Dedicated uith love and

gratitude to my teacher

Dr. P Karanth

THE ROLE OF LANGUAGE IN COGNITIVE DEVELOPMENT IN THE HARD OF HEARING.

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C E R T I F I C A T E

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D E C L A R A T I O N

This Dissertation titled "THE ROLE OF LANGUAGE IN COGNITIVE DEVELOPMENT IN THE HARD OF HEARING" ia the result of try own study under the guidance of Dr. Prathibha Karanth, Head of the Department of Speech Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any University for any other Diploma or Degree.

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"The problems of deafness are deeper and wore complex, if not more important, than those of blindness. Deafness is a much more worse misfortune. For it means the loss of the most vital stimulus - the sound of the voice that brings LANGUAGE, sets THOUGHT astir, and keeps us in the INTELLECTUAL company of man."

Helen Keller.

CHAPTER - I

1. INTRODUCTION

We use language to communicate our ideas about the world and our relations to our physical and social environment. Thus, our language reflects our thinking. But language, in turn serves as a tool for thinking about objects and events in our lives. Language helps us find meanings and relationships to compare new experiences with old ones. It enables us to plan for future events that have not yet occurred. Certainly language and cognition are related...

The relation between linguistic and nonlinguistic development in normal children has been a controversial issue since long. Infact this controveraial issue has found its extensions even in the field of language disorders in children and adults as well as other clinical populations. This issue definitely has clinical implications because, studies on the prerequisites for language development (Morehead & Morehead 1974; Rees, 1973) have led clinicians to conclude that certain behaviours have to be established in children with language disorders before language disorders can be dealt with directly (Menyuk, 1975). Thus, it becomes essential to clarify the relations between these two domains of development - language and cognition.

Over the years, attempts have bean made by several invsatigators to explain the nonlinguistic/cognitive development in children. Some of the outstanding ones among these have been the works of Piaget, Vygotaky, Werner and those of the learning theorists.

The theory of cognitive development that is often referred to in conjunction with language development is that of Jean Piaget. His genetic epistomological view point was that there ia always a constant interaction between the biology and experience. Though the biological structure of any organism permits development, it is the adaptation to the external envrionment which forms the motivation for development, he says. As the internal representation of knowledge changes with maturation, there is also a progressive structurization of knowledge. Thus, the basic premise of Piaget's theory is that there is a fixed developmental sequence in cognitive development. As we would see later, this view point stands in conflict with those of learning theorists.

Piaget describes cognitive development as an active process wherein the child acta upon the given input(s) by applying certain transformational operations, these in turn bring about displacements, connections, combinations, segmentation and reassembling of the inputs. He talks of "assimilation" and "accommodation" as processes which bring about the progressive structurization of knowledge. In his "stage theory", development from infancy to maturity is described as a sequence of stages each of which is necessary for the subsequent stage. A detailed account of this theory would be dealt with in Chapter II.

The Russian Psychologist Vygotsky's (1962) work was putforth as an alternative to Piagetian views. In his work the major emphasis is on the effect of social/educational factors on cognitive development via the use of language. According to him language becomes internalized with maturation. He agrees with Piaget and Merner in that language is the basis upon which mature thinking rests.

One particular view Mhich sets Vygotsky's work apart from other theoretical views is his positing that language is the basis for all future intellectual development once words have been acquired. Also, for Vygotsky, there is no associative connection between thought and language, they are fused. Like Piaget, he too posits that in their ontogenetic development, speech and thought have different roots. Upto a certain point they are independent; later they meet where thought becomes verbal and speech rational.

Werner's theory speaks of development as an orthogenetic process. There is a gradual differentiation and specificity in the organisation of environmental inputs as well as progressive centralization and hierarchic integration. Werner refers to the spiral in development, a retreat from more mature behavior to more primitive behavior, then back again to the mature behavior and this results in a "higher level" or organization.

Like Piaget, Werner suggests that language arises from perceptual experiences but, unlike Piaget he also suggests that language makes possible the conceptual and analytical processes of the last two stages.

Lastly, learning theorists describe learning process as that of forming S-R-R chain. From their view point all "cognitive" behaviors including language can be explained by this S-R-R principle and that maturation plays a role in the type of learning that occurs.

Thus, we see that there are both similarities and differences in these descriptions.

The question that concerns us here is, the influence of a sensory deficit like deafness on cognitiion and language. If one sticks to the proposition that cognitive growth is independent of language, it would lead us to assume that children born with severe or profound hearing deficits would exhibit the same cognitive characteristics as normally hearing children.

Studies on the intelligence of deaf children between the yeara 1930 to 1967 based on standardized non-language performance tests of intelligence such as pinter non-language test, the Grace Arthur Performance Scale, the performance section of the WISC, the Hiskey-Nebraska test of learning Aptitude etc, indicate that the distribution of intelligence among the deaf is essentially the same as that of the hearing (Vernon 1969). These IQ tests were norm based tests and could tell only how a child performs in relation to a large group. They were unable to clarify the basic factors involved in thinking nor how a child reacts cognitlvely to his environment.

The developmental paychologists usually studied statistical patterns of behavior in large group of subjects often with the help of elaborate test procedures. Piaget preferred a different approach. He observed children's behavior in naturalistic situations, taking detailed notes; he sometimes asked children questions and he developed special tests of their abilities. These methods gradually led Piaget to develop a highly influential theory of cognitive development that focussed on the organisation of intelligence and how it changes as the child grows. For Piaget, an 8 year old is not a ministure adult, a shorter and a dumber version of his father. Rather, the child perceives the world in a fundamentally different way from his parents because of the very nature of his thought processes. For Piaget, intellactual growth was not just a matter of adding one skill to another; it was far more complex and far more interesting, involving several ways of understanding the world. Each child develops at a slightly different rate. While psychologists who study IQ are concerned with such differences among individual, Piaget focussed on the underlying processes that are common to all. The exact timing for a given individual depends on the interaction of maturation and experience. Further, moving from one stage to the next is a gradual process - a child does not enter what Piaget called concrete ooerational period as soon as a child is 7 years of age. However, he did believe that these stages must always occur in the same order.

Other research (Templin et al, Furth 1973) has focussed on certain aspects of intelligence as visual perception, memory, abstraction, concept formation, generalization and problem solving in deaf children. Furth (1973) and co-workers presented Piaget type tasks over a period of several years to deaf children and youth. They substituted "signs" or visual cues for spoken or written language to clarify the task requirement. Furth reported the deaf to be equal to the hearing on many tasks but inferior on some like conceptualizing opposites, transfer tasks etc. Furth suggests that language may play a role in giving the hearing an advantage. This seems to raise questions about the relationship of language to cognitive performance in deaf children. Studies have also indicated that language does have an indirect effect for concrete operationa but haa a definite and direct effect on formal operations in which logic hypo-theaizing and problem solving require symbolization.

The message that comes through is that language must support cognitive development at all periods if the deaf person is to function more fully throughout his life as a thinking human being.

Although there ia little disagreement among professionals concerning the usefulness of hearing in the educational process, there is a lot of controversy concerning the way in which it is to be incorporated. A review of procedures currently in use indicates that there are three general types of programs utilizing auditory input : unisensory methods, multisensory methods in which speech is the only verbal stimulus presented, and multisensory methods in which some form of natural communi-cation (cues, signs or finger spelling) is presented simultaneously with speech. The auditory only (unisensory) methods discourage lipreading or other visual cues and train the child to process speech through audition alone. Multisensory programs using only speech stimuli may encourage lipreading and/or vibrotactile stimulation in addition to audition. Other multisensory programs encourage the use of lipreading, signs, gestures, cues and finger spelling in various combinations with audition. Though there are apparently different schools of thought, when it comes to management of deaf children and adults - our ultimate aim should be geared towards a complete rehabilitation. And for this, it is very essential that we have a language program which supports the deaf child's cognitive development. Mhat is required ultimately is a curriculum wherein both language and cognition have priority and are coordinated in such a way that the deaf would be able to live upto thair potentials.

CURRENT STUDY

Piaget's major contributions have been evaluated differently by different scholars. The strength of Piaget's theory lay both in the breadth of the data it was able to explain, and in the elegant manner in which it did so.

Robeck, M.C (1978) in his book considers four aspects of Piaget's work to be monumental and unique:

First, Piaget's elegant and meticulous description of the development of intelligence sets Homosapiens apart from other species. He emphasized the uniqueness of humans in a biological world and warned against over extending the assumptions based on research from lower animals to children's intelligence. He was not afraid, in a world dominated by S-R psychology, to interpret the child's actions in terms of intent. Piaget departed from research on the behavior of lower animals when he formulated his structure of the stages of intelligence. This careful tracing of the development of logical thought from primitive reflex systems is without parallel in scientific literature. His system of periods and stages assumes a biological totality that integrates growth, development, and learning in every human organism.

Second, Piaget demonstrated clearly that learning differs in kind from one level to another. The associations, which may be sensory or symbolic, are the basic bits of experience from which the child's conceptions are self-constructed internally. Nevertheless, these conceptualizations become gradually consistent with adult conceptions because the child's interaction with the real, physical world necessitates accommodation. But Piaget distinguishes between a level of thinking that conserves, reverses or decenters and an earlier level in which the child cannot perform these operations. Operational thought ia distinct from preoperational thought in ways that have been confirmed by many researchers following the original work of Piaget (Wallece, 1967). Education based on the development of conceptual structures have been attempted.

Third, Piaget designed a methodology for exploring the thinking patterns of children, rather than merely testing them on preorders knowledge. Further more his "interviews" could be used by teachers to find out the child's cognitive functioning without formalized diagnosis and adult language that a child might repeat, but not understand. He restored respectability to clinical observations for obtaining research data.

Fourth, Piaget proposed a philosophy, a view of knowing that focuses on the individual's own role in the construction of reality. Piaget saw the child, not as a victim of the envrionment, but as a selector of experience front many possibilities within the human setting. The child assimilates within the limitations and biological potential of his or her cognitive structures at a given stage of development. For the biological child, actions upon things and the functioning of the systems, whether brain or digestive system, result in satisfaction, further action and adaptation. This conception of the role of the learner in his or her own cognitive development is a significant departure from the mainstream of psychology throughout the first half of the twentieth century and a major contribution by Piaget.

In the current study an attempt is made to delineate the role of language in cognitive development in the hard of hearing, in an Indian milien by evaluating the performance of hard of hearing children on specific cognitive tasks.

CHAPTER - II

2 THE PIAGETIAN SCHOOL OF THOUGHT

2.1 INTELLECTUAL ORGANISATION AND ADAPTATION

Jean Piaget's system for conceptualizing cognitive development was greatly influenced by his early training and work as a biologist. As a blologist hae was very much aware and highly impressed by the interaction of mollusks with their environment.

Based on his early work he came to believe that biological acts are acts of adaptation to the perceived environment. He asserts that the basic principles of cognitive development are the same as those of biological development.

For Piaget, intellectual activity cannot be separated from the "total" functioning of the organism. Intellectual functioning to him is a special form of biological activity. Intellectual and biological activity are both part of the overall progress by which an organism adapts to the environment and organises experience.

In order to understand the processes of intellectual organization and adaptation as they are viewed by Piaget, four basic concepts are required - Schema, assimilation, accommodation and equilibrium. These help to explain how and why mental development occurs.

2.1.1 SCHEMA:

Piaget used this term to explain the rather stable responses that children (all persons) make in response to stimuli and account for many of the phenomena associated with memory.

Schemata are cognitive or mental structures by which individuals adapt to intellectually and organize the environment. They are nothing but mental constructs and constructs are concepts or things that are not directly observable but are inferred to exist.

At birth, the infant has few schemata but as the child develops, his schemata also broadens - becomes more generalized, differentiated and progressively more "adult" like. Thus, as the child becomes better able to generalize across stimuli, schemata becomes more refined.

At any point in time, a child's responses are assumed to reflect the nature of the child's concepts or schemata at that time. Behavior patterns that occur repeatedly in the course of cognitive activity are conceptualized as reflecting schemata. The cognitive schemata of the adult are ultimately derived front the sensori-motor schema of the child. The processes responsible for the change are assimilation and accommodation.

2.1.2 ASSIMILATION

Assimilation is the cognitive process by which a person integrates new perceptual matter or stimulus events into existing schemata or patterns of behavior. It is a means of construing external objects, and events in terms of one's own presently available and favoured ways of thinking about things. Let us take the eg., of a child who pretends that a chip of wood is a boat. This child, in Piaget's term is "assimilating" the wood chip to his mental concept of boat, incorporating the object within the whole structure of his knowledge of boats.

Assimilation goes on all the time. As humans, we must continually process an increasing number of stimuli. Assimilation theoretically does not result in development (change) of schemata, but does affect their growth. We can infact compare a schema to a balloon and assimilation to nutting more air in the balloon. The balloon gets larger (assimilation), but does not change its ahape (growth development). Thus, the process of assimilation allows for growth of schemata.

2.1.3 ACCOMMODATION

Piaget explains the change in Schemata from the child's form to that of an adult, with accommodation when confronted with a new stimulus, a child tries to assimilate it into existing schemata, but at times this becomes impossible as it cannot be placed in any available schema. Now the child can do two things:

- he can create a new schema into which he can place the stimulus <u>or</u>
- he can modify an existing schema so that the stimulus will fit in.

Both theae form accommodation. Thus, accommodation is the creation of new schemata or modification of old ones; both these actions result in a change in or development of cognitive structures (Schemata).

In other words, accommodation roughly means noticing and taking cognitive account of the various real properties that external objects and events possess; it means mental apprehension of the structural attributes of environmental data. Let us take the case of a young child who imitates her father's gestures. This child is "accommodating" her mental apparatus (and hence her motor gestures) to the fine detail of her father's behavior.

Once accommodation has taken place, the child can try again to assimilate the stimulus. Since the structure has changed the stimulus is reading assimilated. Assimilation is always the end product that the child actively seeks.

It can be seen that in assimilation, the person imposes his available structure on the stimuli being processed ie, the stimuli are "forced" to fit the person's structure. In accommodation, the reverse is true. The person is forced to change his schema to fit the new stimuli. Accommodation accounts for a qualitative change (development) and assimilation accounts for (growth) a quantitative change; together they account for intellectual adaptation and development of intellectual structures.

2.1.4 EQUILIBRIUM

In Piaget's view, in any cognitive encounter with the environment, assimilation and accommodation are of equal importance and must always occur together within a mutually dependent way. A balance between assimilation and accommodation is necessary as the process themselves. Piaget refers to this balance as "Equilibrium".

Disequilibrium is an imbalance between these two processes and can be thought of as "cognitive conflicts". when it occurs, it provides motivation for the child to seek equilibrium - to assimilate or accommodate. Thus equilibrium is seen as a necessary condition towards which the organism constantly strives.

In summary,

What we already know will greatly shape and constrain what environmental information we can detect and process, just as what we can detect and process will provide an essential base for the activation of present knowledge and generation of new knowledge.

2.2 STAGE THEORY

Piaget's theory divides intellectual development into four major periods/stages:

1) Sensorimotor period (0-2 years)
2) Preoperational period (2 years - 7 years)
3) Concrete operational period (7-11 years)
4) Formal operational period (11 years & above)

Following is a brief note on each of these stages:

2.2.1 Sensori-motor period (0-2 years)

The child at the age of 2 years is cognitively different from the infant at birth. Piaget's conceptualization of how this transformation takes place is as follows. The child at birth performs only reflex activity. Toward the second month of life, the infant makes primitive differentiations of objects in his immediate environment, primarily via the sucking reflex. Between the fourth and eighth months, coordination of vision and touch typically occurs for the first time. The child grasps what it sees. By the end of the first year, the child begins to develop object performance and an awareness that objects beside himself can cause events. Early in the second year, true intelligent behavior typically occurs; the child evolves new means to solving problems through "experimentation". Also he sees himself as an object among objects. Toward the end of the second year, the child becomes able to internally represent objects. This ability liberates him from sensori-motor intelligence, permitting the invention of new means to solve problems through mental activity.

The cognitive development of the sensori-motor period evolves as the child acts on the environment. The actions of the child are spontaneous actions. The motivation for particular actions is internal. The adapting and organizing of assimilation and accommodation operate from the beginning, resulting in the continuous qualitative and quantitative change in schemata. Each new stage is characterized by behaviors reflecting qualitatively superior cognitive structures. Thus, in the first two years of life, it can be seen that each new stage of development incorporates previous stages. The new stages do not displace the old, they merely improve upon them. In the same way, each stage helps to explain the stages that follow.

Upon completing the sensori-motor period (it can be before or after 2 years of age), the child has reached a point of conceptual development that is necessary for the development of spoken language and other cognitive skills during the next major period in cognitive development; the preoperational period. from, this point on, the child's intellectual development will take place increasingly in the conceptual-symbolic area rather than exclusively in the sensorimotor area.

2.2.2 Preoperational period (2-7 years)

When viewed qualitatively the preoperational child's thought is an advance over the thought of the sensori-motor child. It is no longer primarily restricted to immediate perceptual and motor events. Thought is truly representational (symbolic) and behavior sequences can be played out in the head rather than only in real physical events. Even so, perception still dominates reasoning. (When conflicts arise between perception and thought, as in the conservation problems, children using the preoperational reasoning make judgements based on perception.

The preoperational period is marked by some dramatic attainments. Language is acquired very rapidly between the ages of 2 and 4. Behavior in the early part of the period is largely egocentric and nonsocial. These characteristics becomes less dominant as the pariod proceeds and by age 6 or 7 children's conversations become largely communicable and social.

While preoperational thoughts is an advancement over the sensori-motor thought it is restricted in many ways. The child is unable to reverse operations, he cannot follow transformation, perceptions tend to be centred and the child is egocentric. All of these make for slow concrete and restricts thought. During this period, thought is still largely under the control of the immediate and the perceptual environment.

However, cognitive development moves steadily along with a constant evolution of new and improved cognitive machinery or schemata. The preoperational child's behavior is initially like that of the sensori-motor child. By the age of 7, there is little resemblance.

2.2.3 Concrete Operational period (7-11 years)

This is a transitional period between preoperational thought and formal (logical) thought. During this period, the child attains the use of logical operations for the first time. Thought is no longer dominated by perceptions, the child being able to logically solve concrete operational problems.

The concrete operational child is not egocentric in his thought. He can assume the view points of others and his language is social and communicative. He can decentre his perceptions and attend to transformations. All these new characteristics of thought are reflected in his ability to solve the conservation problems that he was previously unable to solve. An important attainment is reversibility, an essential quality in all operations. Two operations that develop during this period are seriation and classification.

While concrete thought is clearly superior to pre-operational thought, it remains inferior to the thought of the older child (over 11 or 12 years). The concrete operational child can use logical operations to solve problems involving "concrete" objects and events. He cannot solve hypothetical problems that are entirely verbal, requiring more complex or abstract operations.

TABLE: 1. PIAGET'S STAGES OF COGNITIVE DEVELOPMENT

SENSORIMOTOR STAGE (BIRTH TO AGE 2)

CHILD THINKS IN VISUAL PATTERNS ("Schemata")

CHILD USES SENSES TO EXPLORE OBJECTS (ie, looks, listens, smells, tastes & manipulates)

CHILD LEARNS TO RECALL PHYSICAL FEATURES OF AN OBJECT.

CHILD ASSOCIATES OBJECTS WITH ACTIONS AND EVENTS BUT DOES NOT USE OBJECTS TO SYMBOLIZE ACTIONS & EVENTS (eg. rolls a ball but does not use ball as a pretend car)

CHILD DEVELOPS "OBJECT PERMANENCE" (ie, comes to realize an object is still there even when out of sight)

PREOPERATIONAL (AGE 2 TO 7)

CHILD ACQUIRES SYMBOLIC THOUGHT (ie, uses rental images and words to represent actions and events not present)

CHILD USES OBJECTS TO SYMBOLISE ACTIONS & EVENTS (eg, pretends a block is a car)

CHILD LEARNS TO ANTICIPATE EFFECT OF ONE ACTION ON ANOTHER (eg, realises pouring milk from pitcher to glass will make level of milk decrease in pitcher as it rises in glass)

CHILD IS DECEIVED BY APPEARANCES (eg, believes a tall, thin container holding a cup of water contains more than a short, wide container holding a cup of water)

CHILD IS CONCERNED WITH FINAL PRODUCT (ie, focuses on the way things look at a particular moment, "figurative knowledge" and not on changes of things or how things got that way, "operational knowledge") AND HE CANNOT SEEM TO REVERSE THINKING.

CONCRETE OPERATIONAL (AGE 7 TO 11)

CHILD'S THOUGHTS CAN DEAL WITH CHANGES OF THINGS & HOU THEY GOT THAT MAY.

CHILD IS ABLE TO REVERSE HIS THINKING.

CHILD HAS GONE BEYOND HOW THINGS LOOK AT A PARTICULAR MOMENT & BEGINS TO UNDERSTAND HOW THINGS RELATE TO ONE ANOTHER.

FORMAL-OPERATIONAL STAGE (AGE 11+)

CHILD BEGINS TO THINK ABOUT THINKING.

CHILD THINKS IN ABSTRACT TERMS WITHOUT NEEDING CONCRETE OBJECTS.

CHILD CAN HYPOTHESIZE ABOUT THINGS.

2.2.4 Formal Operational Period (11 years & above)

This period is the culmination of the development of cognitive structures. Schemata typically reach maximum qualitative development by about 11 years of age or older; some adults never develop formal reasoning. The adolescent is able to think logically in relation to all classes of problems. He can solve hypothetical problems, verbal problems and can use scientific reasoning. The child with formal operations can think about his own thoughts and feelings. Formal operations evolve out of concrete operations. The process of assimilation and accommodation constantly modify cognitive structures through the period of formal opecations. Each structural change incorporates and improves upon the previous structures.

Thus, the process of development of schemata begins at birth and culminates in adolescence.

2.3 PIAGET'S LATER WORK - HIS VIEWS ON THE MENTAL OPERATIONS OF CLASSIFICATION, RELATIONS (SERIATION) & CONSERVATION

Piaget's original clinical method was highly dependent on verbalizations. The examiner posed questions in words and the child was required to answer in the same way. The examiner's questions usually did not refer to things or events which were immediately present, and problems did not always involve concrete objects which the child could manipulate or even see.

After some experience with this method, piaget came to feel that it was inadequate. The child might not understand everything said to him, particularly if words did not always refer to concrete objects. Even if the child did understand perhaps he could not adequately express in words the full extent of his knowledge. Consequently, Piaget, modified his procedure and the result is what we call "the revised clinical method". The new method involves posing questions concerning concrete materials, allowing the child to answer by manipulating the materials, introducing counter arguments and stating queations and pursuing answers in a flexible and unstandardized way.

