12 US children (3.75%); the same pattern was repeated for Personal Causality, 12 S children gave a higher percentage of non-causal answers (27.5%) as opposed to 12 US children (14.375%). These findings do not support the hypothesis, and therefore, the Null Hypothesis that there was no significant difference in the proportions of causal ratings obtained by 12 US and 12 S children could not be rejected.

There are a number of possible reasons for these findings:

(a) Physical Causality

1. The schooled children might have felt that they were being tested on what they had learnt in school (even though each child was told that he was not taking part in a school test but in an experiment). They might have felt, therefore, that they had to explain the phenomenon in terms of what they had learnt in school. In attempting to do this, some of them found that they could not explain the phenomenon adequately, because their grasp of the concept was vague as it might have been learnt by rote and was not really understood. Thus in trying to explain the phenomenon they reverted to pre-causal types of explanations. Alternatively, they might have neglected to mention even the elementary cause of the phenomenon, not because they did not know it, but because, in view of their 'school learning', they felt it was too simple an explanation.

2. The schooled children in this sample seem to have learnt certain concepts, using the rote-learning method. That is, they did not understand the concepts but memorised facts. The majority of these children had no clear conception of refraction, density,etc., although these topics had been taught in school. An illustration of this fact was given when these children were asked to explain why a pencil looked bent in water. Many of the children said that this phenomenon was due to refraction, but when they were asked what they meant by refraction, they could not explain it, and reverted to Stage I/II answers, e.g.:

Researcher: ... What do you mean by refraction?/ What is refraction?

Child: ... Refraction is because the water is heavier than the pencil, it pushes the pencil and bends it.

Further questioning could not elicit the true meaning of refraction. In fact when a child gave a Stage I/II answer, he rarely changed it, but went on repeating it. This type of answer illustrated the fact that these children had no notion of what was meant by refraction, but had nevertheless 'learnt' that this was what made things look bent in water. Such responses were usually rated Pre-causal, because though the child said that the pencil looked bent in water because of refraction, in attempting to explain what he meant by refraction he gave phenomenistic or dynamic types of explanations. The types of responses given by these school children seem to indicate a flaw in the teaching system which seems geared to teach children to pass examinations, without ascertaining whether or not the children have fully understood what they have been taught. The reason for this may be that very little experiential learning seems to occur in schools. For the most part, children are 'spoon fed' the facts necessary for them to pass their examinations. This could be one

reason why, when confronted by abstract questions that test their understanding of concepts rather than memorised knowledge, so many children fail so dismally.

A change in the method of teaching seems to be called for.

It is possible that schooled children did not perform as well as expected on physical causality measures, because of the reasons given above. As Langgulung and Torrance (1973) asserted - "The development of causal thinking is not purely a matter of maturation, and is strongly influenced by the experiences a child encounters, and how he is taught to respond to these experiences," (Langgulung and Torrance, 1973:182). If the way in which children are taught affects their acquisition of causal concepts, then it may be possible that different results might have been obtained if the sample had been taken from a different school. The children were selected from one school (Kaunda Square Primary School), for the present research, to control for any effect that two different schools might have had on the results. However, it seems a follow-up study should take children from different schools, of the same socio-economic level, to see whether the type of instruction affects the development of the causal concepts.

(3) The un-schooled (US) children performed better than expected on the Physical Causality measures. All the unschooled children obtained causal ratings, as compared to 90% of the schooled children. However, a larger percentage of the Causal 12 S children were rated Causal b (25%) as compared to the Causal 12 US children (5%).

One reason why the 12 US children were all rated causal could be because Stage III answers were classified as causal in the categorisation scheme. However, only 37.5% of the 12 US group's answers were Stage III answers, while 58.75% were Stage T_3 and

and IV/V answers. (Of this 58.75%, 33.75% were Stage IV/V answers and 25% were T_3 answers.) Thus, as the majority of the 12 US group's answers were definitely causal, it would be valid to say that this group did display a definitely causal trend.

Another reason why the 12 US children displayed such a strong causal trend could be because they learnt more by observation and experience than did the 12 S children. Whereas the 12 S children are taught, or told, why certain phenomena occur, the unschooled children have to make their own hypotheses as to why things happen- why certain things float, why the whistle produces a noise, and so on. These hypotheses may either be validated by further experiences in which case they are accepted; or they may not be validated by further experiences,in which case they are rejected. For instance, if a child observes that everything that is put into water looks bent, he will be able to identify water as the basic cause of the pencil looking bent. If he has had the opportunity and the inclination to observe this phenomenon closely,he may be able to attribute the bending to the magnifying effect of water, e.g., "The pencil looks bent because the part that is in water looks bigger than the part that is in air...". Because the US children learnt by experience, or by asking their peers or elders the cause of things,they gave simple causal explanations based on their observations of the phenomenon. The 12 US were in a way more privileged than the 12 S children on this test,as the items were based more on observation than abstraction and the US children in general have more time for individual observation and experimentation than do the S children. It is possible that if more abstract types of test materials were used, the schooled children might have obtained significantly higher causal ratings than the unschooled children. In this study an attempt was made to use

material which would be familiar to all the children, but it seems, for reasons stated before, that the type of material used gave an advantage to the US children. The schooled (S) children however gave more sophisticated causal explanations than the US children, e.g. "The pencil looks bent because light bends when it goes from air to water ...". These explanations required an acquisition of formal knowledge, which the US children lacked. The majority of causal IV/V answers given by the unschooled (US) children were for the catapult and floating of wood items, probably because these are the most accessible to direct experience.