Following is a note on Piaget's study of classification, seriation and conservation in children.

2.3.1 CLASSIFICATION

Using the revised clinical method Piaget studied classification in children. According to him, there is a primitive sort of motor classification in the sensori-motor period (0-2 years) when the infant applies to objects in the environment. From about 2-4 years, the child begins to classify collections of objects in a May that is quite primitive. He uses the preconcept. Sometimes he fails to see that one individual member of a class remains the same individual despite slight perceptual changes; and sometimes he thinks that two different members of the same class are the same individual.

Between 5-10 years, the child's classification is still faulty in several ways. There is the phenomena of juxtaposition, inability to see that several objects are indeed members of the same class. There is also syncretism, the tendency to group together a member of disparate events into an illdefined and illogical whole. Piaget makes a number of points about the classes formed from an original array (Opper & Ginsburg, 1979).

(1) No object is a member of both classes simultaneously ie, a large red triangle is in the class of triangles and not in the class of circles. Thus, the classes are mutually exclusive or disjoint.

(2) All members of the class share some similarity eg, a small blue circle, a large pink circle share the property of circularity, Circularity is thus the defining property, the crucial attribute of the class, ie, we include in the class of circles any object which is circular ie, circularity is the intension of the class. The defining property or intension of the other class would be triangularity.

(3) Each class can be described in terms of a list of its members. Instead of describing a class in terms of its defining property or intension, we may simply list out the objects in a class (as a large red or small black etc). Such a list is an extension of the class.

(4) The defining property of a class determines what objects are placed in it. In other words, intension defines extension.

There are three stages of development - the first two called the preoperational which occurs between 2-7 years and the third stage - that of concrete operations from 7-11 years.

Stage 1; To test, classification in the 2-5 year olds, Piaget presented them with geometric shapes of wood and plastic. The shapes included squares, triangles, rings and half-rings all of which were in several colors. The shapes were mixed together and the child was told; "Put together things that are alike" and sometimes additional instructions were given.

The children displayed several methods of grouping the objects. The method was the "smallpartial alignment". With this method the child uses only some of the objects in the original array and puta them together in several ways without any overall guiding plan.

Eg: a child may begin by putting six half rings of various colors in a straight line, then put a yellow triangle on top of a blue square and later put a red square in between two blue triangles, then put squares and triangles in no particular order, in a straight line.

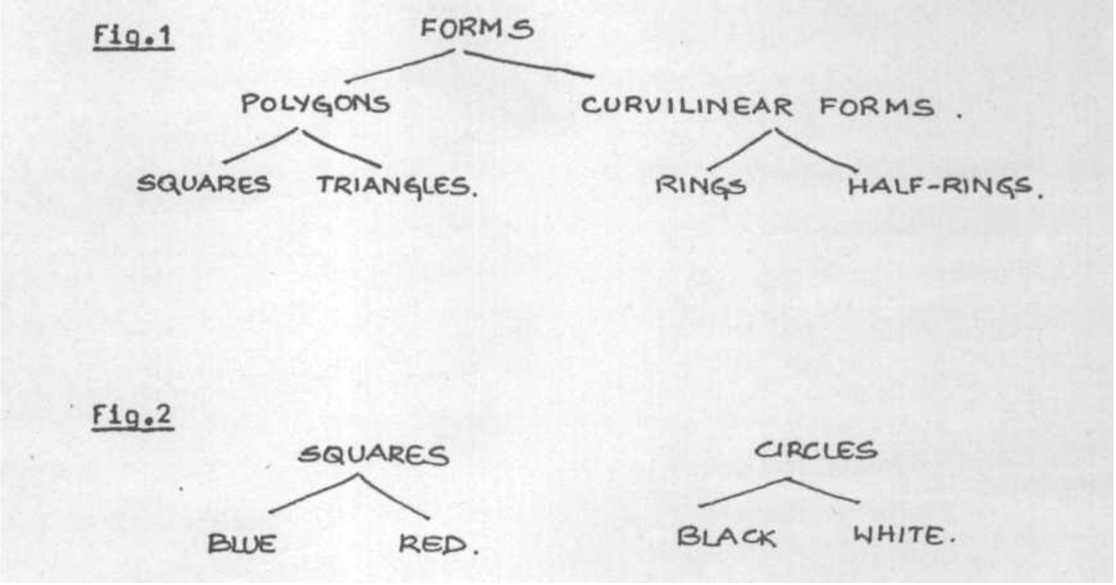
The small partial alignments are not true classes for several reasons - one, that intension does not define extension and secondly, the child does not operate under an overall guiding plan like a system of rules (defining properties) which organise the way in which he arranges the objects.

Other children of this age made use of geometric figures to construct interesting forms or pictures, eg, a child may arrange a number of circles and squares to represent a long vertical object and call it the leaning tower of Pisa or a Qutub Minar. Piaget calls these productions as complex objects. This again is not a true class. Figures are not placed in a complex object because they share some defining property; rather extension ia determined solely by the requirements of the picture under construction.

In another investigation, Piaget presented children of the same age with nongeometric figures for classification - little toys which included people, horses, animals and so on. The results again showed an inability to form classes. Eg, in Piaget's study, one child put two dolls in a cradle, than two wheel barrows together, then a horse. When the examiner asked the child for all the objects like a horse, she gave him all the animals and then a baby and two trees.

This indicates that although the young child may perceive similarities among the objects these do not fully determine what objects go into the collection, ie, this child saw that all animals ware in some respect similar and gave them to the examiner when he asked for objects like the horse. If the child had stopped there, she might have formed a class which was based on the defining property of 'animalness'. However, she went on to throw in the baby and the two trees. The similarity that she first perceived did not fully determine which objects were to be grouped together (extension). It is as if the child had forgotten about the initial defining property and then switched to the other.

Stage 2; Children from about 5-7 years produce collections which seem to be real classes. When presented with the earlier described situation one child produced two large collections, one of which contained all the polygons and the other the curvilinear forms - each subdivided further.



Polygons for eg, contained separate piles of squares, triangles etc and the curvilinear forms involved separate collection of circles, half rings etc. The child thus, not only forms classes but also arranges them hierarchically as shown in Fig.1.

The child's activities were found to be characterized in several additional ways:

(a) He places in the appropriate collection all of the objects which were in initial array. The younger child did not do this; he left a few unclassified.

(b) Intension fully defines extension ie, the child defines a collection on the basis of the defining property of (say) circularity, all circles go into that pile and none is placed in any other.

(c) At a given level of hierarchy, similar defining properties are used to determine collections.

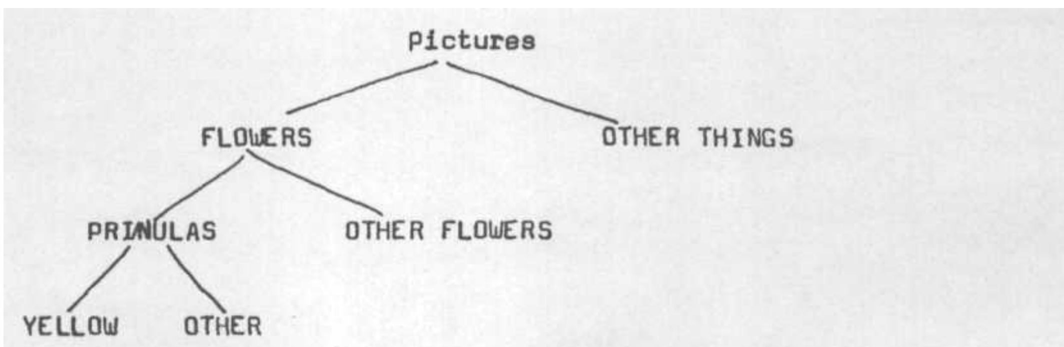
EG: in Fig.1, at the lower level of hierarchy, all of the collections are defined in terms of geometric forms - squares, triangles etc and it is not the case that some collections are defined by form and some by color.

Thus, the child from about 5-7 years produces rather elaborate hierarchical collections which deserve to be called true classes.

Piaget feels that a child at this stage fails to comprehend one crucial aspect of the hierarchy which he has constructed. The child does not understand key relations among different levels of hierarchy. This was the problem of class inclusion.

Piagat investigated the understanding of inclusion relations in children of various stages. For 5-7 years, he presented each of his subjects with a number of picture of flowers and other things. The child was first required to group the pictures in any way he wished and than asked a number of questions concerning inclusion relations. He found children from 5-7 years constructing collections which seemed to involve a hierarchy.

For eg., consider Fig.3



It was seen that this child had constructed a hierarchical arrangement of materials but he maintained that yellow prinulas did not form a smaller collection than the prinulas as a whole, and that the prinulas did not form a smaller collection than flowers as a whole. Both of these answers were wrong for, the part is smaller than the whole from which it derives.

Piagat postulates that once the child has divided a whole into two subgroups, he cannot think simultaneously in terms of the larger collection and the subdivision which he has constructed from it. He has to compare the "sige" of one against that of the other. Under these conditions, the child focusses or centres on tha collection ha can see and ignores the original collection, which no longer is present in its initial state. And since he centres on the part, ignoring the whole, his answers to inclusion are often wrong.

<u>Stage 3</u>: The stage 3 which is concrete operational (7-11 years) the child has a mature notion of class, particulary when real objects are involved. The child sorts them by defining properties, understands the relations between class and subclass and so forth.

Piaget stresses that the age norms describing classification are only approximate. A particular child may pass from stage 1 to stage 2 at 6 years and not necessarily at 4 or 5 years. One child may spend four years in the same stage. He however maintains that the sequence of development is invariant. The child must first be characterized by stage 1 before he can advance to stage 2 and then stage 3. Piaget also points out that a child may or may not be necessarily in the same stage of developments with respect to different areas of cognition, ie, a child may be in stage 1 with respect to classification and in stage 2 of number development. Thus, a child may be slightly more advanced in some categories of thought than in others.

One important issue regarding classification and all other concepts studied by Piaget is the generality of findings for children in different cultures. Recently much cross cultural work has been carried out to determine whether children in different culture employ the types of reasoning described by Piaget and whether the sequences is invariant across cultures, as he proposes. Opper (1979) studying rural and urban children in South East Asian countries, Thailand & Malasia has found that although the ages may vary, the sequence of development is same in different cultures.

2.3.2 RELATIONS

As in the case of classification, Piaget returned to the problem of relations in his later work. Using his revised clinical method, he performed several interesting studies on ordinal relations. These studies involving children from 4 to 8 years of age usually detect three distinct stages of development - Stage 1 lasting from 4-5 years, stage 2 from 5-6 years and Stage 3 from 7 years and above. The first two stages are preoperational and the last one is concrete operational.

while the age norms are approximate, the sequence is crucial.

Stage 1: One study was concerned with the ability to construct an ordering of a collection of 10 sticks which differed only in size (A, B, C, D....) Piaget presented the child with the sticks in a randomly organised array and asked him to select the samllest from the lot. After this an instruction like "Now try to put first the smallest, then one a little bit bigger and so on". In another study, the child was asked to make a staircase from sticks.

When confronted with thia problem children in Stage 1 showed several reactions, none of which was successful. Some children produced random arrangements of sticks like H, E, B, J etc. Other children managed to ordar a few sticks, but not all of them - eg, A,B,C,D,H,F,E etc.

When it come to making a staircase from sticks, he found that the child in this stage constructs an ordering, but only by ignoring the length of each stick ie, the child focuased (centers) on one aspect of the problem (putting tops in order) but ignores another equally important aspect (arranging the bottoms in a straight line).

To summarize, the child at this stage cannot form a systematic ordering of any number of objects although he is sometimes able order a few of them.

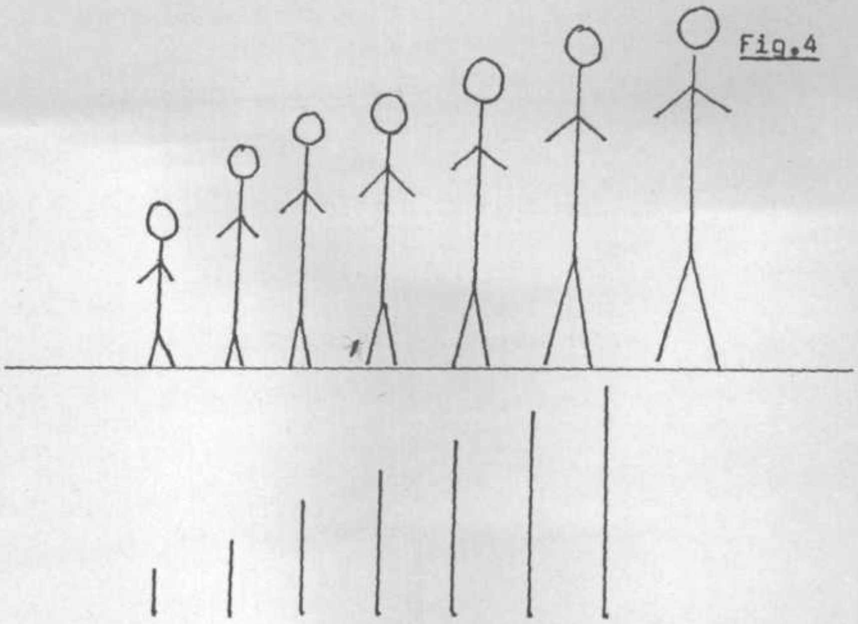
Stage 2: Presented with the same problem, children in the second stage generally succeed in constructing the ordinal arrangement of sticks so that $A < B < C < D < E < F < G < H < I < J$. But the child does not build the ordering without difficulty. The child sometimes begins by ignoring the bottoms of the sticks as in stage 1. Sometimes he makes many errors like $A < D < B$ etc and takes a long time to recognize and correct them. The child continually rearranges his ordering and shifts the sticks from one position to the other. Essentially, the child's procedure is one of trial and error. The child at this stage does not employ a logical procedure and he fails to make systematic comparisons between a given stick and the one immediately proceeding it and all those following.

This tendency is further revealed by the addition of one more problem. After constructing the ordering A through 3, the children were given a new collection of ten sticks each of these could fit in between a pair of sticks of the first series. Children of stage 2 had great difficulty with this problem. Some children however succeeded in producing the correct ordering but only after considerable trial and error.

These difficulties were attributed to several factors. One factor appeared to be that the child perceives the original series aa a whole and finds it hard to break up the series into smaller units. Children of this stage did not approach the problem with a guiding principle. They also had difficulties in deciding that a given element of the new series at the same time was bigger than one stick in the first series and smaller than the next larger stick in the first series. The child trust coordinate these two relations but fails to do so consistently.

Piaget also went on to study the child's ability to construct equivalence between two separate ordering (which involve equal number of elements). He presented children with 10 dolls, A-J, which ware presented in a random display and which could be arranged in order of height and with 10 sticks, A'-J', also randomly arranged, which could be ordered in size. The sticks were smaller than the dolls and the differences between adjacent pairs of a ticks were smaller than between pairs of dolls. The intension of the instructions was to get the child to produce an ordering of the dolls and of the sticks and to make each member of one ordering correspond to the appropriate member of the other ordering. Thus, doll A should have the stick A' and doll B the stick B' and ao on. Piaget calls this process the placing of orderings with one-to-one correspondence.

Fig.4



THE EQUIVALENCE OF RELATIVE POSITION - DOLLS & STOCKS

He found that children of this stage could produce a one-to-one correspondence of dolls and sticks, but only in a trial and error fashion. Most often the child was found to order the dolls (by trial & error) and then order the sticks (by trial & error). After constructing these two separate orderings, the elements were put into one-to-one correspondence. This procedure, though works is cumbersome. What Piaget says is that the child in this stage does not suceed in setting the two orders into one-to-one correspondence. He seers to have established that the orderings are equivalent.

<u>Stage 3</u>: By 6-7 years, the child is successful in all these tasks, says Piaget. When asked to construct a single ordering of sticks differing in size, he can easily do it - over all plan is used as a guide here. When asked to place additional new sticks,

the child in this stage can do so with almost no error. He can compare one of the new sticks with two in the original ordering simultaneously, unlike the child in stage 2. He coordinates two inverse relations - bigger and smaller than. However, as in the case of classification, the one limitation is that the child can deal with relations on a concrete level only.

The concrete operational child can construct orderings, put two such orderings into one-to-one correspondence, and conserve the resulting equivalences. The child's ability to manipulate relations form integrated and comprehensive structures. Piaget posits that each of the child's mental operations cannot be understood without reference to the others of which he is capable. These according to him are to be interpreted in terms of complex systems of operations.

2.3.3 NUMBER

Piaget states that the ability to understand classes and relations is basic to mature concepts in many areas. While refering to the concept of number, Piaget does not imply computational abilities which can be carried out easily by rote and memorization and without understanding. For, a child may memorize the tables but may not be understanding the basic concepts underlying them. Piaget asserts that for mature understanding of number such rote memorization is not sufficient and must be accompanied by a mastery of certain basic ideas - one-to-one correspondence and conservation.

2.3.4 CONSERVATION

The characteristics of preoparational thought described earlier function as obstacles to logical thought. However, they are essential for the development of logical thought and occur naturally and are very clearly seen in conservation problems.

Piaget and his co-workers developed certain problems now called the conservation tasks to assess the children's level of conceptual development and their level of attainment with respect to the concepts involved. CONSERVATION is the conceptualization or schematization that the amount of or quantity of a matter stays the same regardless of any changes in an irrelevant dimension.

Eg., If a row has 8 coins and we move them farther aoart in the row, we still have 8 coins i.e, the number of coins does not change when a change is made in another, irrelevant dimension say, the length of the row. An awareness of number invariance would imply an ability to conserve number and that the corresponding schemata have developed.

This level of conservation ability is a measure of the type of intellectual structures the child has develooed. A preoperation child typically cannot conserve - is, he cannot hold one dimension invariant in the few of changes in other dimensions. By the end of the praoperational period is, by 7 years some conservation structures usually develop.

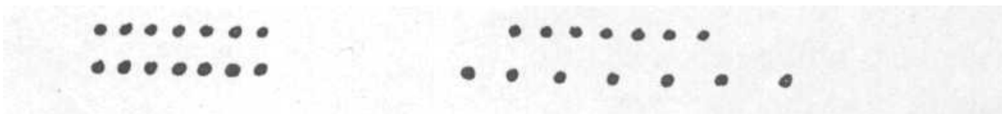
The development from non-conservation to conservation is a gradual one; the change being largely a function of cognitive and sensorimotor actions of the child, says Piagat.

Conservation of Number:

If a 4 to 5 year old is presented with a row of checkers and aaked to construct a row xx that is same, he typically construct a row of tha same length, but his row may not correspond in the number of elements to the model. The typical construction is one where the child places two checkers one opposite each of the and checkers in tha model and then filling in a number of checkers without one-to-one correspondence. If there is correspondence, it is by accident (Piaget, 1967).

The 5 to 6 year old is usually a little more systematic. When he is asked to perform the same conservation task, he uses one-to-one correspondence and makes each row equal in number and length to the model. But if the child sees one row lengthened (transformed as shown below in fig.) without any change in the number of elements, the child declares that they are no longer equivalent. This is true even when if he counts the element in each row. The preoperational child holds that the rows are equivalent only as long as there is a visual correspondence in tha length of arrays.

Fig.5

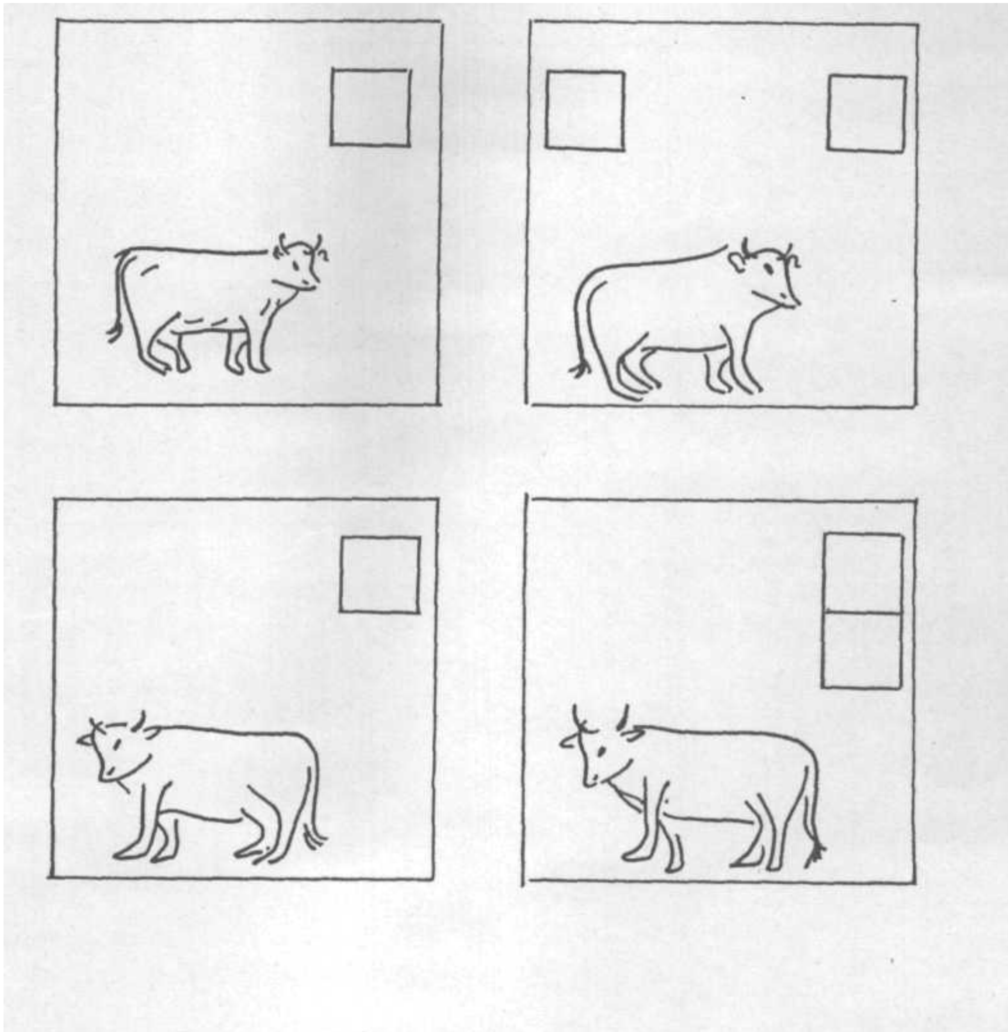


The typical child of 5 or 6 yaars does not conserve number. He ia unable to see that number of elements in a series does not change in the face of other perceptual changes. According to Piagetian theory, the child makes a perceptual instead of a cognitive response following the transformation. The child focusses or centers on one aspect of the event - the length of the rows and ignores other salient aspects of which he is cognitively aware, the number of objects. Also, the child fails to focus on the transformation of stimulus arrays, but focusses on each successive state as if it were independent of the previous states. One to all this the child ends up with a perceptual response. When confronted with a problem where cognitive and perceptual solutions conflict the child makes decisions based on the perceptual cues and hence is "perception bound".

By 6-7 years, the child learns to conserve number. Concurrently he decanters his perceptions attends to transformations and reverses operations.

Conservation of Area:

The second type of conservation problem studied by Piaget reflected the child's concept of area. This was demonstrated by the cows in the field problem (Piaget, Inheldes and Szaminska, 1960). Two sheets of green paper of same size were placed before the child, and the cow (toy or paper cut out) was placed in each field as shown in the figures below.



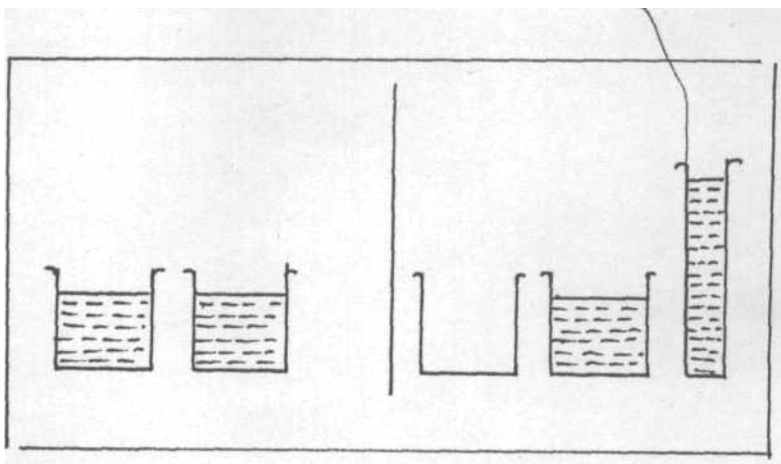
It was explained to the child that there were two fields of grass and a cow in each field. The child was asked, "which cow has more grass to eat?". Tha typical response was that both cows have the same amount of grass to eat. Once visual equivalence of area uas established, the child was shoun a barn (block) being placed in the field and the question was repeated, "which cow has more grass to eat?" Again the response was typically that they both have the same amount of grass. A second block was than placed in each field (Fig. 6 b) ; but in the first case, the second field ia placed away from the first, the second block is placed adjacent to the first in the other field. The same question was asked. The nonconserving child answered that the cow in the second field (blocks adjacent) has more grass to eat. The reasoning implied here suggests that the field with two adjacent barns (one set of barns) has more grass area than the field with two barns separated (two sets of barns) even though the barns are seen as the same size. The child who can conserve says that they both have the same amount to eat. The conserver reasons that the placement of barns is irrelevant to area. Tha important thing is the number of barns.

The non-conserving preoperational child makes a perceptual response; he is unable to decanter and attend to all the salient aspects of the event, nor does he follow the transformations that take place. Each new placement is independent of the previous.

Thus, as with conservation of number, preoparational child fails to conserve. Not until 7 to 8 years of age is conservation of area usually attained.

Conservation of Liquid:

Yet another type of problem is the conservation of liquid. The preoperational child's inability to conserve liquid can be shown with the classic study of Piaget. In this, the child presented with two containers of equal size and shape as shows in Fig. 7 below.



The child is asked to compare the amount of liquid in the two containers. A few drops are added to one, if needed to establish equivalence of volume. When equivalence is attained, the liquid from one of the glasses is poured into a taller and thinner glass (or shorter and wider glass), and the child is again asked to compare the two containers holding liquid. As in the earlier case, an irrelevant dimension has been changed. The typical preoperational child no longer sees the two containers as equivalent in volume and declares that one or the other (usually the taller and thinner container) has more liquid. Reasoning here again is based on the height of one column of liquid compared with the other. This is a typical non-conservation response. If the liquid is then poured back into the original container, visual equivalence is usually achieved again for the child, though not because the child conserves.

Again, the preoperational child typically does not attend to all the transformations that he sees. He centers on the perceptual aspects of the problem; his reason is not logical; reversibility is not present. It is not until the child enters the period of concrete operations (7-11 years) that liquid conservation is usually present. Liquid problems of this type are usually solved after 7 or 8 years. More sophisticated volume conservation problems such as those requiring the measurement of displaced water when an object is immersed, are not solved until 12 years of age (Piaget and Inheldes, 1969).

Piaget states that the child does not develop conservation schemata overnight in an all-or-nothing manner. Conservation concepts are required slowly after much experience and subsequent assimilation and accommodation.

Also, the acquisition of schemata permitting conservation does not take place at the same time in all areas - a particular sequence. Conservation of number is usually attained before other conservation skills, and conservation of volume is usually attained last.

Table 2 shows the ages when the structures permitting conservation are typically acquired. This developmental sequence suggests that the ability to conserve volume implies the ability to conserve lot, area, substance and number ie, previous levels are/have been attained.

<u>TABLE 2</u>

CONSERVATION OF	AGE (in years)
NUMBER	S - 6
SUBSTANCE (mass)	7 - 8
AREA	7 - 8
LIQUID	7 - 8
HEIGHT	9 - 10
VOLUME	11 - 12

2.4 LANGUAGE & THOUGHT - PIAGETIAN VIEW POINT

The moment we talk of language and thought, the question that springs up is - "Which comes first - language or thought? whether the notion is present even before the emergence of language or verbal expression..."

According to Piaget, language and thought have independent roots; they are interrelated at the sate time independent. There are two aspects which are important: (a) Prelinguistic thought & (b) preintellectual speech.

Prelinguiatic thought refers to the onset of thought before that of language. Piaget cites 'symbolic play', 'deferred imitation', and 'mental imagery' as examples.

Symbolic play - children play with things like sticks, tincaps etc which become representative or symbolic of certain other objects.

Deferred Imitation - eg., children see somethings and at a later time, these chains of thoughts are conveyed without speech, by imitation.

Mental imagery - eg., identifying people without being able to name them. Here, thought occurs before speech.

Pra-intellectual speech refers to speech without content and it does occur in a child too. eg: vocal play, babbling etc.

As a child grows up, these two processes of pralinguistic thought and preintellectual speech interact and beyond a particular stage it becomes difficult to separate the two. Verbalizations need not occur necessarily before understanding. The two can be separated but very often they merge. Piaget says that language does not fully shape the child's mental activities. It makes a contribution by making/helping in furthering thought. Verbal weans help in clarification and organization.

Piaget's argument is that the capacity to symbolize things to oneself and others is what we mean by thought; and this precedes language, language being the means of symbolization. Language being abstract and also an advanced means of schama-tization helps 'thought' in attaining equilibrium. Thus thought is possible without language, but only on a very primitive level.

Also, child acquires mature thought only after a long process of development in which language is one factor. Similarly, language is a necessary but not sufficient condition for propositional logic. Since logical operations follow a schedule of their own, it is influenced by language rather than being a product of language.

Piaget and Inhelder cite two studies that support their contention that language is neither a necessary nor sufficient condition to ensure the development of logical thought. They quote the studies of deaf mutes wherein it was found that they develop logical thought in the same sequence as normal children but with a delay of 1-2 years. Language development is seen here as a facilitator of cognitive development but not aa a prerequisite necessary for cognitive development.

Thus, for Piaget, the development of reasoning or thought is independent of language and has its own way and will come about in a child despite the presence or absence of language!

2.5 STUDIES ON COGNITIVE DEVELOPMENT IN THE HARD OF HEARING WITHIN A PIAGETIAN FRAMEWORK

Piaget'a work triggered interest in the winds of several investigators. Studies were done on the deaf youngsters to resolve the controversial language-cognition issue. It was held that if they could develop cognitively in a pattern similar to that of normally hearing children while having no language, it would prove that cognitive development could take place without language. The fact is that findings concerning deaf youngsters have not resolved this issue. In some areas of cognitive development, they are on par with their hearing peers; in others they are retarded; and in still others they excell. The presupposition of their having no language again is open to question and further some aspects of their language development are unaccessible because of the reliance of these assessments on language instructions.

Furth (1963, 1964, 1966, 1971) was one of the first few investigators who had attempted assessing the cognitive abilities in hearing and hearing impaired. Furth reasoned that if cognitive development is not dependent on language, then one would expect hearing impaired children, despite their linguistic deficits, to develop these abilities in much the same manner as hearing children.

Furth administered modified Piagetian tasks to hearing impaired children whose on the basis of their chronological age (8 years) would be expected to be in Piaget's concrete operational (Furth 1966) and formal operational stages (Furth & Younisa, 1965; Younisa & Furth, 1967; Younia3 & Robertson, 1970). Because no retardation was found in the performance of the younger or even the older hearing impaired children on these tasks, Furth concluded that the results supported the Piagetian view that the genetic roots of logical thought are sensorimotor actions and not necessarily language skills. Even though Furth concluded that there were no important differences between the cognitive achievements of the hearing and hearing impaired children, small differences in favour of hearing children were in fact found. Furth attributed these differences to hearing impaired children's difficulty with the verbal aspects of the tasks not to fundamental differences in cognitive skills.

Oleron and Herren (1961) in their study found that deaf children were handicapped when verbal behavior was part of the experimental procedure. To study the performance of deaf on conservation tasks, they devised a series of three figures consisting of a scale pictured as leaning toward one or the other side or being in perfect balance. These pictures were to be equivalent symbols of the words "same weight", "heavy on one aide" or "heavy on the other side" respectively. Testing children of various age groups, Oleron reported that deaf children appeared to be retarded as much as 6 years in comparison with the hearing group. He also reported of a similar difference between hearing and deaf children in grasping the principle of quantity of liquid. Oleron beliavad that Piaget's theory does not sufficiently emphasize the role of language in the development of cognitive behavior, and that his study supports a stronger contribution of language (cited in Furth 1965).

Furth (1964) conducted modified replications of Oleron's study. He believed that inspite of Oleron's precautions and pretraining, the use of pictorial symbols introduced a new difficulty which was mainly responsible for the results. And hence he attempted to make use of a more natural nonverbal symbol for the crucial concepts of "same", "heavier" and "more".

To investigate the conservation of weight, Furth (1964) studied 22 B year old deaf children in a state school for the deaf. He had also studied two control groups of normal hearing children - one group of 8 year olds from second grade and the other group of 6 year olds from first grade.

In this study, deaf and hearing children first judged the weight of two similar-cooking clay balls to be equal. The shape of one of the balls was then changed and they were asked again to indicate which one was heavier or whether both were of equal weight. Since deaf children, particularly at an early age are unable to comprehend a verbal sequence expressing that question, a training procedure with different weights was devised, as well as a manual response.

During the pretraining sessions, the experimenter placed an 802 weight in the palm of each hand and moved both hands in a horizontal fashion, than encouraging the child to imitate this movement. Following this, one 802 weight was exchanged for a 402 weight and the experimenter taking a weight in each hand lowered the hand with the heavier weight. The weights were than exchanged and the experimenter lowered the other hand. The child was then told to imitate the experimenter in his gestures of same weight (horizontal motion) and heavier (downward motion). These gestures were thought to be relatively easy to grasp and to approximate the naturalness of language. The second stage of pre-experimental procedure was then conducted with three balls of clay (two alike and one smaller).

This was followed by the experiment which was conducted in 13 steps.

Step 1. Two similar balls.

2. One ball -one snake.

3. Half a ball- one snake.

4. Two similar balls.

5. One ball - two halves of the other ball.

6. One ball - one half ball.

7. Two similar balls.

8. One ball - one ring.

9. One disc-one ring.

10. Half disc & half ring.

11. Half disc & half ring in both hands

12. One ball - one ring.

13. Two similar balls.

Tha results indicated that the performance of these deaf children (mean age 8.5 years) was similar to that of hearing first graders (6-10 years).

Templin (1950) found that scores of the deaf and the hearing children whom she studied did not differ significantly for any of her subjects related to classification. However, the scores of the hearing children on the subtests related to analogy were significantly higher than the scores of the deaf children. Templin suggested that analogies are less likely to be discerned conuretely in daily life, and that this fact may explain the differences in the scores for the deaf and the hearing children.

Rosenstein's (1960) study also did not show any difference in scores for the deaf and the hearing children. He studied 60 deaf and 60 hearing children in the age range 8-12 years and found no differences. Similar results were also reported by other investigators like Kates, Yudin & Tiffany (1962) who investigated concept attainment in deaf and hearing adolescents.

In one of Furth'a first studies (1961) the classification behavior of 180 deaf and 180 hearing subjects ages 7 through 12, was examined. The children underwent three classification tasks - objects that were same, objects that were similar and a third of objects that had opposite characteristics. The deaf and hearing children performed equally well on the first two kinds of tasks, reflecting an ability to manipulate the concepts of sameness and similarity. However 96% of hearing children were able to complete successfully those tasks reflecting the concept of "opposite" while only 78% of the deaf children were able to do so. Furth suggested that hearing subjects did not "truly" understand the concept of opposition any more completely than the deaf subjects did, but their mastery of language enabled them to give the impression that they did. This explanation would seam to be weak, particularly when the whole thrust of Furth's investigations and tha eventual conclusion that he drew, was that language in and of itself has little influence on the development of logical thought (Meadow, 1980).

Meadow quotes an alternative explanation from the frame work of Blank's (1974) paper on the Cognitive function of language in the praschool years. Blank found that tha tasks with which the deaf children had greatest difficulty were those with instructions which could not be communicated by means of gestures. Thus, one of the functions of language is seen to be to communicate requests that have no visible referent and another is the reverse ability of the experimenter to comprehend what his subjects are communicating. Unless both of these language functions can be performed, the experimenter is unable to say whether the deaf child has or has not grasped a concept (Meadow, 1980).

The other evidence supporting the notion that deaf and hearing perform equally during the earlier stages of cognitive development, with a widening gap at later ages, is derived from another study of Furth (1963). In this study, deaf and hearing college students were administered tasks requiring the more difficult - concept of transfer - the subject is required to extrapolate his knowledge from one situation to another. The deaf students did not perform as well as the hearing subjects on these tasks. Furth suggastad that the deaf because of their language deficit were unable to use a prior sat or price of knowledge.

Both Silverman (1967) and Best (1970) report of results which suggest that a greater grasp of language allows for a higher standard of performance on cognitive tasks on the part of the deaf children.

Goldstein (1987) compared the performance of hearing impaired children uith hearing children on a range of non-verbal cognitive tasks to discover to what extent and in what areas their cognitive abilities might differ. He found that, in general, the hearing impaired children lagged slightly but not significantly behind the hearing on all tasks.

Thus, though several studies have investigated the cognitive abilities of the deaf and hard of hearing, it still presents a picture of many unanswered questions and unresolved problems.

CHAPTER III

3 CURRENT STUDY - METHODS

The study of child language development over the years haa shifted from structure to meaning and more recently, to cognitive and pragmatic factors. The role of language in cognitive development has received much attention and this, in fact has led to the rediscovery of Piaget's Theory of Cognitive Development.

Whether language is necessary or not for cognitive development has been a controversial issue since long especially with regard to the earlier stages of development - preoperational and concrete operational periods. During the preoperational period (2-7 years) the child evolves from one functioning primarily in a sensori-motor mode to one who functions increasingly in a conceptual and representational mode. The preoperational child's thought is characterized by new emerging abilities, the single most evident development being that of spoken language. Around 2 years of age the typical child begins to use words as symbols in the place of objects. A word comes to represent an object. To start with the child uses "one word" utterances and soon his language facility expands. By 4 years, the child has largely mastered the use of spoken language. He can speak and use most grammatical rules and can understand uhat he hears if it contains familiar vocabulary. Such a rapid development of symbolic representation is instrumental in facilitating tha rapid conceptual development that takes place now.

Piaget's own position here has been that language is neither necessary nor sufficient. We does however acknowledge that language may be necessary at the higher stages, at least for some forms of reasoning which require operating on symbolic forms themselves (Piaget 1963), In Chapter 2, we have seen how various investigators have attempted either to corroborate or refute the Piagetian stand point, the results of these studies, and the current view on language cognition issue.

At this juncture, tha question that comes to our mind is:

"GIVEN A LINGUISTIC DEFICIT, WILL A HARD OF HEARING CHILD PERFORM DIFFERENTLY ON COGNITIVE TASKS WHEN COMPARED TO A NORMAL HEARING PREOPERATIONAL CHILD?" if yes,

"CAN WE CORRELATE THE PERFORMANCE WITH THE LINGUISTIC DEFICIT?"

The current project was undertaken to obtain a tangible solution to the above mentioned question.

3.1 AIM:

(1) To study the role of language in cognitive development in the hard of hearing, in an Indian milien and thereby clarify the interrelationship of language and cognition.

(2) Qualitatively assess the performance of hard of hearing children on specific preoperational problems like the conservation tasks which require language mediation.

(3) To check if the mode of communication - oral vs sign language (total communication) can differentially influence the performance on cognitive tasks.

3.2 METHOD:

The performance of two groups of hard of hearing children on cognitive tasks based on a Piagetian frame work, was evaluated. The responses were subjected to both a qualitative and a quantitative analysis (see Chapter 4). The entire test format and the response sheet used for recording are given in Appendix A & B respectively.

3.3 SUBJECTS:

Based on availability twenty six children in the age range 4 years 7 months to 8 years 6 months were chosen as subjects for this study. Out of the twenty six, twentytwo belonged to the praoparational group, the refraining four, 8 years olds were included in this study to compare their performance with the younger ones. These children were placed under the following groups:

GROUP 'A': ORAL GROUP: consisting of eleven children in the age range 4 years 7 months to 7 years 10 months.

GROUP 'A ' : ORAL GROUP: consisting of four children in the age range 8 years 3 months to 8 years 6 months.

GROUP 'B': TOTAL COMMUNICATION GROUP: consisting of eleven children in the age range 4 years 11 months to 7 years 9 months.

This classification was based on the mode of communication used by the children - oral vs. sign. The children in Group 'A' used the oral mode for communication while the children in Group 'B' were invariably found to communicate both amongst themselves and with others in their immediate environment using signs/gestures even though the emphasis at school was on total communication.

TABLE 3 : SAMPLE DISTRIBUTION IN THE CURRENT STUDY

INSTITUTION	SAMPLE (NUMBER OF CHILDREN STUDIED)		
	ORAL GROUP		TC GROUP
	GROUP 'A'	GROUP 'A_1'	GROUP 'B'
ALL INDIA INSTITUTE OF MEDICAL SCIENCES, (AIIMS) NEW DELHI	7	1	-
BALVANTRAY MEHTA VIDYA BHAWAN, NEW DELHI	1	1	8
GOVT. LADY NOYCE SCHOOL FOR THE DEAF, NEW DELHI	-	-	3
OTHER NORMAL SCHOOLS	3	2	-
	11	4	11

Tabla 3 provides information on the sample, sample source, size etc. All children (in Group A, A_1 & B) had bilateral profound hearing losses. The sample was obtained from different Institutions at Delhi. Language used by them was either Hindi or English; however this was not a criterion for selection. Most of the children in the oral grouo (Group A & A_1) used a hearing aid and none of the children in the Total communication group (Group B) were found to be using a hearing aid even thought they had been prescribed one. Hearing impairment in all cases was either congenital or prelinguistic and none of them had any associated problems. All of them belonged to middle class families.

Several other relevant factors like age of prescription and institution of amplification, years of use of hearing aid, hours of speech therapy given, language level of the child were not taken into consideration while selecting the subjects as it was difficult to control these factors. However, information on these factors was taken into individual case histories. Differences whenever found to be significant have been discussed in the light of all these factors (see Chapter 4) in the individual history.

3.4 TOOLS:

The Mysore cognitive capabilities test (MCCT) developed by Padmini, T and Nair (1979) at Mysore, in India, was the test used in the current study. This test which is based on a Piagetian frame work was standardized on a sample of 300 normal children for the age group 4.5 to 7.5 years. This test covers a wide range of cognitive concepts appropriate to children of 5 to 7 years.

The Mysore Cognitive Capabilities Test (MCCT) has six subtests - Metric Relations, Spatial relations, Temporal relations, Belongingness, Sign-symbol and Conservation - each having 2-5 sets of test tasks (refer Appendix A for details).

In order to check the feasibility of administration of the MCCT on a clinical population in this study, this test was first administered to three hard of hearing children in the age range 5-8 years. The following observations were made:

(1) Specific difficulties were encountered in getting the instructions across and also in checking whether the child had comprehended the instructions or not on tasks of temporal relations, signs-symbols and spatial relations.

(2) Administration of the entire test was very cumbersome and time consuming.

Hence, the authors were consulted regarding the choice of test items to suit this population and the time restraints. In the light of the observations trade and the suggestions of the authors, a decision was made to use the tasks included under the three mental operations of seriation, classification and conservation. Under the category of SERIATION TASKS all those subtasts included under Metric Relations and one sub-task of Matrix construction which was included under spatial relations in the original test format were used. Thus for the current study SERIATION TASKS included the following subtasks:

1. Length seriation
2. Area sariation
3. Mass eeriation
4. Volume seriation
5. Matrix construction

Under the category of CLASSIFICATION TASKS the following subtasks were included:

1. Classification of pictures
2. Classification of shapes
3. Identification of the odd one out.

In the original test format these have been included under the category of Belongingness.

Under the category of CONSERVATION TASKS the following subtasks have been included:

1. Judgement of Invariance of number.
2. Judgement of Equivalence of two areas.
3. Judgement of Invariance of mass.
4. Judgement of Invariance of length.
5. Judgement of Invariance of liquid volume.

3.5 PROCEDURE:

Personal data relevant to each individual child was collected either from the parents, teachers or records.

The different tasks of the three mental operations of seriation, classification and conservation chosen for this study, were administered over 2-3 sittings on different days, each sitting ranging from 30 to 40 minutes. In seriation tasks, the child is required to arrange elements according to increasing or decreasing size. Classification is another logical ooeration therein the child has to classify objects and events and relate these classifications. Conservation is the conceptualization that the amount or quantity of a matter stays the same regardless of any change in an irrelevant dimension. For a child to solve a conservation problem, the related abilities to dacenter, follow transformations and reverse operations are all very essential.

The test was administered as per instructions provided in the MCCT format (see Appendix A) with suitable modifications whenever warranted. The help of the parent or the family member accompanying the child was sought if found necessary. For the Group B (Total Communication group) the assistance of the class teacher was sought in the administration of the test and providing the instructions.