It should be noted, however, that although schooled children had a higher percentage of Causal b ratings than unschooled (12 year old) children, this difference was not statistically significant.

In brief, on the basis of the results of this study, schooling does not seem to play a significant role in the development of concepts of Physical Causality. However, since the schooled subjects were all taken from one and the same school, these results are not highly generalisable.

(b) Personal Causality:

A possible explanation of the findings that there is no significant difference between schooled and unschooled 12 year old children's performances on Personal Causality measures may be that since all the children come from similar socio-economic backgrounds, they experience the same, or similar types of social interaction in their homes. The emphasis on inter-personal relations, within the home, and in the social surroundings, leads to greater experience in interpersonal relations, especially with the extended family system found in Zambia. Thus, there are greater opportunities for learning about people's motives and behaviours, not only through one's own

experiences, but also through interactions with one's elders. When a person can understand or attribute reasons for other people's behaviours he should be capable of doing so for his own behaviour. By observing and learning about the causes for other people's behaviour, and by learning about his own internal states through interaction with others, an individual becomes aware of the different factors, internal and external to which behaviour can be attributed. It is possible that, as stated before, because both 12 US and 12 S children experienced the same sort of social situations there was no significant difference between the two groups in the kind of causal ratings they had. Schooling did not seem to affect the development of Personal Causality any more than it affected the development of Physical Causality.

A factor that may have contributed to the finding of the relative independence of the development of Physical and Personal Causality from schooling could be the factor of intelligence. It is possible that a relationship may exist between intelligence and Physical and Personal Causality, i.e. highly intelligent children may obtain higher causal ratings than children of lower levels of intelligence. Since non-probabilistic sampling techniques were used, the intelligence factor could have been evenly distributed within the two groups, and therefore no significant differences were found between the two groups in their performances on either of the two measures of causality.

However,the lack of significant differences between the schooled and un-schooled groups could also be due to the fact that as an accidental sample was taken of the US groups there could have been a higher proportion of average-high IQ boys in this sample than there would have been in a random sample. This can only be checked by repeating the study.

It should be noted that in Zambia un-schooled children are not necessarily below average in intelligence because they do not have places in the schools. There may be a number of reasons why children of average intelligence,and above, do not attend school. One reason is that there are more primary school age children in Zambia than there are places in the schools, and the selection criteria of the schools are often more economic than intellectual. Another

reason may be that although schooling is free, many parents, especially from the compounds, cannot afford the money needed to provide their children with uniforms. Many of the 12 year olds who had stopped schooling after a year or two gave this as the reason for their subsequent non-attendance of school. An interesting point to note here is that the highest score on the Physical Causality items (100) was obtained by an un-schooled 12 year old boy. When he was asked to explain how he knew about refraction, air-pressure, etc., he said that he had learnt about these things by asking his school-going friends what they learnt in school.

HYPOTHESIS 4:

On the Relationship between the Development of Physical Causality and the Development of Personal Causality

This hypothesis stated that there would be a relationship between the development of Physical and Personal Causality within the same age groups. The results indicated that there was no relationship between the scores obtained for Physical and Personal Causality within any of the three groups.

This finding was in line with Whiteman's (1967) and Berzonsky's (1973) findings of the independence of Physical and Psychological Causality. Berzonsky (1973:308) stated that - "Phenomenal connection or continuity in time is said to be the basis of Physical Causality, whereas personal efficiency is thought to be the genesis of the inferential behaviour involved in Psychological Causality". However, it should be noted that when a general correlation of the Physical and Personal Causality scores within the whole sample was computed, a significant relationship between Physical and Personal Causality scores was found, which indicates that both these concepts develop with age. It is possible that no significant relationship between the Physical and Personal Causality scores was found within each group (12 S; 12 US; 6 US), because the age range of the groups (one year) is too small.

The present research results showed that although both Physical and Personal Causality responses seem to develop with age (Hypothesis 1), the rate and timing of the development of the two types of Causality within the groups (6 US; 12 US; or 12 S) seem to be independent of each other. A child classified

causal for Personal Causality (see Appendix III). Thus, the percentage of agreement between Physical and Personal Causality ratings in all three groups is relatively low:

6 US - 45%
12 US - 65%
12 S - 55%

This low agreement between Physical and Personal Causality ratings may be due to the fact that "an understanding of Physical Causality is derived from empirical observations, while a knowledge of personal causation is essentially subjective" (de Charms, 1968, in Kelley, 1973). Furthermore, as a review of the literature of Attribution theory shows (Miller and Ross, 1975; Ghosh and Fry, 1981), attributions for Success and Failure may have an affective basis, whereas imputing causes for Physical Causality items is essentially objective.

Co-variation and Configuration concepts are both used to interpret activities. Children attribute reasons for Success and Failure using both these concepts, i.e., analysing why they have succeeded or failed in the past, as well as reasons for success and failure in the present situation.

The principles of consensus and consistency implied by the Co-variation model were not present in the present test situations, and therefore it is likely that attributions were made using Configuration concepts, and using the Discounting principle. Therefore, as Kelley (1973) stated, effects were attributed to causes with high external justifications. The use of this model in making attributions might explain the high percentage of causal as opposed to Pre- and Peri- causal answers given by the 12 year old children (Table XIV(b)). Six year old children, however, gave a larger percentage of non-causal than causal responses, which seems to imply that they do not consider external justifications for the effect when they make causal attributions for the effect.

In the present study, external factors such as task difficulty, chance, etc., were taken as objective causal explanations for Success or Failure because the tasks were so structured that the child would fail in one condition and succeed in the other. Furthermore, some of the items were based on chance or probability, e.g., the Cow Game, the Bead Game.

Frieze and Weiner (1971) stated that people attribute behaviour with good consequences to internal factors and behaviour with bad consequences to external factors. In fact it was observed in the present study that a large number of Peri-causal ratings (which include a majority of responses involving internal factors) were obtained for Success:

6 US - 40%
12 US - 0%
12 S - 25%

Than for Failure:

6 US - 25%
12 US - 0%
12 S - 10%

by the two groups, 6 US and 12 S. The 12 US group did not obtain any Peri-causal ratings on these two conditions.

It is interesting to note also that there were a higher percentage of purely causal (Causal b) ratings (external factors only), for the failure condition than for the success condition, for the two US groups -

Success		Failure
15%	- 6 US -	20%
30%	- 12 US -	70%

There was no difference in Causal (b) ratings between success and failure conditions for the 12 S group (see Table XIII).

The existence of noticeable differences between ratings on the success and failure conditions seems to indicate the need for a study to test the Frieze and Weiner claim that success is attributed more to internal causal factors and failure is attributed more to external causal factors.

The above analysis illustrates that attributions for Personal causality may be made on a purely subjective/objective basis. Attributions for Physical Causality however are basically objective. This difference in attributional bases may explain the lack of correlation between Physical and Personal Causality scores within the groups.

The Distribution of Scores:

The greater variability of Physical Causality scores as compared to Personal Causality scores when the Standard Deviation of the whole sample, sixty individuals, is taken into account, may be explained by the great difference between these two sets of scores within the 12 US sample. These scores probably affected the variation of the group as a whole.

One reason why the Physical Causality scores of the 12 US sample were so scattered could be because this sample is less homogeneous than the other two. The 6 US group are all totally unschooled, and all engage in more or less the same occupation for the better part of the day, i.e. play. The 12 S group all go to school and are all in Grade 6. They must have had at least average intelligence or else they would not have reached Grade 6. The 12 US group however contained a lot of variable elements. Some of this group had been to school for one or two years while others were completely unschooled. Some of these boys had no official occupation, while others did odd jobs 'piece-work', to earn a little money. It is also possible that intelligence varied a great deal within this group. Thus, children who had an occupation would have less time for observation and so might have given lower causal responses than those with more time for observation, or contrarily, children who were engaged in occupations like brick-building, fencing, etc., might have given more causal answers than jobless children, because of their wider experience with physical phenomena.

The Personal Causality scores were less variable than the Physical Causality scores, probably because all the children experienced the same type of socialisation process, and thus the development of their reasoning about intra-personal matters was more homogeneous.

Test Materials:

An attempt was made in this research to use only the types of materials which would be familiar to Zambian children, as far as possible, as familiarity with test objects has been shown to affect children's performances on tests

(Okonji, 1971; Berzonsky, 1971). It was ascertained that the children were familiar with each item by asking them to identify each of the items before testing. The children could identify all the items for Physical Causality, but the 6 US had problems in identifying the Koh's blocks item on the Personal Causality test. All the other items on this test were easily identified.

It was found in the course of this study that item difficulty was not equivalent on all the tests, and this may have affected the results.

(1) Physical Causality - As stated earlier, items which had been directly experienced by the children, e.g. catapult, whistle and the floating of wood, elicited larger percentages of causal responses than the pencil in water item, from all three groups. The latter item elicited a larger percentage of Pre-causal responses than the other items.

Thus, it is suggested that in future studies, equal proportions of familiar, accessible items, and familiar, inaccessible items, should be used to test causality. This will make the findings more valid.

(2) Personal Causality - Although the Koh's block item was the least familiar to all the children it did not elicit a large percentage of Pre-causal answers from any of the three groups. The majority of responses for this item were III/T3 and IV/V types of responses. This was the case with the Grid item as well as the Cow's tail item.