3.6 RECORDING:

The responses were recorded verbatim on a response sheet designed for this purpose (see Appendix B). The over all behavior of the child, verbal, non-verbal responses and other observations when considered relevant were noted.

Analysis of data and results obtained are presented in the following chapters.

CHAPTER IV

RESULTS AND DISCUSSION

In the current study the performance of two groups of hard of hearing children in the age range 4 years 7 months to 8 years 6 months, on three mental operation tasks of seriation, classification and conservation was evaluated. The Mysore Cognitive Capabilities Test (padmini, T, 1979) was used for this purpose.

Results obtained by all the twentysix subjects on different tasks of seriation, classification and conservation were tabulated.

A 't' test (for a small sample) was computed to study the difference between Group A & Group B on seriation and classification tasks. A qualitative analysis of responses obtained on conservation tasks was done. The results obtained have been discussed with reference to Piaget's findings in this Chapter. Discussions in this chapter also covers the individual differences within Groups (A, A_1, & B) on each of the above mentioned tasks as well as the differences between Group A and Group B.

DISCUSSION:

4.1 SERIATION TASKS

There were four subtasks under the category of seriation, namely,

4.1.1 Length seriation (T_1, T_2, T_3, & T_4)

4.1.2 Area seriation (T_1, & T_2)

4.1.3 Volume seriation (T_1, & T_2)

4.1.4 Matrix construction ((T_1, & T_2 & T_3)

Tasks under 4.1.1, 4.1.2 & 4.1.3 were administered to all eleven children in Group A, four children in Group A and eleven children in Group B. Items of matrix construction were administered only to those children who could comprehend the instructions and had performed successfully on the sub-items of the proceeding three seriation tasks.

Comparison of the over all performance of the Hard of Hearing with Piaget's findings on normal children

Seriation is a cognitive operation which requires an ability to mentally arrange elements according to increasing or decreasing size. According to Piaget a 4-5 year old pre-operational child is unable to form a systematic ordering of any number of objects, though he/she may at times ba able to order a few of them. A 5-6 year old child generally succeeds but only by trial and error. The child uses no logical rule and fails to make a systematic comparison between a given item and the one immediately proceeding it and all those following, then it comes to 1-1 correspondence, this child may succeed in establishing that the orderings are equivalent but does not succeds in setting the two orders into one to one corresoondence. Piaget's study reveals that by 6-7 years the child is successful in all these tasks, he can coordinate two inverse relations - bigger and smaller than, but only at a concrete level.

Different kinds of seriation learning like conservation learning, typically occur at different ages in an invariant sequence. The child first learns to seriate length around 7 years of age; seriation of weight is usually attained around age 9 and seriation of volume is not arrived at until 12 years of age. (Piaget, 1967)

TABLE 4: RESULTS OF PIAGET'S STUDY ON ORDINAL RELATIONS (SERIATION)

STAGE	(AGE OF CHILDREN)	PERFORMANCE
STAGE-1	4-5 years (PREOPERATIONAL)	The child at this stage cannot form a systematic ordering of any number of objects although, he is sometimes able to order a few of them
STATE-11	5-6 years (PREOPERATIONAL)	The child at this stage generally succeeds in constructing the ordinal arrangements but not without difficulty. Their procedure is one of trial & error. The child does not employ a logical procedure and fails to make comparisons systematically between a given item and the one immediately proceedings it and all those following. Placing of ordering into one-to-one correspondence: - the child in this stage does not succeed in setting the two orders into one-to-one correspondence but seems to have established that the orderings are equivalent.
STAGE-III	7 years and above (CONCRETE OPERA-TIONS)	Piaget states that by 6-7 years, the child is successful in all these tasks; he can coordinate two inverse relations - bigger and smaller than, however, only at a concrete level.

In the current study, the over all performance of the hard of hearing children on seriation tasks was found not to be very different from that of the normals as reported by Piaget. The younger hard of hearing children (4-5 years) performed more by a trial and error method, required more assistance and were unable to make appropriate deductions; many a time they requested to see the sticks together (in length seriation) to compare them. Such responses as reported by Piaget indicate that the preoperational child cannot mentally order events in a series. In this study, the 6-8 year old hard of hearing children performed qualitatively better, which again corroborates Piaget's study.

Comparison of the performance of hard of hearing children on the different subtasks of seriation (length, area & volume) reveals that these children too like the normals learn to seriate length first (as seen on the scores). Most of the hard of hearing children (excepting the Group A and 6 year olds in Group A) had difficulty with area seriation tasks especially those tasks (T_2) in which they were required to seriate cut out triangular areas.

The task of treatest difficulty was that of volume seriation. All the hard of hearing children excepting the Group A_1 children and 2 children in Group A failed to perform on task T_2 in volume seriation which required them to seriate based on the amount of liquid in the container. Even thoae children who scored a maximum of 4/4 on this task required assistance or appeared puzzled when asked whether their response was right.

All these observations reveal that the performance of the hard of hearing children is not different qualitatively or quantitatively from that of the normals.

4.1.1 LENGTH SERIATION:

There were four subtasks included under the category of length seriation (refer Appendix A for details). Maximum total score on this was six.

Performance of children in Group A on length seriation tasks:

All the subjects in Group A except S_1 (4 years 7 months, F) and S_2 (5 years, F) scored 6/6 on tasks of length seriation. S_1. scored 1.5 points, for she scored a partial score of 1 point on T_1 and 0.5 points on T_2 and scored no points on T_3 and T_4. S_2 scored 5.5 points scoring 0.5 points on T_2.

Table 5A & A_1, show the scores obtained by children in Group A & A_1, on tasks of length seriation.

TABLE 5A: SCORES OBTAINED BY GROUP 'A' CHILDREN ON LENGTH SERIATION TASKS

SUBJECT	AGE/SEX	LENGTH SERIATION				TOTAL SCORES OBTAINED
		T_1 Max:2	T_2 Max:1	T_3 Max:1	T_4 Max:2	
S_1	4 yra.7 mos F	1	0.5	-	-	1.5
S_2	5yrs. F	2	0.5	1	2	5.5
S_3	5 yrs. F	2	1	1	2	6.0
S_4	5 yrs.1 mos F	2	1	1	2	6.0
S_5	5 yrs.1 mos M	2	1	1	2	6.0
S_6	5yrs.2 mos F	2	1	1	2	6.0
S_7	5 yrs.9 mos F	2	1	1	2	6.0
S_8	6 yrs.3 mos F	2	1	1	2	6.0
S_9	6 yrs.6 mos F	2	1	1	2	6.0
S_{10}	7 yrs.3 mos F	2	1	1	2	6.0
S_{11}	7 yrs.10 mos F	2	1	1	2	6.0

TABLE 5A$_1$: SCORES OBTAINED BY GROUP 'A$_1$' CHILDREN ON LENGTH SERIATION TASKS

SUBJECT	AGE/SEX	LENGTH SERIATION				TOTAL SCORES OBTAINED
		T_1	T_2	T_3	T_4	
S_{12}	8 yrs. 1 mos M	2	1	1	2	6.0
S_{13}	8 yrs. 2 mos F	2	1	1	2	6.0
S_{14}	8 yra. 5 mos F	2	1	1	2	6.0
S_{15}	8 yrs. 8 mos M	2	1	1	2	6.0

Performance of children in Group A_1 on length Seriation Tasks:

All the four children in this grouD in the age range 8 years 1 month to 8 years 8 months obtained a maximum score of 6/6 on length seriation tasks. All of them exhibited a batter understanding of instruction and required very little assistance on these tasks unlike the younger ones. Their performance was thus qualitatively better than that of the younger hard of hearing children.

Performance of children in Group B on Length Seriation Tasks:

All the subjects in Group B except S_{20} (6 yrs. 4 months M) and S_{24} (7 years 8 months, M) scored a maximum of 6/6 on tasks of length seriation. Both S_{20} and S_{24} having failed to have performed without assistance on T_3 and T_4 obtained a partial score on these and hence an overall score of 5/6 on seriation tasks.

Table 5B shows the scores obtained by children in Group B on length seriation tasks.

TABLE 5B: SCORES OBTAINED BY GROUP 'B' CHILDREN ON LENGTH SERIATION TASKS

SUBJECT	AGE/SEX	LENGTH SERIATION				TOTAL SCORES OBTAINED
		T_1 Max:2	T_2 Max:1	T_3 Max:1	T_4 Max:2	
S_{16}	4 yrs.11 mos F	2	1	1	2	6.0
S_{17}	5yrs.mos M	2	1	1	2	6.0
S_{18}	6 yr8. F	2	1	1	2	6.0
S_{19}	6yrs.2mos M	2	1	1	2	6.0
S_{20}	6yrs.4 mos M	1	1	1	2	5.0
S_{21}	6yrs.6mos M	2	1	1	2	6.0
S_{22}	6yrs.9mos F	2	1	1	2	6.0
S_{23}	6 yrs.8 mos M	2	1	1	2	6.0
S_{24}	7 yrs.8 mos M	2	1	1	1	5.0
S_{25}	7 yrs.8 mos M	2	1	1	2	6.0
S_{26}	7 yrs.9 mos M	2	1	1	2	6.0

<u>Comparison of Group A and Group B children on Lenqth Seriation Tasks:</u>

There was no significant difference seen qualitatively between the Group A and Group B children on Length Seriation Tasks. The 4-5 year olds in both the groups needed more assistance than the older ones. Majority of the children in both the groups with a few exceptions mentioned earlier scored a maximum of 6/6 on length seriation tasks.

Table 6 shows a comparison of scores obtained by Group A and Group B children on Length Seriation Tasks.

TABLE 6: COMPARISON OF GROUP 'A' & GROUP 'B' CHILDREN ON LENGTH SERIATION TASKS

GROUP 'A' (ORAL GROUP)							GROUP 'B' (TOTAL COMMUNICATION GROUP)						
SUB-JECT	AGE/SEX	LENGTH SERIATION				TOTAL SCORE OBTAINED	SUB-JECT	AGE/SEX	LENGTH SERIATION				TOTAL SCORE OBTAINED
		T_1 Max:2	T_2 Max:1	T_3 Max:1	T_4 Max:2				T_1 Max:2	T_2 Max:1	T_3 Max:1	T_4 Max:2	
S_1	4 yrs.7 mos F	1	0.5	-	-	1.5	S_{16}	4 yrs.11 mos F	2	1	1	2	6.0
S_2	5yrs. F	2	0.5	-	2	5.5	S_{17}	5 yrs.8mos M	2	1	1	2	6.0
S_3	5yrs. F	2	1	1	2	6.0	S_{18}	6yrs. F	2	1	1	2	6.0
S_4	5yrs.1 mos F	2	1	1	2	6.0	S_{19}	6 yrs.2 mos M	2	1	1	2	6.0
S_5	5yrs.1 mos M	2	1	1	2	6.0	S_{20}	6 yrs.4 mos M	1	1	1	2	5.0
S_6	5yrs.2 mos M	2	1	1	2	6.0	S_{21}	6 yrs.6 mos M	2	1	1	2	6.0
S_7	5yrs.9 mos F	2	1	1	2	6.0	S_{22}	6 yrs.9 mos F	2	1	1	2	6.0
S_8	6 yrs.3 mos F	2	1	1	2	6.0	S_{23}	6 yrs.11 mos M	2	1	1	2	6.0
S_9	6 yrs.6 mos F	2	1	1	2	6.0	S_{24}	7 yrs.8 mos M	2	1	1	1	5.0
S_{10}	7 yrs.3 mos F	2	1	1	2	6.0	S_{25}	7 yrs.8 mos M	2	1	1		6.0
S_{11}	7 yrs.10 mos M	2	1	1	2	6.0	S_{26}	7 yrs.9 mos M	2	1	1	2	6.0

4.1.2 AREA SERIATION

Two subtasks (T_1 - seriation of cut out rectangular areas and T_2 - seriation of cut out triangular areas) were included under Area Seriation Tasks. The maximum possible score under this category was 4.

Performance of Group A children on Area Seriation Tasks:

Eleven out of fifteen children in Group A scores 4/4 points on tasks of area seriation. The remaining subjects S_1 (4 years, 7 months, F), S_3 5 years, f), S_5 (5 years 1 month, M) and S_{10} (7 years 3 months, F) received only partial scores on T_1 and/or T_2 for the following one or more reasons:

(1) Only three items in a row were correctly seriated from either end.

(2) the child failed to see subtle differences and produces the same errors consistently even after repeated attempts.

(3) needs assistance in noting the differences by superimposing one cut out on the other.

It was observed that all these four children had greatest difficulty with T_2 wherein the child had to look at the subtle differences in the area of triangles and seriate them.

TABLE 7A shows the scores obtained by Group 'A' children on Area Seriation Tasks and $7A_1$ the scores obtained by Group 'A' children.

TABLE 7A: SCORES OBTAINED BY GROUP 'A' CHILDREN ON AREA SERIATION TASKS

SUBJECT	AGE/SEX	AREA SERIATION		TOTAL SCORES OBTAINED
		T_1 Max:2	T_2 Max:2	
S_1	4 yrs. 7 mos F	2	1	3
S_2	5yrs. F	2	2	4
S_3	5yrs. F	1	1	2
S_4	5 yrs. 1 mos M	2	2	4
S_5	5yrs. 1 mos M	1	1	2
S_6	5 yrs. 2 mos F	2	2	4
S_7	5yrs. 9 mos F	2	2	4
S_8	6 yrs. 3 mos F	2	2	4
S_9	6 yrs. 6 mos F	2	2	4
S_{10}	7 yrs. 3 mos F	1	1	2
S_{11}	7 yrs. 10 mos F	2	2	4

TABLE $7A_1$: SCORES OBTAINED BY GROUP A CHILDREN ON AREA SERIATION TASKS

SUBJECT	AGE/SEX	AREA SERIATION		TOTAL SCORES OBTAINED
		T_1 Max:2	T_2 Max:2	
S_{12}	8 yrs. 1 mos M	2	2	4
S_{13}	8 yrs. 2 mos F	2	2	4
S_{14}	8 yrs. 5 mos F	2	2	4
S_{15}	8 yrs. 8 mos M	2	2	4

Performance of Group A children on Area Seriation Tasks:

All the four children in this grouo scored a maximum of 4/4 on area seriation. Thay could perform accurately on the very first attempt without any assistance, following instructions.

Performance of Group B children on Area Seriation Tasks:

Only one child out of eleven in Group B (S_{22}: 6 years 9 months, F) scored a maximum of 4/4 points on tasks of area seriation. The remaining children excepting S_{24} obtained an overall score of 3/4 on area seriation. These children received only a partial score of 1 on T_2 since they required more of assistance and demonstration for this task, especially when compared to children in Group A. S_{24} (7 years 8 months, M) failing on T_2 obtained only 2/4 for his performance on T_1 .

Table 7B shows the scores obtained by Group B children on area seriation tasks.

TABLE 7B: SCORES OBTAINED BY GROUP 'B' CHILDREN ON AREA SERIATION TASKS

SUBJECT	AGE/SEX	AREA 5ERIATI0N		TOTAL SCORE OBTAINED
		T_1 Max:2	T_2 Max:2	
S_{16}	4 yrs. 11 mos F	2	1	3
S_{17}	5 yrs. 8 mos M	2	1	3
S_{18}	6 yrs. F	2	1	3
S_{19}	6yrs. 2 mos M	2	1	3
S_{20}	6 yrs. 4 mos M	2	1	3
S_{21}	6 yrs. 6 mos M	2	1	3
S_{22}	6 yrs. 9 mos F	2	2	4
S_{23}	6 yrs. 11 mos M	2	1	3
S_{24}	7 yrs. 8 mos M	2	-	2
S_{25}	7 yrs. 8 mos M	2	1	3
S_{26}	7 yrs.9 mos M	2	1	3

Comparison of Group A and Group 8 on Area Seriation Tasks:

It was observed that Group A children required less assistance and demonstrations on area seriation tasks when compared to Group B children. Group 8 children had a greater tendency to over look the subtle differences especially on T_2 and were seen to consistently produce the same error patterns. This fetched them a lesser score on area sariation tasks when compared to Group A children.

Table 8 gives a comparison of scores obtained by Group A & B children on area sariation tasks.

TABLE 8: COMPARISON OF GROUP 'A' & GROUP 'B' ON AREA SERIATION TASKS

GROUP 'A' (ORAL GROUP) — GROUP 'B' (TOTAL COMMUNICATION GROUP)

SUBJECT	AGE/SEX	AREA SERIATION		TOTAL SCORE OBTAINED	SUBJECT	AGE/SEX	AREA SERIATION		TOTAL SCORE OBTAINED
		T_1 Max:2	T_2 Max:2				T_1 Max:2	T_2 Max:2	
S_1	4 yrs. 7 mos F	2	1	3	S_{16}	4 yrs.11 mos F	2	1	3
S_2	5yrs F	2	2	4	S_{17}	5 yrs. 8 mos M	2	1	3
S_3	5 yrs. F	1	1	2	S_{18}	6 yrs. F	2	1	3
S_4	5 yrs. 1 mos F	2	2	4	S_{19}	6 yrs.2 mos M	2	1	3
S_5	5 yrs. 1 mos M	1	1	2	S_{20}	6 yrs.4 mos M	2	1	3
S_6	5 yrs. 2 mos M	2	2	4	S_{21}	6 yrs.6 mos M	2	1	3
S_7	5yrs. 9 mos F	2	2	4	S_{22}	6 yrs.9 mos F	2	2	4
S_8	6 yrs. 3 mos F	2	2	4	S_{23}	6 yrs.11 mos M	2	1	3
S_9	6 yrs. 6 mos F	2	2	4	S_{24}	7 yrs.8 mos M	2	-	2
S_{10}	7 yrs.3 mos F	1	1	2	S_{25}	7 yrs.8 mos M	2	1	3
S_{11}	7 yrs.10 mos F	2	2	4	S_{26}	7 yrs. 9 mos M	2	1	3

4.1.3 VOLUME SERIATION:

There were two subtasks (T_1 & T_2) included under this category) and the maximum possible score wes 4 (refer appendix A for details).

Performance of Group A children on Volume Seriation Tasks:

Only two out of eleven children in Group A scored 4/4 points on tasks of volume seriation. The remaining children had scored a maximum of 2/2 points on T_1 but had failed to score any on T_2.

T_2 required the child to seriate the containers based on the amount of liquid (volume), they contained. Invariably these children seriated them based on height of container even after repeated instructions.

Table 9A and A_1 and B show the scores obtained by Group A & A_1 children on volume seriation tasks.

TABLE 9A: SCORES OBTAINED BY GROUP 'A' CHILDREN ON VOLUME SERIATION TASKS

SUBJECT	AGE/SEX	VOLUME SERIATION		TOTAL SCORES OBTAINED
		T_1: Max:2	T_2: Max:2	
S_1	4 yrs.7 mos F	2	-	2
S_2	5 yrs. F	2	-	2
S_3	5 yrs. F	2	-	2
S_4	5 yrs.1 mos F	2	—	2
S_5	5 yrs.1 mos M	2	—	2
S_6	5yrs.2 mos M	2	-	2
S_7	5yrs.9 mos F	2	-	2
S_8	6 yrs.3 mos F	2	2	4
S_9	6 yrs.6 mos F	2	2	4
S_{10}	7 yrs.3 mos F	2	-	2
S_{10}	7 yrs.10mos F	2	-	2

TABLE 9A_1: SCORES OBTAINED BY GROUP 'A_1' CHILDREN ON VOLUME SERIATION TASKS

SUBJECT	AGE/SEX	VOLUME SERIATION		TOTAL SCORES OBTAINED
		T_1 Max:2	T_2 Max:2	
S_{12}	8 yrs.1 mos M	2	2	4
S_{13}	8 yrs.2 mos F	2 -		2
S_{14}	8 yrs.5 mos F	2	2	4
S_{15}	8 yrs.8 mos M	2	2	4

Performance of Group A_1 children on Volume Seriation Tasks:

Three out of four subjects in Group A_1, obtained a maximum score of 4/4 on volume seriation tasks. S_{13} (8 years 2 months, F) obtained a score of 2/4 failing to perform on T_2.

Performance of Group B children on Volume Seriation Tasks:

All the eleven children in Group 8 had difficulty in comprehending the instruction for T_2 wherein the child was required to seriate based on the amount of liquid in the container. Despite repeated instructions, these children seriated the containers based on size/height. However, all the children performed successfully on T_1 following instructions alone and hence an overall score of 2/4 on volume seriation tasks.

Table 9B shows the scores obtained by Group B children on volume seriation tasks.

TABLE 9B: SCORES OBTAINED BY GROUP 'B' CHILDREN ON VOLUME SERIATION TASKS

SUBJECT	AGE/SEX		VOLUME SERIATION		TOTAL SCORES OBTAINED
			T_1 Max:2	T_2 Max:2	
S_{16}	4 yrs. 11 mos	F	2	-	2
S_{17}	5yrs. 8 mos	M	2	-	2
S_{18}	6 yrs.	M	2	-	2
S_{19}	6 yrs. 2 mos	M	2	-	2
S_{20}	6 yrs. 4 mos	M	2	—	2
S_{21}	6 yrs. 6 mos	M	2	-	2
S_{22}	6 yrs. 9 mos	F	2	—	2
S_{23}	6 yrs. 11 mos	M	2	—	2
S_{24}	7 yrs. 8 mos	M	2	—	2
S_{25}	7 yrs. 8 mos	M	2	—	2
S_{26}	7 yrs. 9 mos	M	2	—	2

Comparison of Group A and Group B on Volume Seriation Tasks:

The performance of Group A and Group B children on T_1 of volume seriation was the same. The difference came up in terms of their performance on T_2 of volume seriation. The Group A children appeared to have comprehended the instructions but consistently made the same errors. It appears that they have not yet acquired the mental operation required for seriation based on volume. Group B children also performed poorly on T_2; however unlike Group A there was no means of ascertaining whether they had comprehended the instructions.

Table 10 shows the scores obtained by Group A and Group B children on volume seriation tasks.