The Bead game elicited a larger percentage of Pre-causal responses than any of the other items on this test. This may have been due to the nature of the item. As it was a probability item and involved no direct action by the child, unlike the other items, children without a clear notion of chance could not give the correct answer (that the red beads were picked by chance),and reverted to phenomenistic explanations for this item - e.g., "The red beads came because you shook the bag".

This item clearly illustrated that the type of item used in testing causality may lead to certain types of responses not elicited by other items. It is interesting to note here that almost all the Stage I answers, in all three groups, were given for the Bead game.

Thus, it is suggested, that in the event of this study being repeated, equal proportions of probability and non-probability items should be used on this test.

In summary, it can be said that the high percentage of causal ratings received by all three groups on both measures of causality may have been a function of the type of items used in testing. Therefore it is suggested that a follow-up study should use equal proportions of familiar-accessible and familiar-remote objects/items, and equal proportions of probability and non-probability items in testing causality, in order to control for these types of effects. Items of equivalent levels of difficulty should be used on both the tests.

Sources of Bias Error:

(1) It was not possible to ascertain the exact ages of the children tested. The parent's estimate of the child's age had to be taken (no written records being available) and children who were slightly older or younger than specified may have been included in the sample. This source of error is difficult to control when testing children from the Compounds. However, since the ages given by parents could not have varied too drastically from the actual age of the child (not more than a year's difference either way), it is felt that this factor should not have made a significant difference to the results.

(2) The sampling of un-schooled children was done in one area - Kalingalinga - to control for any differences that may have arisen from taking a sample from compounds with different socio-economic structures.

The US sample was not taken from the same area (Kaunda Square) as the S sample, because not many totally un-schooled children were located in this area. Most of the 12 US located in this area had been to school for at least three years. The reason why more totally un-schooled children were located in Kalingalinga may be because there is no primary school in this compound.

(3) Because all the US sample was collected from one area, the sample could have been contaminated by the children telling their friends what had happened when they were tested. Thus it is possible that some of the children tested had some prior knowledge of the test, although they all denied it.

Furthermore, the researchers were always followed by children, and other children always came to watch while a child was being tested. It may be possible that some of these children in the audience were tested on another day, although an attempt was made to avoid this by visiting different areas of the compound on different days.

The only way this problem could be avoided is if the researchers had a base within the compound, like a room,in which each child could be tested individually without being watched by others.

(4) Due to the unavoidable presence of an audience -other children- while being tested, the child's responses could have been affected in some way for both measures of causality. (For items such as the Cow's tail item, however, the child being tested was totally isolated from the audience.)

(5) Since the success and failure conditions for each item (Personal Causality) were experienced immediately after each other, the child's response in one condition could have been affected by his response in the previous condition. Also, the child may have suspected that his performance was being manipulated as he always succeeded and failed for each item.

One way to control for this would be to structure two tasks equivalent to, but not exactly the same as each other. Thus, even if the child failed on one task and succeeded on the other, he would be less likely to suspect manipulation, as the two tasks are not the same.

The order of presentation of the success and failure conditions could also be changed, i.e., success and failure need not follow each other, they could be mixed up, e.g.:

S S S F F S F F

(1) (2) (3) (1) (2) (4) (3) (4) ... (the numbers in brackets indicate the item number)

This procedure was not followed in this study, because it was not known whether any significant effects arose from experiencing either the success or failure conditions first. Therefore, a counter-balancing procedure was used to control for order effects. As analysis of the results did not seem to indicate any systematic order effects, so a future study could systematically mix up the presentation order of the success and failure conditions.

(6) The categorisation schemes were formulated by the investigator for the present research. It may be possible that the investigator erred in the definition of Stage III type responses, as Causal responses (for Physical Causality). It may be more valid to classify Stage III responses as Peri-causal responses.

CONCLUSIONS

The hypothesis that there are developmental differences in the perceptions of Physical and Personal Causality was accepted. This finding was consonant with the findings of Piaget (1930), Baldwin and Baldwin (1970) and Cohen (1981), that the concept of causality develops with age.

Similar stages were identified in the development of Physical and Personal Causality, but it was found that these stages were not equivalent to each other, i.e. the Peri-causal stage in Personal Causality was not equivalent to the Peri-causal stage in Physical Causality, and so on.

It was found that schooling had no significant effect on either type of causality. However, this finding is not highly generalisable as the children were all taken from one school.

No correlation was found between Physical and Personal Causality measures within any of the three groups. This finding was consistent with the findings of Berzonsky (1973) and Whiteman (1967), that Physical and Psychological Causality are independent of each other. However, a significant relationship between Physical and Personal Causality scores was found within the whole sample, which implies some sort of relationship between the two. The absence of any significant relationship between these two measures within each of the three groups may have been due to either the small age range of the group, or the limited sample size.

It was suggested that the lack of correlation between Physical and Personal Causality responses may have been due to the fact that their attributional bases are different.

SUGGESTIONS FOR IMPROVEMENTS:

1. Familiar-remote, as well as familiar-accessible items should be used to test both types of causality.

2. It should be ensured that the items used are equally familiar to the children. The inclusion of one highly familiar item such as the catapult might lead to a large number of causal reasons being given for that item, thus introducing a source of bias.

3. The categorisation scheme should be changed to include only causal answers which attempt some logical explanation for the phenomena, and not just identify the basic cause of the phenomena. That is, T_3 should be the first of the causal categories, while Stage III should be classified as a Peri-causal stage for Physical Causality.

4. The Causal (a) category should be changed to include configurations with at least three causal responses only.

5. In order to make the two categorisation scales equivalent, Stages I - T_2 could be classified Pre-causal, Stage III - Peri-causal, and Stages T_3 - V Causal, on both categorisation schemes.

6. The schooled and un-schooled samples should both be taken from the same areas, or from equivalent areas, and the schooled sample should be selected from more than one school, so that the results are more generalisable.

7. The un-schooled population should be taken from different areas, of similar socio-economic status, to avoid sample contamination. It should be attempted to test all the children from one area on the same day.

8. The relationship, if any, between intelligence and Physical and Personal Causality should be investigated.

REFERENCES

1. AUSUBEL, D.P. and SCHIFF, H.M. (1954). The effect of incidental and experimentally induced experience in the learning of relevant and irrelevant causal relationships. Journal of Genetic Psychology, 84, 109-123.

2. BALDWIN, C. and BALDWIN, A.L. (1970). Children's judgements of kindness, Child Development, 41, 29-47.

3. BEARD, R.M. (1969). An outline of Piaget's Developmental Psychology, Routledge and Kegan Paul Ltd.

4. BEM, D.J. (1972). Self-Perception theory, in Berkowitz, Ed. Advances in Experimental Social Psychology, Vol.6, Academic Press.

5. BERKOWITZ, L. (1980). A Survey of Social Psychology, Holt, Rhinehart, and Winston.

6. BERZONSKY, M.D. (1971). Interdependence of Inhelder and Piaget's model of logical thinking, in Modgil (1974), Piagetian Research.

7. BERZONSKY, M.D. (1973). Some relationships between children's conceptions of physical and psychological causality, Journal of Social Psychology, 90, 299-309.

8. CAMPBELL, S.F. (1976). Piaget Sampler, John Wiley and Sons.

9. COHEN, E., GELFAND, D. and HARTMAN, D. (1981). Causal reasoning as a function of behavioural consequences. Child Development, 52, 514-522.

10. DONALDSON, M. (1978). Children's Minds, Fontana.

11. FRIEZE, I. and WEINER, B. (1972). Perceiving the causes of success and failure, in Kelley, 1973.

12. FRY, P.S. and GHOSH, R. (1980). Attributions of Success and Failure, Journal of Cross Cultural Psychology, II, 343-363.

13. GREENFIELD, P., REICH, O. and OLIVER, R.R. (1966). On Cultural Universals, in Bruner, J.S., OLIVER, R.R. and GREENFIELD, P., (1966). Studies in Cognitive Growth, John Wiley and Sons.

14. GOODNOW, J.J. and BETHON, G. (1966). Piaget's Tasks: The Effects of schooling and intelligence, Child Development, 37, 573-582.

15. HART, H.L.A. and HONORÉ, H. (1959). Causation in the law, in Mackie, 1974

16. HEIDER, F. (1958). The Psychology of Interpersonal Relations, John Wiley and Sons.

17. HUME, D. (1888). A Treatise of Human Nature, Ed.by Keynes and Straffa, (1938, Cambridge).

18. KELLEY, H.H. (1973). The Process of Causal Attribution, American Psychologist, 28, 107-129.

19. KELLEY, H.H. and MICHELA, J.L. (1980). Attribution Theory and Research, Annual Review of Psychology, 31, 457-503.

20. KRUGLANSKI, A. (1980). Lay Epistemeo-logic-processes and contents: Another look at Attribution Theory, Psychological Review, 87, 70-87.

21. LANGGULUNG, H. and TORRANCE, P. (1973). A cross-cultural study of children's conceptions of situational causality, Journal of Social Psychology, 89, 175-183.

22. LUNZER, E. (1960). Recent studies in Britain based on the work of Jean Piaget, NFER Publishing Co. Ltd.

23. MACKIE, J.L. (1974). The Cement of the Universe, A study of causation, Oxford University Press.

24. MAIER, H.W. (1968). Three Theories of Child Development, Harper and Row, Inc.

25. McARTHUR, L. (1972). The How and What of Why, Journal of Personality and Social Psychology, 22, 171-193.

26. MICHOTTE, A. (1963). The Perception of Causality, Hazell and Viney.

27. MILLER, D.T. and ROSS, M. (1975). Self-serving biases in the Attribution of Causality, Psychological Bulletin, 82, 213-225.

28. MODGIL, S. (1974). Piagetian Research, NFER Publishing Co. Ltd.

29. MUSSEN, P.H. (1963). The Psychological Development of the Child, Prentice Hall Inc.

30. NASS, M.L. (1956). The effects of three variables on children's conceptions of Physical Causality, Journal of Abnormal Social Psychology, 69, 669-673.