TABLE 10: COMPARISON OF GROUP 'A' AND GROUP 'B' ON VOLUME SERIATION TASKS

GROUP A (ORAL CROUP) GROUP B (TOTAL COMMUNICATION GROUP)

SUBJECT	AGE/SEX		VOLUME SERIATION		TOTAL SCORES OBTAINED	SUBJECT	AGE/SEX		VOLUME SERIATION		TOTAL SCORES OBTAINED
			T_1 Max:2	T_2 Max:2					T_1Max:2	T_2 Max:2	
S_1	4 yrs.7 mos	F	2	-	2	S_{16}	4 yrs.11 mos	F	2	-	2
S_2	5yrs.	F	2	-	2	S_{17}	5yrs. 8 mos	M	2	-	2
S_3	5yrs.	F	2	-	2	S_{18}	6yrs.	M	2	-	2
S_4	5yrs.1 mos	F	2	-	2	S_{19}	6yrs. 2 mos	M	2	-	2
S_5	5yrs.1 mos	M	2	-	2	S_{20}	6 yrs. 4 mos	M	2	-	2
S_6	5 yrs.2 mos	M	2	-	2	S_{21}	6yrs. 6 mos	M	2	-	2
S_7	5yrs.9 mos	F	2	-	2	S_{22}	6 yrs. 9 mos	F	2	-	2
S_8	6 yrs.3 mos	F	2	2	4	S_{23}	6 yrs.11 mos	M	2	-	2
S_9	6 yrs.6 mos	F	2	2	4	S_{24}	7 yrs. 8 mos	M	2	-	2
S_{10}	7yrs.3 mos	F	2	-	2	S_{25}	7 yrs. 8 mos	M	2	—	2
S_{11}	7 yrs.10 mos	F	2	-	2	S_{26}	7 yrs. 9 mos	M	2	—	2

COMPARISON OF OVERALL PERFORMANCE OF GROUP 'A' & GROUP 'B' ON SERIATION TASKS:

The mean scores obtained on seriation tasks were calculated for both the groups, 't' test for a small sample was used to determine if the difference between the means was significant.

Table 11 gives a comparison of scores obtained on all the three seriation tasks by Group A and Group B children.

Table 12 shows the mean values for Group A and Group B and their 't' values.

't' test revealed that though a difference in performance between Group A and Group B is noted it is NOT SIGNIFICANT.

Thus, no significant qualitative or quantitative difference was seen between the two groups of hard of hearing children on seriation tasks.

TABLE 11: COMPARISON OF GROUP 'A' & GROUP 'B' CHILDREN ON SERIATION TASKS

SUBJECT	AGE/SEX	SERIATION TASKS			TOTAL SCORE OBTAINED	SUBJECT	AGE/SEX	SERIATION TASKS			TOTAL SCORE OBTAINED
		LENGTH	AREA	VOLUME				LENGTH	AREA	VOLUME	
S_1	4 yrs.7 mos F	1.5	3	2	6.5	S_{16}	4 yrs.11 mos F	6	3	2	11
S_2	5yrs. F	5.5	4	2	11.5	S_{17}	5 yrs. 8 mos M	6	3	2	11
S_3	5yrs. F	6.0	2	2	10.0	S_{18}	6 yrs. M	6	3	2	11
S_4	5yrs.1 mos F	6.0	4	2	12.0	S_{19}	6 yrs. 2 mos M	6	3	2	11
S_5	5yrs.1 mos M	6.0	2	2	10.0	S_{20}	6 yrs. 4 mos M	5	3	2	10
S_6	5yrs.2mos M	6.0	4	2	12.0	S_{21}	6 yrs. 6 mos M	6	3	2	11
S_7	5yrs.9mos F	6.0	4	2	12.0	S_{22}	6 yrs. 9 mos F	6	4	2	12
S_8	6 yrs.3mos F	6.0	4	4	14.0	S_{23}	6 yrs.11 mos M	6	3	2	11
S_9	6 yrs.6mos F	6.0	4	4	14.0	S_{24}	7 yrs. 8 mos M	5	2	2	9
S_{10}	7 yrs.3mos F	6.0	2	2	10.0	S_{25}	7 yrs. 8 mos M	6	3	2	11
S_{11}	7 yrs.10 mos F	6.0	4	2	12.0	S_{26}	7 yrs. 9 mos W	6	3	2	11

TOTAL: 124.0

MEAN : 11.27

TOTAL: 119

MEAN : 10.81

TA8LE 12: MEAN VALUES FOR GROUP 'A' & 'B' ON SERIATION TASKS & THEIR 't' VALUES

TASK	GROUP 'A' (ORAL GROUP) N = 11 AGE RANGE: 4 yrs.7 mos to 7 yrs. 10 mos	GROUP '8' (TOTAL COMMUNICATION GROUP) N = 11 AGE RANGE: 4 yrs. 11 mos to 7 yrs. 9 mos.	't' VALUES
SERIATION	11.27	10.81	0.65

4.1.4 MATRIX CONSTRUCTION

As stated earlier, items of matrix construction were administered only to those children who could comprehend the instructions and had performed successfully on the subitems of the preceeding three seriation tasks.

The subitems of matrix construction were administered only to six out of fifteen children in Group A & A_1. Out of the six, three belonged to Group A.,; the remaining three belonged to Group A in the age range 5 years 9 months to 6 years 6 months (S_7, S_8 & S_9).

Table 13 shows the scores obtained by Group A & A_1 on Matrix test items. Only two children S_{12}: 8 years 1 month & S_{15}: 8 years 8 months) in Group A_1, scored a maximum of 6/6 on this task. All the other children received partial scores based on their constructions (as indicated in the test format; see appendix A).

The performance of Group B children on Matrix construction tasks could not be evaluated in this study, as it was felt that the children were not following the instructions.

TABLE 13: PERFORMANCE OF SIX SUBJECTS IN GROUP A and A_1 ON TASKS OF MATRIX CONSTRUCTION:

SUBJECT	AGE	MATRIX CONSTRUCTION (SCORES)		
		T_1 Max:2	T_2 Max:2	T_3 flax: 2
S_7	5 yrs. 9 mos	1	-	-
S_8	6 yrs. 3 mos	2	1	1
S_9	6 yrs.6 mos	1	2	1
S_{12}	8 yrs. 1 mos	2	2	2
S_{14}	8 yrs. 5mos	2	2	1
S_{15}	8 yrs. 8mos	2	2	2

4.2 CLASSIFICATION TASKS:

There were three test items included under the category of clasaification, namely,

4.2.1 Classification of pictures.

4.2.2 Classification of shapes.

4.2.3 Identification of odd things in a group.

These test items were administered to all the twenty six children in the current study.

Comparison of the overall performance of the Hard of Hearing with Piaget's findings on normal children:

Classification is another mental operation which was studied extensively by Piaget. Studying the classification of non-geometric figures, Piaget found that 2-5 year old pre-operational children may perceive similarities among the objects; however these do not determine fully what objects go into the collection. Similarly a 5-7 year old oreoperational child's answers to class inclusion are often wrong because the child is unable to decentre.

When it comes to classification of shapes the 2-5 year old Stage I children group them by several methods while a

5-7 year old not only fours true classes but also arranges them hierarchically. While a 7-11 year old child has a matrix notion of class can sort them by defining properties and understands the relations between class and subclass and so forth.

In the current study it was noted that all the younger hard of hearing failed to classify pictures on their own; many of them could perceive the similarities among pictures but could not determine which picture would go into which collection. On the contrary, the older children (Group A_1) could not only classify the pictures but could also name each category. These are similar to the findings of Piaget. On the remaining two tasks of classification differences between the two groups of hard of hearing became evident. These have been discussed in detail under each task in the following sections. The oral group (Group A & A_1) children were found to perform in a manner which is not very different from that described by Piaget.

RESULTS Of PIAGET'S STUDY ON CLASSIFICATION

STAGE	AGE	PERFORMANCE
STAGE.I	2 - 5 years (PREOPERA-TIONAL)	CLASSIFICATION OF SHAPES: - The children in this stage displayed several methods of grouping the objects: viz., - "Small partial alignments")which are - "Complex objects") not true)classes CLASSIFICATION OF NON-GEOMETRIC FIGURES: - Although the young child may perceive similarities among the objects these do not fully determine what objects go into the collection.
STAGE.II	5 - 7 years (PREOPERA-TIONAL)	CLASSIFICATION OF SHAPES: - The child in this stage not only forms true classes but also arranges them hierar-chically. - Piaget feels that the child now fails to comprehend one coucial aspect of hiararchy which he has constructed; he does not under-stand key relations among different levels of hierarchy. This was the problem of class inclusion. CLASS INCLUSION: — Here the child has to compare the "size" of one against that of the other. The child in this stage centres on the part, ignoring the whole & hence his answers to inclusion are often wrong.
STAGE.III	7-11 years (CONCRETE OPERA-TIONAL)	The child now has a mature notion of class, particularly when real objects are involved. The child sorts them by defining properties, understands the relations between class and subclass and so forth.

4.2.1 CLASSIFICATION OF PICTURES

In this task sixteen cohered pictures (of animals, birds, fruits and vehicles) were presented in a jumbled fashion to the child; the child was required to classify these pictures and based on the kind of classes the child forced scores were given (see appendix A for details). Maximum possible score on this task was eight.

Performance of Group 'A' children on Classification of Pictures:

Out of eleven children in Group A only six children (S_5, S_6, S_8, S_9, S_{10}, & S_{11}) in the age range 5 years 1 month to 7 years 10 months scorad 6/8 points on this task, having forced only three classes of pictures. Subjects S_1, S_2, S_3, S_4 & S_5 scored only 4/8 points as they could form only two classes of pictures on their own.

Table 14A shows the scores obtained by Group A children on the task of classification of pictures.

The following were some observations trade with respect to classification of pictures:

(1) The younger children in this group in the age range 4 years 7 months to 5 years 1 month (S_1, S_2, S_3 & S_4) could not

classify the pictures on their own following instructions. Only when shown that two or more items (like say, Grapes & Scooter) would not be placed in the same class or two or more items (like say, banana and orange) belonged to the tame class, could they classify the retraining pictures. Even after such elaborate instructions the examiner many a times had to pick up,the first card and ask the child to give the rest which would be categorized with the first one.

This observation as stated earlier, correlates with Piaget's findings that young children though may perceive similarities among objects, these do not fully determine what objects go into the collection.

(2) All the eleven children in Group A grouped animal and bird pictures together, ie, they formed three classes in total instead of four.

TABLE 14A: SCORES OBTAINED BY GROUP 'A' CHILDREN ON TASKS OF PICTURE CLASSIFICATION

SUBJECT	AGE/SEX	SCORE OBTAINED ON CLASSIFICATION OF PICTURES (Max:8)
S_1	4 yrs. 7 mos F	4
S_2	5 yrs. F	4
S_3	5 yrs. F	4
S_4	5 yrs. 1 mos M	4
S_5	5 yrs. 1 mos	6
S_6	5 yrs. 2 mos F	6
S_7	5 yrs. 9 mos F	4
S_8	6 yrs. 3 mos F	6
S_9	6 yrs. 6 mos F	6
S_{10}	7 yrs. 3 mos F	6
S_{11}	7 yrs.10 mos F	6

TABLE 14A_1: SCORES OBTAINED BY GROUP 'A ' CHILDREN ON TASKS OF PICTURE CLASSIFICATION

SUBJECT	AGE/SEX	SCORE OBTAINED ON CLASSIFICATION OF PICTURES (Max:8)
S_{12}	8yrs. 1 mos M	8
S_{13}	8 yrs.2 mos F	8
S_{14}	8 yrs.5 mos F	8
S_{15}	8 yrs. 8 mos M	8

Performance of Group A_1 children on tasks of classification cf pictures

All the four children in Group A_1. scored a maximum of 8/8 on this task. Their performance was thus better when compared to the younger ones. They could classify all the pictures into four district classes and would even name each category as 'animals', 'fruits', 'transport', etc.

Table 14 A_1 shows the scores obtained by Group A, children on this task.

Performance of Group B children on tasks of Classification of Pictures

Only one child S_{21} (6 years 6 months, M) scored a maximum of 8/8 points on this task classifying the pictures into four groups. S_{18} (6 years, F) and S_{19} (6 years, 2 months,M) scored 6/8 on this task as they could form only three classes of pictures; they grouped the animals and birds in one class. Two of the subjects S_{16} (4 years 11 months, F) and S_{17} (5 yrs. 8 months, M) in this group scored 4/8 points while four of the other older subjects in this group S_{22} (6 years 9 months, M), S_{23} (6 years 11 months, M), S_{25} (7 years 8 months, M) and S_{26} (7 years 9 months, M) also scored only 4/8 points.

Tabla 14B shows the scores obtained by Group B children on tasks of classification of pictures.

TABLE 14B: <u>SCORES OBTAINED BY GROUP 'B' CHILDREN ON CLASSIFICATION OF PICTURES</u>

SUBJECT	AGE/SEX	SCORE OBTAINED ON CLASSIFICATION OF PICTURES
S_{16}	4 yrs.11 mos F	4
S_{17}	5 yrs.8mos M	4
S_{18}	6 yrs. F	6
S_{19}	6 yrs. 2mos M	6
S_{20}	6 yrs. 4mos M	-
S_{21}	6 yrs. 6mos M	8
S_{24}	6yrs. 9 mos F	4
S_{23}	6 yrs.11 mos M	4
S_{24}	7 yrs. 8 mos M	-
S_{25}	7 yrs. 8 mos M	4
S_{26}	7 yrs. 9mos M	4

There were two children in Group B, S_{20} (6 years 4 months, M) and S_{24} (7 years 8 months, M) who failed to obtain any score on this task. They grouped all pictures together deSpite assistance.

Comparison of Group 'A' and Group 'B' on the Task of Classification of Pictures

A glance at the scoras obtained by children in Grouo A and Group B reveals that the overall performance of Grouo A children is batter than that of Group 8, though none of the children have been able to score a maximum of 8/8 on this task. There appears to be an improvement in the scores on this task in Group A with increase in age (with the exception of child S_7 (5 years 9 months) who scored only 4/8 points on this task.

Individual differences in performance is greater in Group B than in Group A. It was found that the performance of the three six year old subjects (S_{19}, S_{20} & S_{21}) was better than that of the younger as well as the older ones in the group.

Subjects S_{16}, S_{18}, S_{19}, S_{22} S_{23}, S_{24}, & S_{25} were enrolled in a special school for the hearing impaired and they received the services of a speech therapist in the school regularly. Tha report from their school teacher revealed that they include activities similar to these classificatory tasks in their school curriculum. In such a context, we would expect these children to perform better than the children in Group A.

However, we can see that there not much of a difference in fact the 7 year olds in Group B have done poorer than the 7 year olds in Group A.

The poorer performance of S_{17} and S_{18} in Group 'B' compared to the other children in Group B can be attributed to the following factors:

(1) factors related to schooling - the curriculum in the school from which these two children were sampled was different.

(2) Both the children belonged to a lower middle class family back ground; which rules out proper home training to a great extent as well as adequate linguistic exposure.

Table 15 shous the scores obtained by Group A and Group B children on task of Classification of Pictures.

TABLE 15: COMPARISON OF GROUP 'A' AND GROUP 'B' ON CLASSIFICATION OF PICTURES

GROUP 'A' (ORAL GROUP)			GROUP 'B' (TOTAL COMMUNICATION GROUP)		
SUBJECT	AGE/SEX	SCORE	SUBJECT	AGE/SEX	SCORE
S_1	4yrs. 7 mos F	4	S_{16}	4 yrs. 11 mos F	4
S_2	5yrs. F	4	S_{17}	5yrs. 8 mos M	4
S_3	5yrs. F	4	S_{18}	6 yrs. F	6
S_4	5yrs. 1 mos M	4	S_{19}	6 yrs. 2 mos H	6
S_5	5yrs. 1 mos M	6	S_{20}	6yrs. 4 mos H	-
S_6	5yrs. 2 mos F	6	S_{21}	6yrs. 6 mos M	8
S_7	5yrs. 9 mos F	4	S_{22}	6 yrs. 9 mos F	4
S_8	6yrs. 3mos F	6	S_{23}	6 yrs. 11 mos M	4
S_9	6yrs. 6 mos F	6	S_{24}	7 yrs. 8 mos M	-
S_{10}	7yrs. 3 nos F	6	S_{25}	7 yrs. 8 mos M	4
S_{11}	7 yrs.10 mos F	6	S_{26}	7 yrs. 9 mos M	4

4.2.2 CLASSIFICATION OF SHAPES

This task required the child to arrange/classify a set of card board cut outs (of four different colors and -four different sizes but of same shape) based on a double criterion of color and size (see appendix A for details). While partial scoring was also possible, the maximum score was 8.

Performance of Group 'A' children on Classification of Shapes;

Out of eleven children in Group 'A' only one child (S_8: 5 years 9 months, F) scored a maximum cf 8/8 points on this task.

Among the remaining ten, one children (S_9: 6 years 6 months, F) scored 7/8 on this task for she could complete the task only after the examiner laid the first row.

Six of the other children (S_3, S_4, S_5, S_7, S_{10} & S_{11} scored 4/8 as they could classify the shapes based on only a single criterion (color or size) and the remaining three (S_1, S_2 & S_6) scored nil as they could not classify the shapes as per instructions and laid them randomly.

Table 16A shows the scores obtained by Group A children on classification of shapes.

TABLE 16A: SCORES OBTAINED BY GROUP 'A' CHILDREN ON CLASSIFICATION OF SHAPES

SUBJECT	AGE/SEX		SCORE Max:8
S_1	4 yrs. 7 mos	F	-
S_2	5yrs.	F	-
S_3	5 yrs.	F	4
S_4	5 yrs. 1 mos	F	4
S_5	5 yrs. 1 mos	M	4
S_6	5 yrs. 2mos	M	-
S_7	5 yrs. 9mos	F	4
S_8	6 yrs. 3mos	F	8
S_9	6 yrs. 6mos	F	7
S_{10}	7 yrs. 3mos	F	4
S_{11}	7 yrs. 10 mos	F	4

TABLE 16A_1: SCORES OBTAINED BY GROUP A_1 CHILDREN

SUBJECT	AGE/SEX		SCORE Max:8
S_{12}	8 yrs. 1 mos	M	8
S_{13}	8 yrs. 2mos	F	4
S_{14}	8 yrs. 5 mos	F	8
S_{15}	8 yrs. 8 mos	M	7

Performanca of Group A_1 children on Classification of Shapes

Two children in Group A_1 (S_{12}: 8 years 1 mon, M and S14: 8 years, 5 mons, F) scored 8/8 points on this task having classified the shapes on the basis of the double criterion without any assistance.

S_{15} (8 years 8 months, M) scored 7/8 points. Initially he classified the shapes based on color; however when told that there was yet another way of classifying them, he could reclassify them but only with assistance.

S_{13} (8 years 2 months, F) repeatedly classified the shapes based on color alone and hence scored only 4/8 points.

Table 16A_1, shows the scores obtained by Group A_1, children.

Performance of Group 'B' children on classification of Shapes

Only five subjects in Group B (S_{21}, S_{18}, S_{19}, S_{20}, S_{22} & S_{25}) werw able to perform adequately on this task. The remaining five failed to obtain any score.

Some important observations made in this context were:

(1) The teachers (whose assistance was sought for instructing

the children) reported of difficulty in conveying the instructions across by signs alone or signs and oral mode.

{2) Even those children who performed with much assistance, could classify the shapes based on only one single criterion of color or size.

(3) Those children who failed to score on this task were those who arranged the shapes randomly without any underlying rule.

Table 16B shows the scores obtained by Group 'B' children on classification of shapes.

TABLE 16B: SCORES OBTAINED BY GROUP 'B' CHILDREN ON CLASSIFICATION OF SHAPES

SUBJECT	AGE/SEX	SCORES
S_{16}	4 yrs. 11 mos F	—
S_{17}	5yrs. 8 mos M	-
S_{18}	6 yrs. F	4
S_{19}	6 yrs. 2 mos N	4
S_{20}	6 yrs. 4 mos M	4
S_{21}	6 yrs. 6mos M	4
S_{22}	6 yrs. 9mos F	4
S_{23}	6 yrs. 11 wos M	4
S_{24}	7 yrs. 8 mos M	—
S_{25}	7 yrs. 8 mos M	4
S_{26}	7 yrs. 9 mos M	—

Comparison of Group 'A' and Group 'B' children on Classification of Shapes

Overall performance of Group A children on this task appears to be better than that of Group B. The younger children in both the groups failed to perform on this task. Also, the children in Group B required more instructions and the teacher whose assistance was sought in administering the instructions reported of difficulty in conveying the instructions either by signs or by signs + oral mode. It is possible that the poorer performance in group B may be due to failure to get the instructions or other reasons stated earlier.

In Table 17, a comparison of scores obtained by Grouo A and Group B children is shown.

TABLE 17: COMPARISON OF GROUP 'A' AND GROUP 'B' ON CLASSIFICATION OF SHAPES

GROUP 'A' (ORAL GROUP) GROUP 'B' (TC GROUP)

SUBJECT	AGE/SEX	SCORE Max:8	SUBJECT	AGE/SEX	SCORE Max: 8
S_1	4 yrs. 7 mos F	-	S_{16}	4 yrs.11 mos F	-
S_2	5yrs. F	-	S_{17}	5 yrs.8 mos M	-
S_3	5 yrs. F	4	S_{18}	6 yrs. F	4
S_4	5 yrs. 1mos F	4	S_{19}	6 yrs. 2 mos M	4
S_5	5 yrs. 1mos M	4	S_{20}	6 yrs. 4 mos M	4
S_6	5 yrs. 2mos M	-	S_{21}	6 yrs. 6 mos P	4
S_7	5 yrs. 9mos F	4	S_{22}	6 yrs. 9 mos F	4
S_8	6 yrs. 3mos F	8	S_{23}	6 yrs. 11 mos M	4
S_9	6 yrs. 6mos F	7	S_{24}	7 yrs. 8 mos M	—
S_{10}	7 yrs. 3mos F	4	S_{25}	7 yrs. 8 mos M	—
S_{11}	7 yrs. 10mos F	4	S_{26}	7 yrs. 9 mos M	—

4.2.3 IDENTIFICATION OF ODD THING IN A GROUP

In this category, three sets of picture cards were presented one after the other and the child had to identify the odd one out and reason why it was the odd one in each set (see appendix A for details). Maximum score possible Mas 6 (2 for each oresentation); partial scoring was done based on the response and kind of reasoning given.

Performance of Group 'A' children on identification of odd thing in a group:

Out of eleven children in Group A only one child S_8 (6 years 3 mons, F) scored a maximum of 6/6 points on this task. following is an account of history relevant to child S_8 and also her responses.

This child 6 years 3 months of age was enrolled in a special school for the hearing impaired (Hindi medium) in 1984 when she was 2 years of age. She was then enrolled in a Montessori School for normal children in January 1986 when she was 3% years of age and remained in this school for nearly a year. In 1987 April, she was shifted to another normal school (Holy Child Auxilium School, New Delhi) to the Kindergarden class. She is currently a student of Class I in the same school. She has been attending speech therapy sessions periodically at the

All India Institute of Medical Sciences, Delhi since 19B3. It is also north noting that this child's mother is a graduate and a teacher in the same school and has been one of the important variables in this child's environment, influencing greatly her speech and language development.

S_8 has been one of the five children in the entire sample of 26 children who have scored an overall of 20 and above on classification tasks.

Let us now look at her responses for the 3 subtests in the 'odd thing out' set;

PICTURES PRESENTED	RESPONSE
(a) Eye, hand, Nose & Mango (any fruit)	points to the picture of mango & says it is different because it is a fruit; puts the retraining three pictures together and says "body parts - Eye, Hand, Nose".
(b) Lion, Tiger, Elephant & Fish	Picks the picture of the fish as the odd one out,when asked to reason she said "fish has 2 fins" "lives water". "Lion, tiger, elephant live in forest".
(c) Axe, knife, Handsaw & Pencil	Points to the picture of the pencil. "Write with pencil"; points to the other pictures and says "cannot write".

We can see that this child has not only been able to identify the odd one out but has also been able to verbally reason why it was different. Though her verbal output was restricted to 2-4 word utterances or had omissions of articles like 'the' etc, or needed extensions, we can perhaps conclude that cognitively this child tray match a normal hearing child of the same age but profound hearing loss presents restrictions on her linguistic abilities, and because of her expressive deficits may not be able to express all that she perhaps wants to. We can however attribute this child's performance to various factors like exposure to normal schooling, early institution of training, speech therapy, binaural fitting of hearing aid, and most importantly,maternal involvement and home training; apart from those factors pertaining to the child herself like - motivation etc.

Subjects S_4 (5 years 1 month, F), S_9 (6 years 6 months F) and S_{11} (7 years, 10 months, F) scored 4/6 points on this task. Their responses to this task were as given below.

IDENTIFICATION OF THE ODD THING IN A GROUP

SUBJECT	RESPONSE	REASONING
S_4 5yrs.1 mos F	a) POINTS TO THE PICTURE OF THE FRUIT 'BANANA'	She placed the refraining three pictures together, but could not express why the 'banana' was the odd one out.
	b) PICKS OUT THE PICTURE OF THE 'FISH'	Nods her head when asked "क्या यह अलग है?" (are they " when asked "why?" says "खाते है" different?" meaning-(eat it)
	e) 'Pencil'	Unable to reason further; mother reported that she had not seen an 'axe or hand saw' earlier; possible that she might have picked the familiar one
S_9 6 yrs.6 mos F	a) 'Mango'	when asked why? says 'eat it' (and signs खाते है to her mother)
	b) 'fish'	she pointed to the picture of the fish & said 'water' and to the others & said 'जंगल'(meaning forest)
	c) - NR	labelled the 'blade' & 'pencil'. Mother stated that she was not familiar with the other pictures
S_{11} 7 yrs.11 mos F	a) POINTS TO THE PICTURE OF FRUIT	could not reason why: placed the remaining pictures together
	b) 'fish'	unable to reason further
	c) 'pencil'	points to pencil & gestures that she writes with it; however did not group the reaaining pictures as previously.

S_{10} (7 years 3 months, F) scored 3/6 on this task obtaining partial scores on 2 of the subitems and no score on the third subitem.

S_5 (5 years 1 month, M) and S_7 (5 years 9 months, F) scored 1/6 on this task. Their responses were as follows:

<u>IDENTIFICATION OF THE ODD THING IN A GROUP</u>

SUBJECT	RESPONSE	REASONING
S5 5yrs. 1 mos M	'Banana' NR NR	said 'केला' (kela - banana) howe gave no further explanations. happended to pick out the right card and neither labelled nor reasoned further. did not point to any picture in particular in response to the Question.
S_7 5yrs.9 mos F	'Banana' NR	'केला' (kela - banana) - no further reasoning. She did not say anything about the body parts. just labelled all the pictures -

Remaining four children (S_1, S_2, S_3 & S_6) scored no points on these tasks, having failed to perform adequately on these tasks.

TABLE 18A: shows the scores obtained by Group A children on Identification of the Odd one out.

TABLE 18A: SCORES OBTAINED BY GROUP 'A'CHILDREN ON IDENTIFICATION OF ODD ONE OUT

SUBJECT	AGE/SEX	IDENTIFICATION OF THE ODD ONE			TOTAL SCORE
		a (2)	b(2)	c (2)	
S_1	4yrs. 7 mos F	-	-	-	-
S_2	5yrs. F	-	-	-	-
S_3	5yrs. F	-	-	-	-
S_4	5 yrs. 1 mos F	1	2	1	4
S_5	5yrs. 1 mos M	1	-	-	1
S_6	5yrs. 2 mos M	—	—	—	-
S_7	5 yrs. 9 mos F	1	—	—	1
S_8	6 yrs. 3 mos F	2	2	2	6
S_9	6 yrs. 6 mos F	2	2	—	4
S_{10}	7 yrs. 3 mos F	2	1	—	3
S_{11}	7 yrs.10 mos F	1	1	2	4

Performance of Group A_1 children on identification of Odd thing in a group

The performance of all the four children in Grouo A_1, were qualitatively batter than that of Group A children. S 12 (8 yrs. 1 mos, M) and S_{14} (8 yrs. 5 mos, F)scored a maximum of 6/6 while S_{13} (8 yrs. 2 mos, F) and S_{15} (8 yrs. 8 mos, M) scored 5/6.

Table $18A_1$ shows the scores obtained by Group A. children on this task:

TABLE 18 A_1: SCORES OBTAINED BY GROUP A_1 CHILDREN ON IDENTIFICATION OF ODD THING IN A GROUP

SUBJECT	AGE/SEX	IDENTIFICATION OF ODD ONE			TOTAL SCORE
		(a)	(b)	(c)	
S_{12}	8 yrs.1 mos M	2	2	2	6
S_{13}	8 yrs.2 mos F	2	2	1	5
S_{14}	8 yrs.5 mos F	2	2	2	6
S_{15}	8 yr8.8 mos M	2	2	1	5

All these children were attending normal schools and two were receiving speech therapy services regularly. Apparently the language abilities of these children were superior when compared to many of the other children in this study and this is reflected in their responses when they were asked to explain and reason uhy the particular picture they had picked out was the odd one out.

For instance, when S_{12} (8 yrs. 1 mos, M) was asked why the picture of the banana was the odd one and why it could not be classified the other way, he said:

"This is wrong.....cannot keep it (in hindi) [यह गलत है... नहीं रख सकते]

Points to the picture of the banana and says, "

यह shop में होती है " and " यह यहाँ पर "

(This you find in Shop) (This here).

(pointing to the face to indicate the body parts).

Performance of Group 'B' on Identification of the Odd Thing:

The children in Group 'B' appeared to have maximum difficulty in this task. The main difficulties faced by the examiner were in terms of getting the instructions across to the child, checking whether the child had really comprehended the instructions. Invariably all the children either attempted signing the label for the picture or imitated the instructor.

Comparison of Group 'A' and Group 'B' on Identification of Odd Things in a Group

This was the task of all the three classification tasks, on which the differences between the two groups of hard of hearing became significant. Group A children where found to have a qualitatively better output modality for indicating their responses. The responses of Group B children as stated earlier were such, that it could not be concluded where it was due the communicative restraints or because of not having understood the instructions for the task.

COMPARISON OF OVERALL PERFORMANCE OF GROUP 'A' AND GROUP 'B' ON CLASSIFICATION TASKS:

Table 19B shows the scores obtained by Group A & B children on each of ths classification tasks and their total scores.

A qualitatively superior response was obvious with Group 'A' children especially the older ones when compared to those of Group 'B'.

A quantitative analysis using the 't' test revealed that there was a significant difference between the two groups ('t' value 2.16 significant at 0.05 level) the children of Group 'A' performing better than Group 'B' children (see Table 19 A).

TABLE: 19 A

TASK	GROUP 'A' (ORAL GROUP) N = 11 AGE RANGE: 4 yrs.7 mos to 7 yrs. 10 mos	GROUP 'B' (TOTAL COMMUNICATION) N = 11 AGE RANGE: 4 yrs. 11 mos to 7 yrs. 9 mos	't' Value
CLASSIFICATION	10.72	6.72	2.16

TABLE 19 B: COMPARISON OF GROUP 'A' AND GROUP 'B' ON CLASSIFICATION TASKS

GROUP 'A' (ORAL GROUP) / GROUP 'B' (TOTAL CLASSIFICATION)

GROUP 'A' (ORAL GROUP)						GROUP 'B' (TOTAL CLASSIFICATION)					
SUBJECT	AGE/SEX	CLASSIFICATION TASKS			TOTAL SCORE OBTAINED	SUBJECT	AGE/SEX	CLASSIFICATION TASKS			TOTAL SCORE OBTAINED
		PICTURES	SHAPES	ODD ONE				PICTURES	SHAPES	ODD ONE	
S_1	4 yrs.7 mos F	4		-	4	S_{16}	4 yrs.11 mos F	4	-	-	4
S_2	5yrs. F	4	-	—	4	S_{17}	5 yrs. 8 mos M	4	-	-	4
S_3	5yrs. F	4	4	-	8	S_{18}	6 yrs. M	6	4	-	10
S_4	5yrs.1 mos F	4	4	4	12	S_{19}	6 yrs.2 mos M	6	4	-	10
S_5	5yrs.1 mos M	6	4	1	11	S_{20}	6 yrs. 4 mos M	-4		2	6
S_6	5yrs.2 mos F	6	-	-	6	S_{21}	6 yrs. 6 mos M	8	4	-	12
S_7	5 yrs.9 mos F	4	4	1	9	S_{22}	6 yrs. 9 mos F	4	4	-	8
S_8	6 yrs.6 mos F	6	8	6	20	S_{23}	6 yrs. 11 mos M	4	4	-	8
S_9	6 yrs.6mos F	6	7	4	17	S_{24}	7 yrs.8 mos M	-	-	-	0
S_{10}	7 yrs.3mos F	6	4	3	13	S_{25}	7 yrs.8 mos M	4	4	-	8
S_{11}	7 yrs.10 mos. F	6	4	4	14	S_{26}	7 yrs.9 mos N	4	-	-	4

4.3 CONSERVATION

As stated earlier, conservation is the conceptualization or the schematization that the amount/quantity of matter stays the same regardness of any changes in irrelevant dimension.

Ability to conserve reflects the type of intellectual/cognitive structures developed in a child. By the end of 7 years, some conservation structures are generally seen to develop in a child; however the development from non-conservation to conservation proceeds gradually.

In the current study, five tests of conservation with two subtests each were chosen from the MCCT for administration. They were:

(1) Judgement of Invariance of Number (T_1, T_2)
(2) Judgement of Equivalence of two areas
(3) Judgement of Invariance of mass
(4) Judgement of Invariance of length
(5) Judgement of Invariance of liquid volume.

Performance of Group 'A' children on Conservation Tasks:

The most striking observation trade was that none of the children in Group 'A' had conserved. There were no transitional conservers, all 11 were NON-CONSERVERS.

TABLE 20: APPEARANCE OF CONSERVATION STRUCTURES - PIAGET (1967)

AGE	CONSERVATION OF
5-6 years	child NUMBER:
4-5 yrs.	- fails on 1-1 correspondence tasks. - more systematic. - uses one to one correspondence but does not conserve number - makes perceptual bound responses instead
5-6 yrs.	of cognitive responses following the transformation. - learns to conserve number - decenters his perceptions, attends to transformations, reverses operations
6-7 yrs. 7 - 8 years	SUBSTANCE (mass)
7 - 8 years	AREA LIQUID
9 - 10 yrs.	WEIGHTT
11 - 12 yrs.	VOLUME

The observations made with regard to each child of Group A and Group A_1 are presented in the following tables.

PERFORMANCE OF 4-5 yr. olds ON CONSERVATION TASKS (GROUP A)

SUBJECT	AGE/SEX		OBSERVATION
S_1	4 yrs.7 mos	F	- very inconsistent pointing responses. - imitates the examiner's action on T_1 & T_2. - child's mother was not sure whether the child could comprehend terms like "बराबर/छोटा/बड़ा (equal/small/big) or phrases "किसमें ज्यादा या बहुत दूर चलना होगा?" (in which would you have to walk an equal distance or a greater distance) - has not been exposed to such terms either at home or during therapy
S_2	5 yrs.	F	- imitation of examiner's acts. - no verbal response to conservation Ques. - occasional verbal output - छोटा/बड़ा (cho:ta/bada (small/big) - unable to comprehend instruction?
S_3	5 yrs.	F	- has no verbal output. - comprehension reportedly good (as per mother) - Mother reports that she has notbeen exposed to such activities earlier; she could not provide further information about the child's comprehension & expressive abilities - the child looks very attentively when being given the instructions; imitates every action

PERFORMANCE OF 5-6 yr.olds ON CONSERVATION TASKS: (GROUP A)

SUBJECT	AGE/SEX	OBSERVATION
S_4 & S_7	5 yrs.1 mos F 5 yrs.9 mos F	1. NUMBER T_1: typical non-conservation response pointed to shorter row & said "छोटा" (cʰo:ta = sm and to longer one "बड़ा" (bada = big) Following her verbal responses, she lengthened the shorter row & placed her hands on either sides as if to indicate that they were the same or looked alike. T_2: Similar response. 2. AREA The child could not appreciate the equivalence of two areas. In response to the conservation Question she could place the torn bit of paper back in place. 3. MASS Typical non-conservation response. would gesture to indicate 'छोटा' (cʰo:ta) small & 'बड़ा' (bada) big 4. LENGTH In response to the conservation Question on both T_1 & T_2 would only say 'छोटा / बड़ा' (cho:ta bada) pointing to the shorter & longer wires. 5. LIQUID VOLUME NOT ADMINISTERED
S_6	5 yrs.1 mos M	- appeared attentive - no verbal output - nonverbal imitation of examiner's action in response to the conservation questions.

SUBJECT	AGE/SEX	OBSERVATION
S_6	5 yrs.2 mos M	1. NUMBER T_1: moves his hand over the longer line and signs 'बड़ा (bada = big)', unable to relate further. T_2: lengthens the straight line of card board chips as in T_1 and signs 'बड़ा'. 2. AREA - agreed on equivalence of two areas. - T_1: could not verbally reason whether there was equal space to write on both sheets of paper; but he placed one paper over the other & moved his fingers along the margins. - T_2: nods to head (±I don't know' as per his mother) in response to the conservation Question. 3. MASS - kept saying 'छोटा / बड़ा (cho:ta / bada)' pointing to the balls of clay. - appeared that he had not comprehended the instructions. 4. LENGTH - pointed to the shorter wire & said (छोटा c^ho:ta = & to the longer wire - 'बड़ा' ("bada = big) T_1: pointed to the bent wire & said 'पहाड़ (= mountain)'. T_2: could not answer the question; but he straightened the wire & said "बड़ा (big)".

PERFORMANCE OF 6-7 yr. OLDS ON CONSERVATION TASKS (GROUP A)

SUBJECT	AGE/SEX	OBSERVATION
S_8	6 yrs.3 mos F	1. NUMBER - Typical non-conservation response. " long ... has more"
S_9	6 yrs.6 mos F	2. AREA T_1: places the cut out piece and says "both same" T_2: inconsistent.. appeared confused. 3. MASS T_1 & T_2: non-conservation response. 4. LENGTH T_1 & T_2: S_8 said 'it is crooked...long" (for the bent wire) but could not relate further. S_9 kept changing her responses & said 'छोटा / बड़ा '. (small / big) 5. LIQUID VOLUME NOT ADMINISTERED

PERFORMANCE OF 7-8 yr. OLDS ON CONSERVATION TASKS (GROUP A & A_1)

S_{10}	7 yrs.3 mos F	- response typical of a non-conserver
S_{11}	7 yrs.10 mos M	
S_{12}	8 yrs.1 mos M	
S_{13}	8 yrs.2 mos F	
S_{14}	8 yrs.5 mos F	
S_{15}	8 yrs.8 mos M	

Performance of Group 'B' children on Conservation Tasks:

There were certain very basic difficulties in assessing this grouo on conservation tasks.

(1) Firstly, the use of signs in conveying the instructions. There are no specific signs for words like /bara : bar/ (बराबर meaning 'equal' in Hindi) or /ek jaise (एक hei जैसे हैं meaning 'are alike' in Hindi). The teachers also reoorted that these children might not have acquired most of the signs as they had just been enrolled in school or they use signs of their own.

(2) Secondly, there was no way to check whether the concept of equivalence had been understood by the children, for, in response to the conservation questions they would either gesture /cho:ta or bada) (छोटा / बड़ा meaning 'big/small' in Hindi) or appear to be indecisive.

(3) Thirdly, many of them could not comprehend when asked /kju/ (क्यों ? meaning 'why')

In such circumstances it is not appropriate to draw conclusions about the performance of these children on conservation tasks. This problem Mill be discussed in a greater length in later sections.

4.4 CONCLUSION

The results discussed above have shown that the performance of hard of hearing children on some aspects match that of the normal children while in some aspects they don't (eg: on some of the classification tasks and on conservation tasks). These latter aspects perhaps require wore verbal interaction or nonverbal interaction of the kind that will expose the child to these mental operations.

Support to earlier findings that language influences and facilitates cognitive development may be seen in the performances of the two groups of hard of hearing children (Group A & B) on classification tasks like Identifying the odd one out and give appropriate reasons for the same.

Irrespective of the mode of communication - oral vs sign (or total communication) it was noted that the hard of hearing children performed poorly on certain tasks. This implies that both the modes of communication are not completely adequate and there is a need to improve and develop the same for the hard of heating.

CHAPTER V

5. SUMMARY

A group of twentysix hard of hearing children in the age range 4 yrs. 7 months to 8 yrs. 6 months were studied for their performance on the "Mysore Cognitive Capabilities Test (T.Padmini, 1979). Eleven children were included in Group A (oral group), four older children in Group A_1 (oral group) and eleven children in Group B (total communication group). History relevant to each child was collected from the parents or family members or the records. The results of the study were compared with the classical findings of Jean Piaget on normal hearing children. A comparison both qualitative and quantitative between Group A and Group B on the three mental operational tasks of seriation, classification and conservation from the Mysore Cognitive Capabilities test was done.

The results have indicated that the performance of the hard of hearing children is similar to that of the normal children on certain tasks (especially nonverbal tasks like that of the seriation tasks) while they don't match the normal children on certain other tasks (like some of classification tasks and the conservation tasks). Such observations imply the lack of adequate verbal and/or nonverbal instructions of the kind that will expose the child to these mental operations.

Qualitative and quantitative comparison of Group A and Group B on the different mental operations revealed the following:

(1) The overall performance of Group A children was better than that of Group B children.

(2) 't' test for a small sample revealed a significant difference between the two groups on classification tasks but not on seriation tasks.

(3) All the twentysix children in this study failed to perform on the conservation tasks. Though this finding indicates a orobable delay, it would not be possible to make a generalization based on this data. Studies over a larger population and age range is warranted.

The findings in this study like the earlier ones emphasizes the need for further studies on cognitive - language development on both groups of hard of hearing children with more elaborate instructions.

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APPENDIX A & B

V Sign Symbols:-

1. Decoding Symbols
2. Decoding signs into actions

VI Belongingness:-

1. Classification of Pictures
2. Classification of Shapes
3. Identification of Odd things in a Group

I Metric Relations:-

1. Length seriation

Materials:- a) 7 dolls graded in length

b) 7 wooden sticks graded in length

Task:

T_1 : Given a set of (7) dolls of different heights the child has to seriate them from the shortest to the longest (or vice versa)

T_2 : Give a set of 5 sticks of different lengths inajumbled array: the child has to seriate them in order of length

T_3 : Given extra sticks (2) of different lengths, the child has to insert them into the series formed in T_2.

T_4 : Given paired dolls and sticks, matching the dolls and sticks in two series by length, the child has to point out the corresponding dolls for the selected sticks according to their ordinal relations when the doll series is spread out disturbing the alignment of the paired series,

<u>Instructions</u>:-

Though the test items are standardised,instructions are adopted (flexible) to the particular subject, especially with regard to the lattar's understanding of the terms used in quantification, estimation of length, sameness etc. The main objective of the instruction is to make the subject understand the task he is expected to perform rather than testing vocabulary or knowledge.

T_1 : Present materials in (a) 7 dolls standing in a group and say 'see if you can arrange these brothers in the ascending/descending ordBr of height - the shortest to the longest'. Experiementer(i) may if necessary demonstrate what she uants by arranging three dolls in the order; or by placing the shortest doll and asking the child (c) to continue the series in the ascending order. If necessary give 'C'* encouragement to finish her series or to correct a mistake saying "Is that over? Is it all right? Is anything wrong?"

T_2 : Present materials in (b) 5 sticks (remaining the 3rd and 6th ones) in a jumbled array and say 'can you out these sticks in order as you did with dolls.' 'Is anything wrong? Allow for correction.

T_3 : Open the T_2 arrangement so that the order remains but uith a space about 2-3 cm between the elements. Hand over the 3rd stick and say 'where should be this?' repeat with 6th stick.

+ C = CHILD

Note : Proceed to T_4 only if (c) is successful at least partially in T_1 and T_2 .

T_4 : Bring back T_4 arrangement of doll series and pair with the seriated sticks as in fig (1), 'Look here comes this longest stick for the biggest doll next comes this. . . . .lastly this shortest stick belongs to the shortest doll".

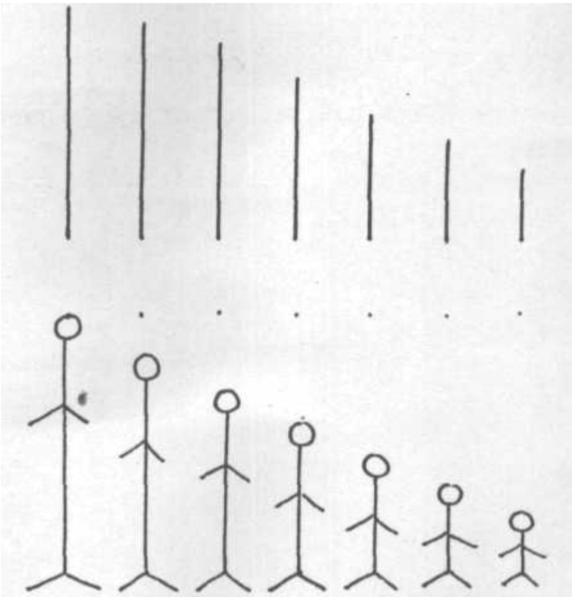


FIg. 1.

Let space between elements be about 5 cm.

Now spread out the doll series as in Fig.(2) so that the order retrains but uith a space of about 10 cm between dolls and sticks leaving the sticks as before,may slightly disturb the alignment on the line so that irrelevant perceptual ones are not prominent. Point to the 3rd stick and ask "show me the doll to which this stick belongs. Repeat with 5th, 2nd and 6th or 7th stick".