31. NEAL, G. (1959). Age Placement of Science in a Junior School, in Lunzer, E., 1960.

32. OAKES, M.E. (1947). Childrens explanation of natural phenomena, in Ausubel and Schiff, 1954.

33. OKONJI, M.O. (1971). A Cross-Cultural Study of the effects of familiarity on classificatory behaviour, Journal of Cross-Cultural Psychology, 2, 39-49.

34. PINARD, A. and LAURENDEAU, M. (1969). Causal Thinking in the Child, IUP Inc.

35. PARISCHA, P. and SURI, P. (1959). Qualitative Analysis of childrens explanations of physical causality, Central Institute of Education, (New Delhi) Publications, No.31.

36. PIAGET, J. (1930). The Child's conception of Physical Causality, Routledge and Kegan Paul.

37. PIAGET, J. (1953). Origin of Intelligence in the Child, Routledge and Kegan Paul.

38. PIAGET, J. (1971). Understanding Causality, W.W. Norton and Co.Ltd.

39. SEGALL, M.H. (1979). Cross-Cultural Psychology, Wadsworth Inc.

40. SOROKIN, P.A. (1943). Socio-Cultural Causality, Space and Time, Duke University Press.

41. SKINNER, B.F. (1953). The operational analyses of psychological terms, in Bem, 1972.

42. STREUFERT, S. and STREUFERT, S.C. (1969). Effects of conceptual structure, failure and success on attributions of causality and interpersonal attitudes, Journal of Personality and Social Psychology, 11, 138-147.

43. TILLMAN, W.S. and CARVER, C.S. (1980). Actors and observers attributions for success and failure: A comparative test of predictions from Kelley's cube; Self-serving bias, and Positivity bias formulations, Journal of Experimental Social Psychology, 16, 18-32.

44. WHITEMAN, M. (1967). Children's conceptions of Psychological Causality, Child Development, 38, 143-155.

A P P E N D I X I:

QUESTION FORMAT (STANDARDISED)

APPENDIX IA: QUESTION FORMAT (STANDARDISED)

- The children were asked first to identify all the items used in testing, for both Physical and Personal Causality measures.
- There was a list of basic standardised questions asked of all children, as shown below, but if the child's response was unclear/ uncategorisable, further questions were asked.

Whistle	-	Where does the sound come from?
	-	How is the sound made?
	-	How does blowing in air make the sound?

Pencil	-	Is it straight? (Out of water)
in	-	Is it straight? (In water) What has happened to it?
Water	-	Why is it bent?
	-	How does water make it bend?
	-	Do all things bend in water?
	-	Is it really bent?

Floating	-	What happens to the block of wood when it is put in water?
of	-	Why does it float?
Wood	-	Do all light things float in water?
	-	Does wood always float in water?

Catapult	-	How does it work?
	-	How is the stone thrown out?
	-	How does pulling and releasing the bands make the stone to be thrown?

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(4) Bead Game

(P) - How did you manage to pick red beads without looking?

- Are there any other reasons why you got red beads?

(F) - Why didn't you pick any red beads?

- Are there any other reasons why you did not get red beads?

Often, depending on the child's answer, further questions were asked, to try to establish exactly what the child meant.

A P P E N D I X II:

A BREAKDOWN OF THE CLASSIFICATION OF RESPONSES GIVEN BY EACH SUBJECT FOR PHYSICAL AND PERSONAL CAUSALITY ITEMS, IN THE THREE GROUPS.

APPENDIX II: (A). PHYSICAL CAUSALITY

(i) 6 Years, (UNSCHOOLED)

SUBJECTS	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL RATING
	W	P	F	C	
1.	III	III	IDK	III	a
2.	IDK	I	IDK	III	Pre
3.	III	II	IDK	III	Peri
4.	T_3	II	III	II	Peri
5.	III	II	III	III	a
6.	III	II	III	IV	a
7.	III	III	III	III	a
8.	IDK	I	IDK	III	Pre
9.	IV	IDK	III	III	a
10.	T_3	I	T_3	IV	a
11.	III	III	III	III	a
12.	III	IDK	IV	IV	a
13.	III	II	III	IV	a
14.	II	II	III	III	Peri
15.	II	II	T_2	III	Peri
16.	III	I	III	III	a
17.	III	I	III	V	a
18.	IDK	IDK	T_3	III	Peri
19.	IDK	III	III	IV	a
20.	III	III	III	III	a

KEY:

W = Whistle

P = Pencil in Water

F = Floating of Wood

C = Catapult

Pre = Pre-causal

Peri = Peri-causal

a = Causal (a)

b = Causal (b)

APPENDIX II: (A). PHYSICAL CAUSALITY

(ii) 12 Years (UNSCHOOLED)

	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL
SUBJECTS	W	P	F	C	RATING
1.	V	III	III	IV	a
2.	IV	III	IV	III	a
3.	V	V	V	V	b
4.	T_3	T_3	III	V	a
5.	T_3	II	III	IV	a
6.	T_3	I	III	IV	a
7.	III	III	III	IV	a
8.	T_3	III	III	IV	a
9.	III	III	T_3	IV	a
10.	III	T_3	IV	IV	a
11.	T_3	III	III	V	a
12.	III	T_3	III	IV	a
13.	T_3	T_3	T_3	IV	a
14.	III	T_3	T_3	IV	a
15.	III	III	T_3	IV	a
16.	III	III	T_3	V	a
17.	III	T_3	III	V	a
18.	T_3	T_3	III	IV	a
19.	III	II	IV	IV	a
20.	T_3	III	III	IV	a

KEY:

W = Whistle

P = Pencil in Water

F = Floating of Wood

C = Catapult

Pre = Pre-causal

Peri = Peri-causal

a = Causal (a)

b = Causal (b)

APPENDIX II: (A) PHYSICAL CAUSALITY

(iii) 12 Years (Schooled)

SUBJECTS	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL RATING
	W	P	F	C	
1.	T_3	V	III	IV	a
2.	T_3	II	III	V	a
3.	T_3	T_3	V	V	b
4.	IV	T_3	V	V	b
5.	V	T_2	III	III	a
6.	III	V	III	V	a
7.	III	IV	V	V	b
8.	III	III	III	IV	a
9.	IDK	I	III	IV	Peri
10.	T_3	T_3	I	IV	a
11.	III	I	I	V	Peri
12.	III	T_3	T_3	IV	a
13.	V	II	T_3	IV	a
14.	V	IV	IV	V	b
15.	T_3	T_3	T_3	V	a
16.	T_3	T_1	III	IV	a
17.	T_3	T_3	V	V	b
18.	IV	I	III	III	a
19.	T_3	T_2	III	V	a
20.	T_3	T_3	IV	V	a

KEY:

W = Whistle

P = Pencil in Water

F = Floating of Wood

C = Catapult

PRE = Pre-causal

PERI = Peri-causal

a = Causal (a)

b = Causal (b)

PPENDIX II (B) PERSONAL CAUSALITY

i) 6 Years (UNSCHOOLED)

SCT	CONDITION (SUCCESS OR FAILURE)	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL RATING
		K	C	G	B	
	(S)	III	IV	IV	V	a
	(F)	T_3	V	T_3	V	
	(S)	T_3	IV	IDK	IDK	Pre
	(F)	IDK	IV	IDK	IV	
	(S)	III	V	IV	IDK	Peri
	(F)	IV	III	IV	I	
	(S)	V	IV	IV	III	a
	(F)	V	IV	V	III	
	(S)	T_3	IV	IV	V	Peri
	(F)	T_3	IDK	T_3	V	
	(S)	T_3	IV	IV	V	Peri
	(F)	IDK	IDK	T_3	V	
	(S)	III	III	IV	V	Peri
	(F)	II	IV	I	V	
	(S)	III	III	III	V	Pre
	(F)	III	IDK	IV	I	
	(S)	IV	IDK	IDK	IDK	Pre
	(F)	T_3	IDK	III	IDK	
	(S)	IV	IV	IV	V	b
	(F)	IV	IV	V	V	

KEY:

S = Success condition
F = Failure Condition
K = Assembly Task
C = Blindfold Game (Cow's Tail)
G = GRID Excercise
B = Bead Game
PERI = Peri-causal
PRE = Pre-causal
a = Causal (a)
b = Causal (b)

APPENDIX II (B) PERSONAL CAUSALITY

(ii) 12 Years (Unschooled)

SUBJECT	CONDITION (Success or FAILURE)	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL RATING
		K	C	G	B	
1.	(S)	T_3	III	T_3	IV	a
	(F)	T_3	IV	T_3	IV	
2.	(S)	IV	III	V	IV	a
	(F)	IV	IV	IV	V	
3.	(S)	IV	V	IV	V	b
	(F)	IV	IV	IV	V	
4.	(S)	V	V	V	V	b
	(F)	V	IV	IV	IV	
5.	(S)	IV	V	IV	V	b
	(F)	IV	IV	IV	V	
6.	(S)	T_3	V	IV	V	a
	(F)	T_3	V	V	V	
7.	(S)	IV	IDK	IV	V	a
	(F)	IV	IDK	IV	V	
8.	(S)	IV	IDK	IV	V	a
	(F)	IV	IV	IV	V	
9.	(S)	V	III	IV	V	a
	(F)	IV	III	IV	T_3	
10.	(S)	III	V	IV	V	a
	(F)	IV	IV	IV	IV	

KEY:

S = Success Condition

F = Failure Condition

K = Assembly Task

C = Blindfold Game (Cow's Tail)

G = GRID excercise

B = Bead Game

Pre = Pre-Causal

Peri = Peri-Causal

a = Causal (a)

b = Causal (b)

APPENDIX II (B): PERSONAL CAUSALITY

(iii) 12 Years (Schooled)