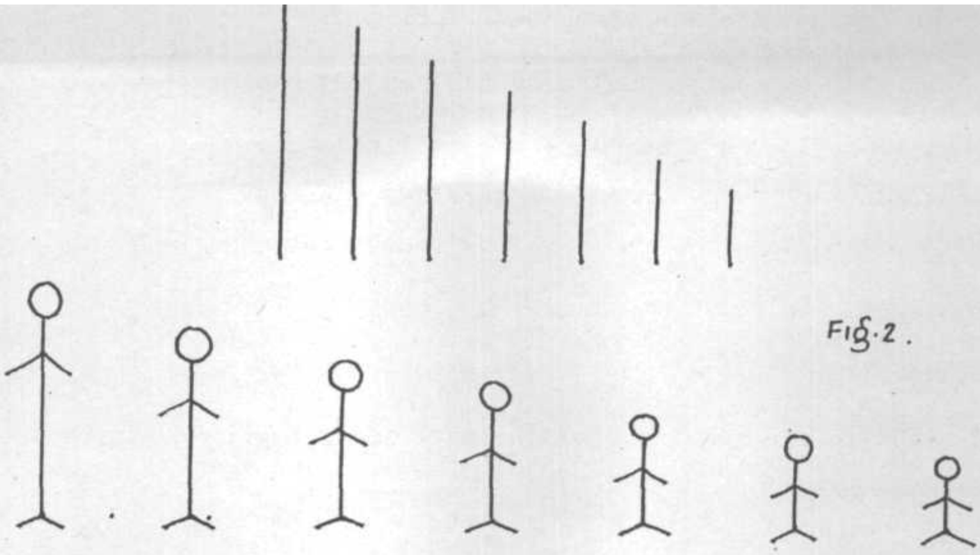


Fig.2.

Scoring Max.6

T_1 : - Score 2 for corract solution

Score 1 if dolls arranged in two sub series or any four dolls correctly seriated.

T_2 :- Score 1 for correct solution

Score 1/2 if sticks are arranged such that thcee sticks from one end are seriated, the other end of the row not being seriated properly.

T_3 :- Score 1 if both the sticks are correctly inserted.

T_4 :- Score 2 if all the four sticks are correctly pointed out.

Score 1 if at least 2 are correctly identified.

2. Area seriation:

Materials: a) 4 card board rectangles of different areas

b) 4 card board triangels (all are acute angled) of different areas (the difference being fairly clear even in crude judgement).

Task:

T_1 : Given a set of rectangles of different areas the child has to seriate them.

T_2 : Given a set of triangles of different areas the child has to seriate them.

Instructions:

T_1 : Present materials in (a) as in fig.(1) and say "here are some pieces of card board one is quite big, this one is small.... This one is very small... etc. See if you can arrange them in an order as you did with dolls; when (c) finishes ask Is it right? Is anything wrong! Allow for correction.

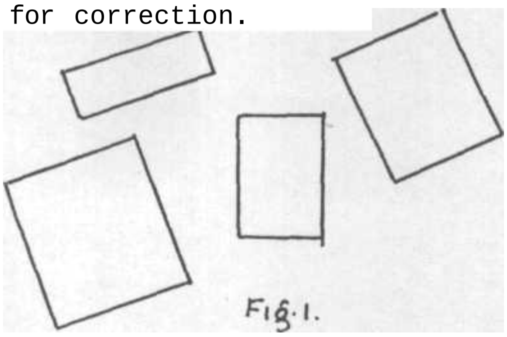


Fig.1.

T_2 : Present materials (b) as in Fig(2) proceed as in T_1

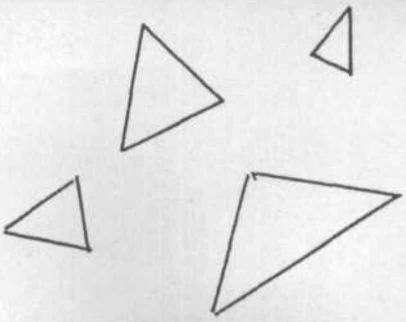


Fig. 2.

Scoring:

T_1) Accept 1, 2, 3, 4, 5 or 5, 4, 3, 2, 1 as correct solution.

T_2) Score 2 for correct solution

Score 1 if 3 in a row is correct from either end.

3. Volume seriation:

Materials: a) 4 empty open card boards of different capacities.

b) 4 plastic containers of different size with coloured water filled upto the level marked on each container.
(the differences being fairly clear in crude judgement).

Task: Given a set of three dimensional things of different volumes, the child has to seriate them.

T_1 : 4 empty open card board boxes.

T_2 : 4 different sized containers having different amount of liquid.

Instructions:

T_1 : Present (a) materials in the order 4,1,3,5,2 say 'Look these are boxes which can hold sand or grains this one can arrange them in an order from the smallest to the biggest.

T_2 : Present (b) Materials in the order 3,2,4,1,5 say look these bottles contain water/juice. This one has more water than this, this has very small amount etc. See if you can arrange them in an order starting with the bottle which has very little water". After child finishes ask "Is that right? Is any thing wrong?" Allow for correction.

Scoring: Max.4

T_1) Accept 1,2,3,4,5 or 5,4,3,2,1 as correct solution.
T_2) Score 2 if all are correct
Score 1 if 3 from either end are correct.

4. Equidistant points location:-

Materials: A small ball of clay, 5 dolls & 2 identical bottles.

Task: T_1 : The child has to locate a series of points at the same distance from a given point.

T_2 : The child has to locate a series of points at the same distance from the given points.

Instructions:

T_1 : Place the clay bell and doll (1) at a distance of 5 to 6 cm from it say "look that is a ball and here is a boy who likes to play with the ball a game which all boys have to stand at the same distance from the ball but at same distance from one another". Handover another doll and say "Can you stand this boy so that he is at tha same distance from the ball as this boy (point to the doll(1) place him anywhere in such way that he is not nearer or farer than this boy (Doll 1) from the ball."

Repeat uith three more dolls handing them over, one by one, after child places each doll.

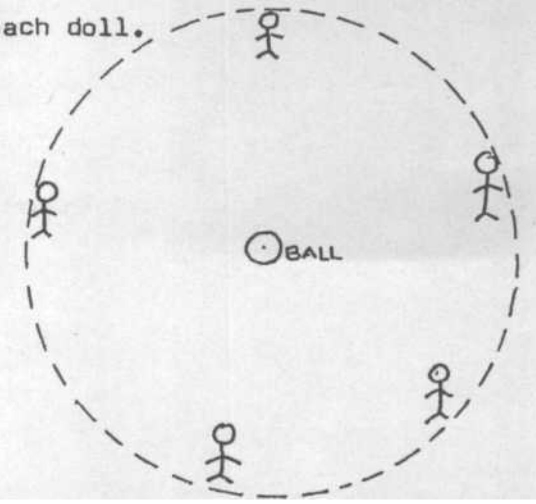


Fig.1.

T_2 : Place two identical bottles at a distance of 12 to 15 cm apart. Handover one doll and say ?"see if you/can stand this boy so that both these bottles are at the same distance from the boy. Remember one bottle should not be far, the other being near him, both the bottles should be equally far from (near to) the boy.

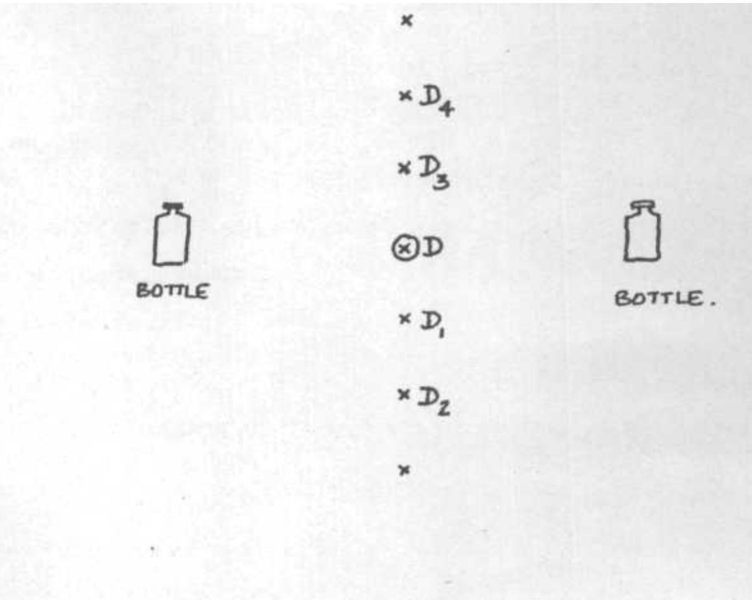
If she does not understand the condition place the doll'D' at different points between the bottles and shorn that at certain points (i) the distance from the two bottles is more or less same.

If she tries to keep his doll at the same (or adjacent) point as doll D is, say some other olaces you can locate many other points which will be at the same distance from both bottles.

Repeat with four more dolls.

Each time after child finishes allow for correction once, asking "Is that right? Is anything wrong?

Fig 2.



Scoring: Max.5

T_1 : Score 2 if all the 4 dolls are correctly placed. (approximation of 1/2 cm is allowed) anywhere on the implied circle.

Score 1 if only 2 or 3 dolls are correctly placed without demonstration

T_2 : Score 3 if all the 4 dolls are correctly placed without demonstration anywhere on the implied straight line (perpendicular biscelor of the assumed line from the two bottles)

Score 1 if only 2 or 3 dolls are correctly placed with more ones from demonstration.

5. Distance Estimation:

Materials: a) A pair of steal rods of diameter 5 mm & 16 to 20 cm in length

b) Two beads with holes sufficiently big to thread with the rods.

Task: Given the straight lines, the child has to find out a point on the second line corresponding to that on the first straight line where a point is marked by the experimenter.

Instructions:

Thread one bead ends into the pair of needles say, 'Let her assume that these needles are roads and these beads are cars (carts) Ask the child to make the car to and fro on rod A for show movement of car on the road.

T_1 : Rods A and B are parallel but not aligned

Place the roads as in Fig (1) let the beads rest at the end of the roads move the bead on road B about 7 to 8 cm from the starting position saying 'Look I move the car from here to there see if you can move your car the same distance as my car moved'.

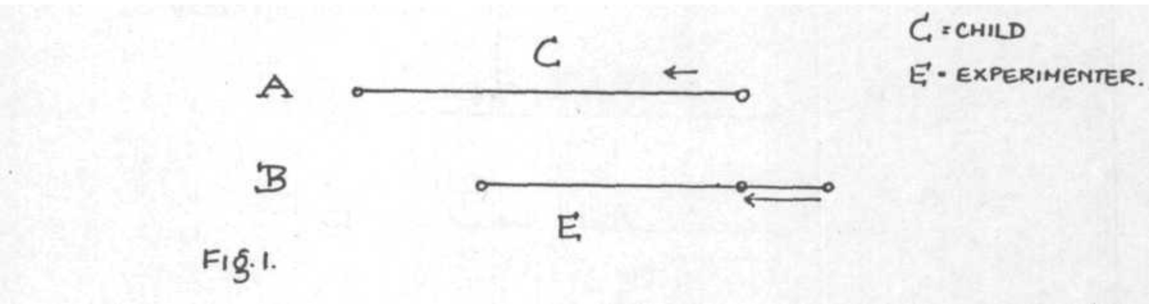


Fig. 1.

Scoring: Max. 6

T1) Score 2 or 0 in each situation

T2)

T3)

II Spatial Relations:

1. Haptic Recognition:-

Materials:

A. Sat of tuelve shapes made and arranged as in Fig (1) in thick hard board of which five are duplicated as follows:

a. 1. semi circle star (2 of same size) with jogged edge.

2. Trapezium (two of the same size)

b. 1. Five edged star (2 of different size)

2. Square (2 different size)

3. Circle/disc (tuo of different size)

(Total No. 12 + 5, the later kept separately)

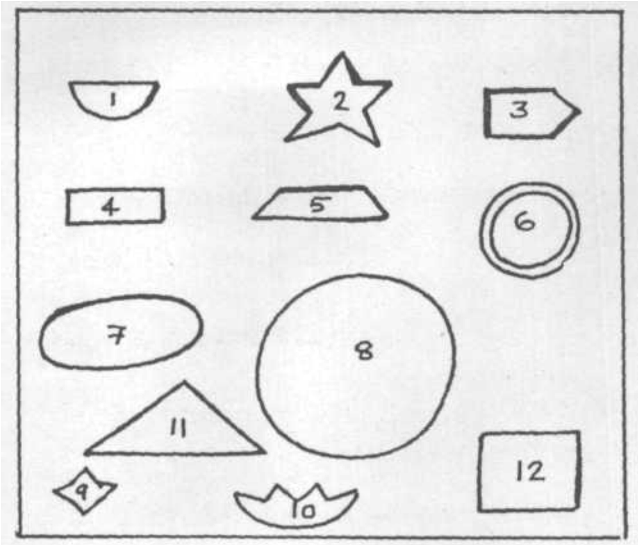
B. A screen with wrist holes.

Task: Given a number of that geometrical shapes to feel around each one without being allowed to see it, the child has to identify each geometrical shapes from a collection of such geometrical cut outs.

T_1 : Same shape and same size too.

T_2 : Same shape and different size.

Fig.1



<u>Instruction:</u>

E sits in front of C fixing up the screen in between them.

12 shapes are scattered on the surface so that all are clearly visible. The child is allowed to clear look at all the shapes in Fig.1. Say "if you put your hands through the holes in this screen I will put a shape in your hand. The shape will be exactly like one of these. I want you to feel it very carefully and tell me which of these shapes is just like the one I have out in your hands".

T : Same shape and same size:

1)  er. 10

2)  number 5.

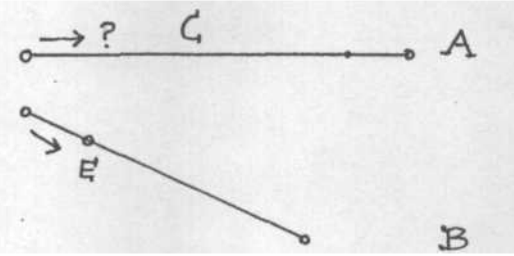
If child cannot understand the task bring back the beads to starting oosition and repeat once.

If child moves the road itself warn him "Does the road trove? No. you have to move your car but not the road Add rod A in oosition helding child to move his car,

T_2 : <u>Rods A and B are not parallel not aligned</u>

Place the rods as in Fig (2) let the beads rest at the end of the rods. Repeat instruction as in situation (1) moving the bead 8 to 10 cm on the Rod B from starting position.

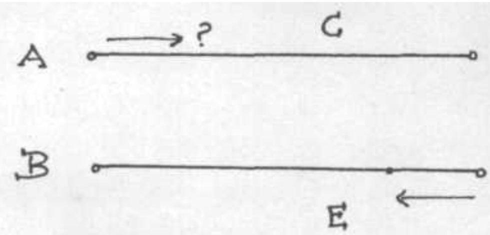
Fig.2.



T_3 : <u>Rods A and B ara parallel and aligned to each other</u>

Place the rods A and B as in Fig (3). Let beads rest at the opposite ends of the rods. Say 'Let my car start from this end and your car from that end. Repeat instruction as in situation (1) moving the bead 5 to 6 cm from the starting point.

Fig.3.



<u>Scoring</u>: Max. 6

T1)
T2) Score 2 or 0 in each situation
T3)

II Spatial Relations:

1. <u>Haptic Recognition</u>:-

<u>Materials:</u>

A. Sat of twelve shapes made and arranged as in fig (1) in thick hard board of which five are duplicated as follows:

a. 1.  semi circle star (2 of same size) uith jogged edge.

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2.  Square (2 different size)

3.  Circle/disc (two of different size)

(Total No. 12 + 5, the later kept separately)

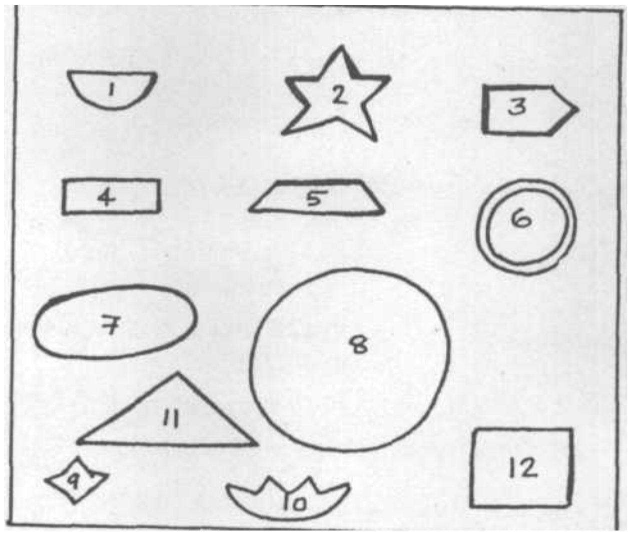
B. A screen uith wrist holes.

<u>Task</u>: Given a number of that geometrical shapes to feel around each one without being allowed to see it, the child has to identify each geometrical shapes from a collection of such geometrical cut outs.

T_1 : Same shape and same sizs too.

T_2 : Same shape and different size.

Fig.1

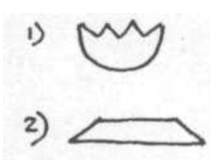


<u>Instruction:</u>

E sits in front of C fixing uo thB screen in between them.

12 shapes are scattered on the surface so that all are clearly visible. The child is allowed to clear look at all the shapes in Fig.1. Say "if you put your hands through the holes in this screen I will put a shape in your hand. The shape will be exactly like one of these. I want you to feel it very carefully and tell me uhich of these shapes is just like the one I have out in your hands".

T_1 : Same shape and same size:



number.10

number.5 .

Cover the scattered shapes from a sheet of paper pass in terun No.10. Allow ample time for recognition say 'Have you finished felling it by touch and take back the shape. Remove the cover sheet on the scattered shapes. Do not allow the child to touch array. Say 'Now show me the shape which is just like the one you felt in your hands now. Discourage 'C from guessing e.g. insists that he searches with his eyes and examine different possibilities thoroughly before making a selection and does not randomly select shapes.

Repeat with No.5

T_2 : <u>Same shape of different size</u>:

1. No.2 a star slightly bigger than one in the set
2. No.12 a square slightly smaller than one in the set
3. No.8 a circle bigger than one in the set.

Say, 'that was very good, let us go through some more shapes. Now I will put a shape into your hand as before. The shape will be like one of these, but it may be a bigger or smaller one than the one you see in this set. So I want you to feel it carefully and tell me which of these shapes is just like the one I have put in your hands though it is smaller or bigger than the one you feel in your hands.

Pass in turn 2, 12, 8 and proceed as in T_1.

<u>Scoring</u>: Score 1 for each shape correctly identified on each presentation.

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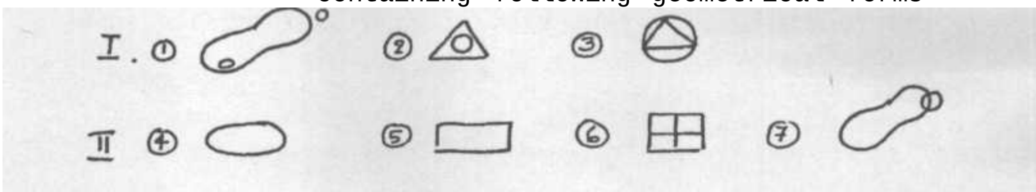
2. Figure Drawing

<u>Materials:</u> a) A book let (or set of cards) with each page containing following geometrical forms



b) Paper and a Pencil

<u>Task</u>: Give a no. of drawing of geometrical figures the child has to-

T_1 : copy them by visual perception

T_2 : draw them for memory.

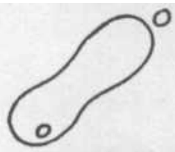
<u>Instructions:</u>

T_1 : Present the child the booklet open up the first figure (1) Hand over the pencil then pointing to the drawing, ask make one like this on this paper, Back side of the score sheet may be given for drawing. Child should be encouraged to copy the shape as bast as he can (2 trials may be allowed for each drawing. Discourage erases or correction), ask which is the closest.

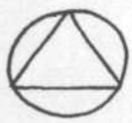
T_2 : Say 'Now I will show you a figure look it carefully. Then I will close the booklet see if you can draw the figure from memory. Open up II (4) say 'Look at this drawing carefully. Expose the drawing to child for 10 seconds, close the booklet and say, make one just like that on this paper. Repeat with II - 5, 6, 7 drawings (Two trials may be allowed in each case).

Scoring:

T1) Score 1 for each figure correctly drawn approximations
T2) are allowed as follows:

I 1.  A closed irregular shape with one ring clearly outside and other inside it. Size of the figures is not considered.

2.  The inside circle should not touch any point on the triangle. An approximate circle and equilateral trinagles are considered right.

3.  All the three vertices of the triangle should just touch the circle should not protrude beyond the circumference of the circle.

II All the four drawings should be approximately similar to that of the model drawings shown. However, the size of the drawings is not considered.

3. <u>Shape Recognition:</u>

<u>Materials</u>: a) Tuo drawings as in Fig (1) and (2) in the book let or on cards

b) Two small cards with a triangle drawn in one and a square in the other.

<u>Task</u>: Given a particular shape such as a triangle or a square, the child has to identify as many such shapes as he can in a complex geometrical drawing.

T_1 : Triangles

T_2 : Squares

<u>Instructions:</u>

T_1 : Present the (b i) card containing a triangle & say, 'Here is a figure, look at it carefully. Now present card containing fig (1) and say there are some such figures (point to the triangle in the card) of different sizes, locate this shape in the drawing (Point to the fig (1) in the card) see if you can point them out'. If child stops after locating only one triangle, encourage him to search for more triangles. At the child need not name shape. Ask him to outline the shape he has located in the drawing by his fore finger each time. Max. time 2 minutes.

T_2 : Present (b ii) card containing a square and (a) card containing fig (2) proceed with the instructions as in T_1 Max. time 60 seconds.

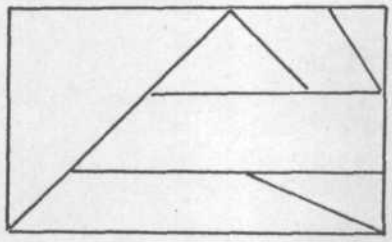


Fig.1

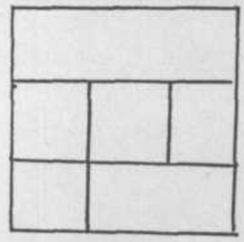


Fig.2.