UBJECT	CONDITION (Success or FAILURE)	CLASSIFICATION OF RESPONSES FOR EACH ITEM				FINAL RATING
		K	C	G	B	
..	(S)	V	III	III	III	a
	(F)	V	V	IV	IV	
	(S)	IV	V	V	I	a
	(F)	T_3	V	I	IV	
	(S)	III	T_3	III	III	Peri
	(F)	III	III	V	III	
	(S)	IV	T_3	V	T_3	a
	(F)	IV	T_3	V	T_3	
	(S)	V	III	V	IV	a
	(F)	V	III	V	IV	
	(S)	IV	IV	III	I	Peri
	(F)	T_3	T_3	V	IDK	
	(S)	IV	III	V	V	a
	(F)	T_3	III	V	V	
	(S)	V	V	V	III	a
	(F)	V	IV	V	IV	
	(S)	IV	III	III	I	Peri
	(F)	IV	IV	V	I	
(	(S)	V	V	IV	V	b
	(F)	IV	IV	V	V	

KEY:

S = Success Condition
F = Failure Condition
K = Assembly Task
C = Blindfold Game (Cow's Tail)
G = GRID excercise
B = Bead Game

PRE = Pre-Causal
PERI = Peri-Causal
a = Causal (a)
b = Causal (b)

A P P E N D I X III:

PHYSICAL AND PERSONAL CAUSALITY RATINGS WITHIN THREE GROUPS

APPENDIX III: COMPARISON OF PHYSICAL AND PERSONAL CAUSALITY RATINGS.

(III) a. 6 Years, (UNSCHOOLED)

SUBJECTS	RATINGS OF PHYSICAL CAUSALITY		RATINGS FOR PERSONAL CAUSALITY
1.	Peri Causal	x	Causal (a)
2.	Pre Causal		Pre Causal
3.	Peri Causal		Peri Causal
4.	Causal (a)		Causal(a)
5.	Causal (a)	x	Peri Causal
6.	Causal (a)	x	Peri Causal
7.	Causal (a)	x	Peri Causal
8.	Pre Causal		Pre Causal
9.	Causal (a)	x	Pre Causal
10.	Causal (a)		Causal (a)
11.	Causal (a)		Causal (a)
12.	Causal (a)		Causal (a)
113.	Causal (a)		Causal (a)
14.	Peri Causal	x	Pre Causal
15.	Peri Causal	x	Pre Causal
16.	Peri Causal		Peri Causal
17.	Causal (a)	x	Peri Causal
18.	Peri Causal	x	Causal (a)
19.	Causal (a)	x	Peri Causal
20.	Causal (a)	x	Pre Causal

KEY:

W = Whistle

P = Pencil in Water.

F = Floating of Wood

C = Catapult

Pre = Pre-Causal

Peri = Peri-Causal

a = Causal (a)

b = Causal (b)

X - indicates a difference in ratings).

APPENDIX III: COMPARISON OF PHYSICAL AND PERSONAL CAUSALITY RATINGS.

(III) b. 12 Years (UNSCHOOLED)

SUBJECTS	RATINGS FOR PHYSICAL CAUSALITY		RATINGS FOR PERSONAL CAUSALITY
1.	Causal (a)		Causal (a)
2.	Causal (b)	x	Causal (a)
3.	Causal (a)		Causal (a)
4.	Causal (a)	x	Causal (b)
5.	Causal (a)		Causal (a)
6.	Causal (a)		Causal (a)
7.	Causal (a)	x	Peri-Causal
8.	Causal (a)		Causal (a)
9.	Causal (a)		Causal (a)
10.	Causal (a)		Causal (a)
11.	Causal (a)		Causal (a)
12.	Causal (a)		Causal (a)
13.	Causal (a)	x	Causal (b)
14.	Causal (a)		Causal (a)
15.	Causal (a)	x	Causal (b)
16.	Causal (a)	x	Causal (b)
17.	Causal (a)		Causal (a)
18.	Causal (a)		Causal (a)
19.	Causal (a)		Causal (a)
20.	Causal (a)	x	Causal (b)

(x - indicates a difference in ratings).

APPENDIX III: COMPARISON OF PHYSICAL AND PERSONAL CAUSALITY RATINGS.

(III) c. 12 Years, (SCHOOLED)

SUBJECTS	RATINGS FOR PHYSICAL CAUSALITY		RATINGS FOR PERSONAL CAUSALITY
1.	Causal (a)		Causal (a)
2.	Causal (a)		Causal (a)
3.	Causal (b)	x	Peri Causal
4.	Causal (b)	x	Causal (a)
5.	Causal (a)		Causal (a)
6.	Causal (a)	x	Peri Causal
7.	Causal (b)	x	Causal (a)
8.	Causal (a)		Causal (a)
9.	Peri Causal		Peri Causal
10.	Causal (a)	x	Causal (b)
11.	Peri Causal	x	Causal (b)
12.	Causal (a)	x	Peri Causal
13.	Causal (a)		Causal (a)
14.	Causal (b)		Causal (b)
15.	Causal (a)		Causal (a)
16.	Causal (a)	x	Causal (b)
17.	Causal (b)	x	Causal (a)
18.	Causal (a)		Causal (a)
19.	Causal (a)		Causal (a)
20.	Causal (a)		Causal (a)

(x - indicates a difference in ratings)