Scoring:

T_1 : Score 1/2 for each triangle correctly identified.

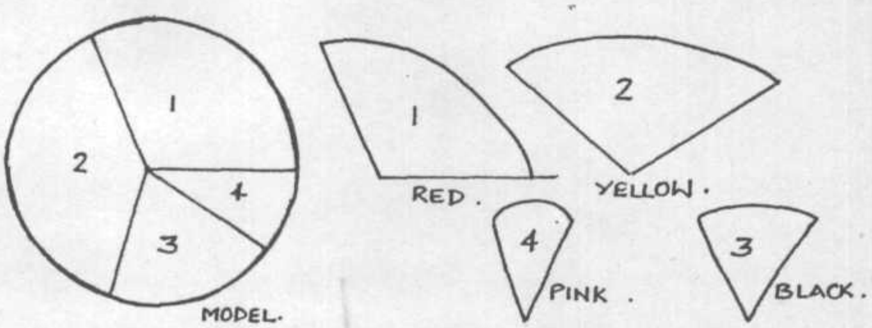
4 triangles. Max score - 2

T_2 : Score 1/2 for each square correctly identified.

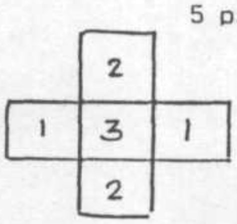
2 squares. Max. score - 1

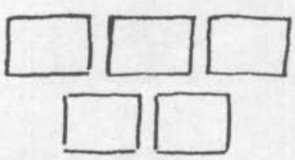
4. Shape completion: Materials: a) Two circular cards with about 10 cm diamet one (model) divided into four sectors in different colours and the other one cut into four corresponding pieces with the same colour as in the model (Fig.1)

Fig.1



b) Two cross shaped cards (fig.2) one cut into 5 pieces and coloured.





1 = BLACK
2 = RED
3 = YELLOW.

<u>Task:</u> Given a model shape and cut pieces of that shape, the had to complete the shape with the cut pieces by T_1 visual perception, T_2 from memory.

<u>Instructions:</u>

T_1 : Place the model circular card in front of child and lay down the four cut pieces too in a random order as shown in fig (1) & say, 'A card exactly like this (point out the model) has been cut into few pieces (Point to the pieces), See if you can arrange them together to make a whole one just like this"

If child hesitates or does not understand demonstrate once but do not describe,watch hou I do this....Scatter in cut pieces as before and ask child to complete the shape uith child finishes, ask, Is that all right? Is anything wrong? Allow for correction once. Max. time 60 seconds.

T_2 : Say, 'Now I am going to show you one more shape. But I will remove the model after you have a good look at the model. Then I will want you to place the pieces in their proper places, so that the finished shape will be exactly like the model."

Present the cross shape for 30 seconds & say, "have a good look so that you will remember the shape, the arrangement of the colours too" Remove the cross shape and immediately present the five cut pleces in a random order or mixed way and say "Put these pieces together to make a whole figure exactly like one you saw just now. Ask is it right? Is anything wrong. Allow for correction.

Max, time 60 seconds.

<u>Scoring:</u>

T_1 : Score 2 for correct completion

Score 1 (i) if correct following demonstration
(ii) if the order of the colour is different but the shape is correct.

T_2 : Score 2 for correct completion.

Score 1 if the order of the colour is allowed, but the shape is correct.

5. <u>Matrix Construction:</u>

<u>Materials</u>: a) Nine wooden cylindrical blocks varying three degrees in height and three degrees in diameter in other words 2 levels each.

b) A ruled plague of hard board to construct 2x2 and 3x3 matrices.

<u>Task</u>: Given a matrix varying 2 (or 3) degree in height and 2 (or 3) degrees in diameter the child has to replace and reproduce the matrix.

T_1 : Reproduction of 2x2 matrix

T_2 : Replacement of 3x3 matrix

T_3 : Reproduction of 3x3 matrix

Instructions:

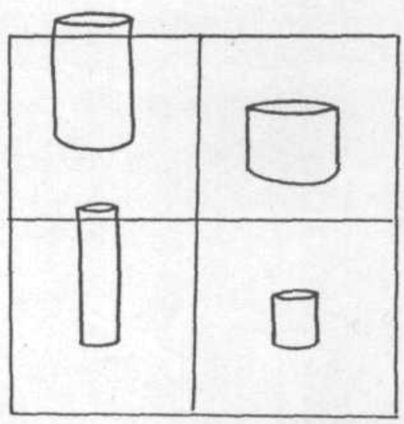
T_1 : Reproduction of 2x2 matrix.

E sits facing child with the constructed matrix between them. Say "Look you see how we have pieces on this board in a particular arrangement with these here." (Point to short ones, but do not describe and these here (Point to the tall ones but do not describe). Scramble all the few pieces and place before the child and say 'see if you can arrange all these properly on the board. Dust as they were before. If child is successful, then score.

Child need not reproduce the matrix in the exact arrangement presented, any adequate/correct matrix (uith tne intended gradation is acceptable.

If child is incorrect, ask "Is that right? Is anything wrong? Allow for correction.

Fig.1



2x2 MATRIX.

T_2 : Replacement - 3x3 matrix

Present 3x3 matrix as in fig.2 "Look nou you see how these blocks are arranged on the board, we have the same pattern as before with small blocks now with these here, these here. (Point to the three rows and then to three columns one by one but do not describe) Take a good look, then remove four blocks B1, B3, A2 C (fig 3) in full sight of child, mix them up and place the pieces before child mix them up and place the pieces before child. Take care to avoid giving partional ones. 'Ask place the pieces on the board exactly where they were before' when child finishes, ask, 'Is it alright? Is anything wrong? " Allow for correction.

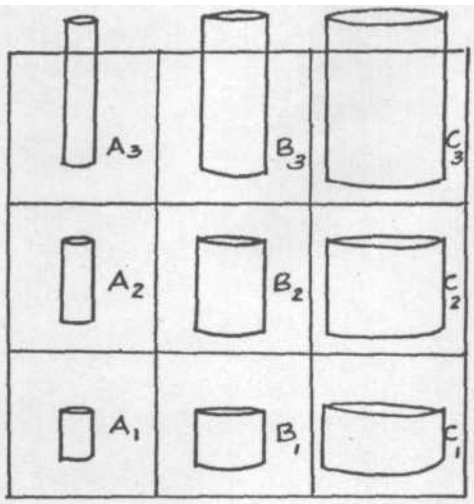


Fig.2

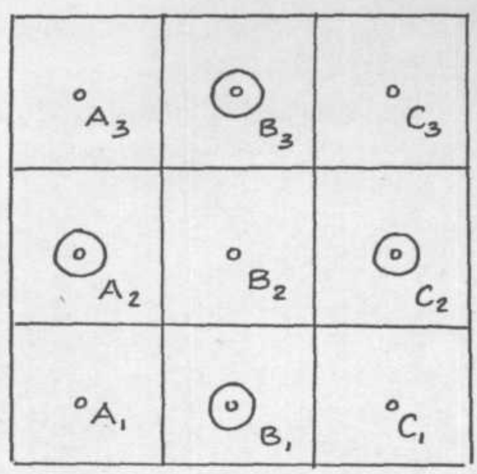


Fig.3

T_3 : Reproduction - 3x3 matrix.

If child makes correct replacement in all cases in T_2- say 'good' if not place the blocks in their correct positions without any explanation, ask 'child to have one wore close look, then scramble all the blocks and place them before child and ask child to reproduce the matrix in other words to place all the blocks in the same arrangement (with proper gradation but not necessary direction) as before.

Scoring:

T_1 : Score 2 for correct reproduction of 2x2 matrix.

Score 1 if at least two mere placed correctly first and the other were correct

T_2 : Score 2 for correct replacement of all blocks

Score 1 for correct replacement of tuo blocks

T_3 : Score 2 for correct reproduction of 3x3 matrix.

(Any adequately graded matrix is acceptable).

Score 1 if only 2 rows or 2 columns correct.

III CONSERVATION

1. Judgement of Invariance of Numbers

Materials: 10 Red chips
10 Blue chips

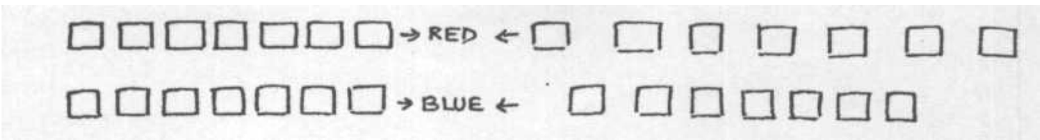
Task:

Given two sets of equal numbers the child has to judge the quality of tuo sets when the perceptual arrangement of one set is altered.

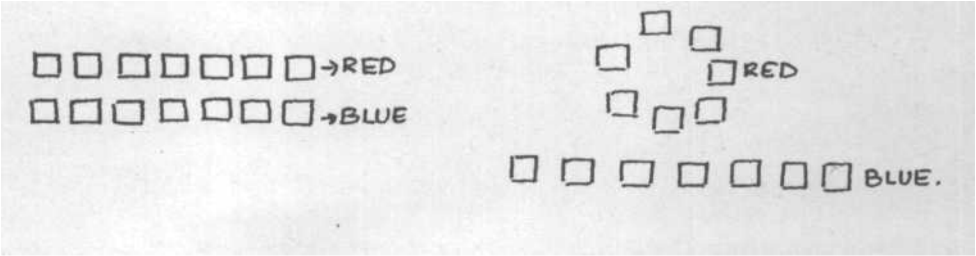
Instructions:

Ley out one row of series red chips and say 'put out the same numbers of blue chips as I have out red chips...Just as many no more no less. (Child need not necessarily count the chips in both the sets). If necessary, pair of the red and blue chips one to one and make sure that the child appreciate the numerical equivalence of the two rows (even without being able to count).

T_1 : Modify the layout by spacing out the red chips as in fig.2. Ask, 'Are there as many... the same number of red one's as blue one's or are not there? or are there more? or are there less? Why?. Encourage child to explain in hia own words for confirmation.



T_2 : Modify the layout arranging the red chios in a circle and ask the 'conservation question' as in situation.



Scoring: Max. 2

T1) Score 1 for correct answers in both the situations.
T2)

Note: Answers to be accepted as correct only with a fairly adequate explanation. Answer like following may be judged correct;

1) There are as many red ones as blue ones it was so before. We have not taken anything away (Identify judgement)

2) We could put the others in a circle as well or put one by the other so there are not more red ones or blue ones (Reversibilate judgement)

3) Here the blue ones are in a long row but there is space in between the chips so that makes it the same (Compensation judgement).

2. <u>Judgement of Equivalence of Two Areas:</u>

<u>Materials</u>: a) Two equal sheets of plain paper (about 10x15 cm)

b) A pair of scissors

<u>Task</u>: Given two identical areas the child has to judge the equality of two areas after equal parts are taken out from them.

<u>Instructions:</u>

Fold the two sheets of paper together in such a way that each is divided into 8 equal parts uith the impression of folded lines (fig 1), unfold the sheets and present them and say 'Here are tuo sheets having the same amount of space to urite on each of them the other. Encourage him to appreciate the equivilence of the two areas (super impose on over the other, if necessary)

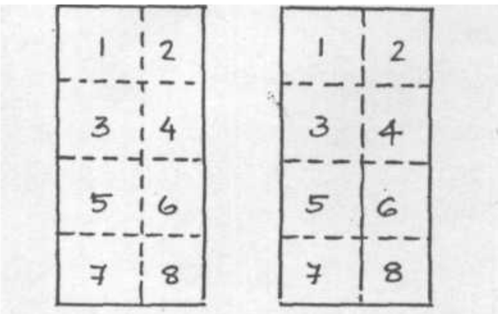


FIG. 1.

T_1 Cut portion 1 in sheet A uith the help of scissors then in sheet 8 put the tuo cut pieces in front of the child (fig 2). present A and B sheets and say 'I have removed a piece of paper from this (A) and a piece of paper from this (B) too. Now is there the same, amount of space to write on each sheet or is there more space in the sheet A or perhaps more in this sheet B. Encourage child to explain in his own words (for confirmation).

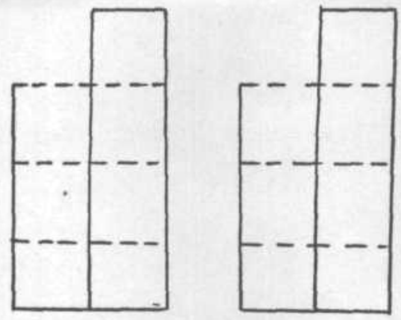


Fig.2.

T_2 : Repeat instructions removing portions in A and portion B in B.

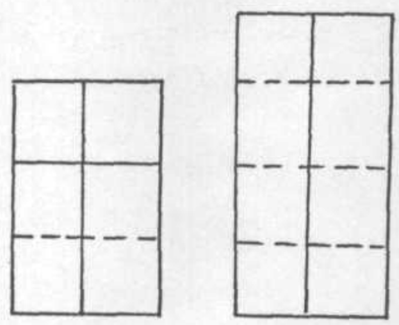


Fig.3.

<u>Scoring:</u>

T_1) Score 1 for correct answers in each situation.
T_2)

<u>Correct answers:</u>

In each situation, the two areas are judged equal.

<u>Identity</u>: 1. There is the same to write because we have taken out equal (some) pieces of Daoer.

Reversibility: (ii) the same because if we out back these Dieces where they were it would be the same as before.

Copensation: (iii) Both are same (equal) this look bigger but at this end one niece is short because you have removed the piece, at this end.

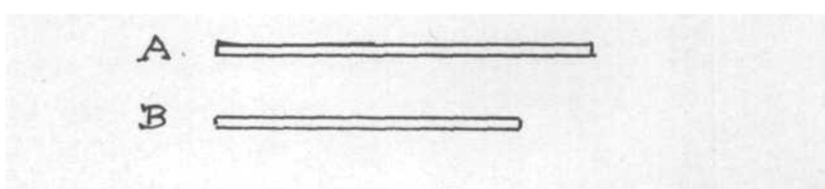
3. Judgement of Invariance of Length

Materials: Two flexible wires (string) of difrerent lengths (approximate 10 cm & 15 cm)

Task: Given two unequal lengths the child has to judge the invariance of the unequal lengths when the perceptual presentation of one length is altered.

Instructions:

Present two wires as in fig (1) & say 'Let us assume that these two wires are roads. Now on this road 'A' is there just as far to walk as on this road 'B' or is there perhaps farther to walk here (A)? This road 'A' is it the same length as this one 'B' or length is longer or not so longer as this one? Ensure that child notices tne inequality and correctly judges A to be longer than B.



T_1 : Bend A so that its end coinside with those of fig B (fig 2) and now is there as far to walk on this road A as on this road B of two ants are walking one on this road and other one on this road, would they both dalk the same distance. After child answer, straighten A as it had been originally.

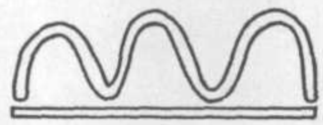


Fig. 2.

T- : Twist A such that when the two wires are laid out one below the other fig.3 (direct distance between ends is shorter in A than in B) Proceed with instructions as in situation (i).

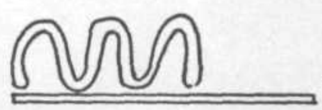


Fig. 3.

Scoring:

T_1) Score 1 for correct answer in each situation. Note
T_2) down the child answer it tray be one of three arguments is Identity, Reversiblity or condensation.

4. Judgement of Invariance of Mass:

Materials: Two balls of modelling clay (diameter approx. 4 cm)

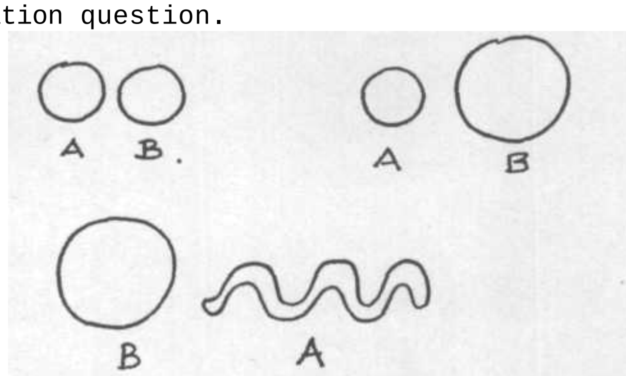
Task: Given tuo balls of clay of equal amount the child has to judge the invariance of the amount of two balls after one of the balls is rolled into different shapes.

Instructions:

Ask.child to make sure that the tuo balls are made of the same amount of clay say 'Let us pretend that these balls are made of pastry make it so that if we ate one of them, we would both have the same amount to eat, no more no less (alternatively present two balls of clay and have them judged as equal by look and by weight.)

T_1 : Say ' watch what I am going to do. Mould B into the shape of sausage (3 cm long). Ask, Is there the same amount in the ball? or perhaps more in the sausages?

T_2 : Remould the sausage into ball without any explanation. Role A into the shape of a snake and ask the conservation question.



Scoring: Max. 2

T_1) Score 1 for correct answer in both the situations.

T_2) Accept any of the three arguments in identify reversibility compensation as correct.

5. Judgement of Invariance of Liquid Volume:

Materials: a) Two identical glasses A and A' (about 3 cm in diameter and 6 cm tall)

b) One wider taller glass (p)

c) Tuo identical small glasses each about one half of the volume of A (P_1 , P_2)

d) Two bottles containing different coloured water.

Task: Given two glasses of liquid of equal different coloured water judge the invariance of the quantity of liquid after the liquid from one of the glasses is poured into a different sized container.

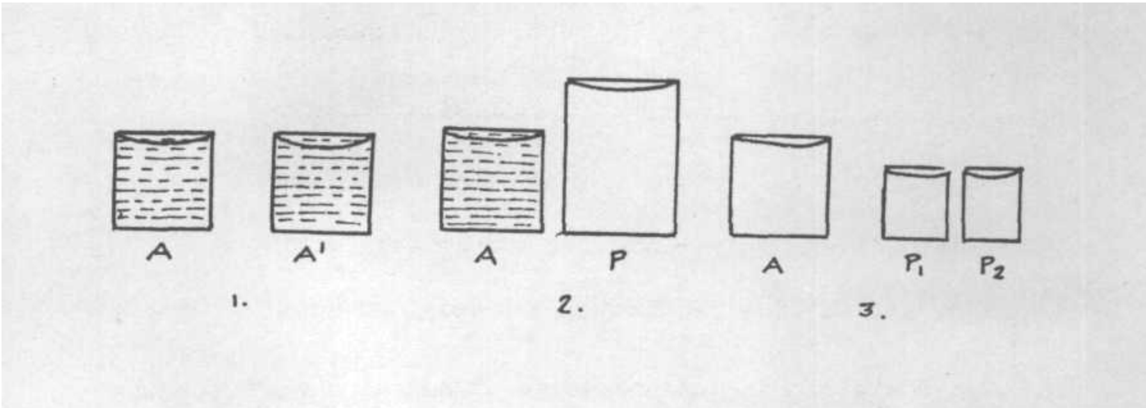
Instructions:

Get the child to agree that A and A' are the same in both height and diameter. Take one of the bottles and pour uater into it. Ask the child to take the bottle and pour the same quantity into A'. "Pour exactly the same quantity, no more or no less" when child Dours the liquid ask, 'if you drink this juice (A) and I (or your friend) that juice A' will we both have the same amount to drink?

Make sure that he agrees that A and A' contains equal amount of liquid.

T_1 : Pour all the water from A' into P in full sight of child. Have we both got the same quantity now or has one of us got a lot and the other only a little.... who! if we drink it, Try to elicit explanation from child pour back P to A'

T_2 : Pour water from A' to both P_1 P_2 and follow the same instruction as in situation 1, emphasize child to compare the liquid in P_1 and P_2 taken together with that in Glass A.



Scoring:

T_1) Score 1 for correct answer in both the situations.

T_2)

Accept any of the three arguments, Identity, Reversibility or compensation as correct.

IV TEMPORAL RELATIONS:

1. Judgement of simultaneity speed and distance covered

Materials: Two wooden dolls with a piece of chalk with a clean floor area (table surface) settings. Two parallel lines representing two tracks with a doll on each.

Task : Given a doll racing demonstration in different situations the child has to judge simultaneity equality of synchronous (corresponding) intervals order of events in time with reference to distance covered by each doll.

Instructions

Preparatory Exercise:

Examiner demonstrate a race between two dolls in the following three situations. Both start and stop with a click at the same instant in all the three situations keeping the time constant for both the dolls.

T_1: Starting positions at the same corresponding level from one end (of the table/surface) say Look here are two dolls (A & B) ready for a race. Note carefully where they stand 'Draw a small circle round the starting points of each doll when I say'ready go' they start and when I say stop they stop, where they are I want you to watch carefully how they run. Demonstrate the race saying 'Ready Go' (Making A move slightly faster than B) and stop, Let the dolls stop at the points as shown in figure (1), Ask the following questions in a suitable manner.

Q1. Did the dolls start running at the same time7

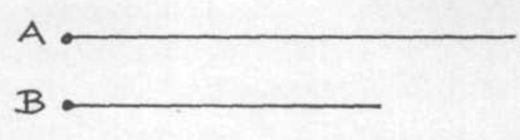
Q2 . Did the dolls stop running at the same time?

Q3. Did both dolls run the same distance?

Q4. Who run faster?

If child points to one of the two dolls as the answer encourage him to explain why he thinks so.

Fig.1.



T_2 : Starting positions at unequal distance from the edge or and equal intervals of time with different speed. Proceed with instructions as in situation (1).

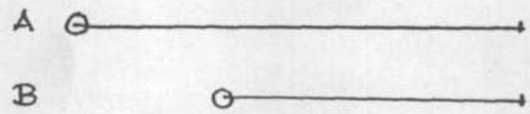


Fig. 2.

T_3 : Starting positions at unequal distance from the edge equal interval of time with different speed. Proceed with instructions as in situation (1)

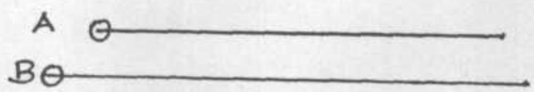


Fig. 3.

Scoring:

T1) Score 2 if all the 4 questions are correctly answered.

T2)
T3) Score 2 if 1st and 2nd questions are correctly answered.

Score 1½ if the first 3 questions are correctly answered.

V DECODING SYMBOLS:

Materials: a) A set of 10 foot prints (cut out in hard board/card-board) 5 forming left foot in one colour (red) and 5 forming right foot in another colour (green)

b) One pair of foot prints same as above with yellow dots painted all over them.

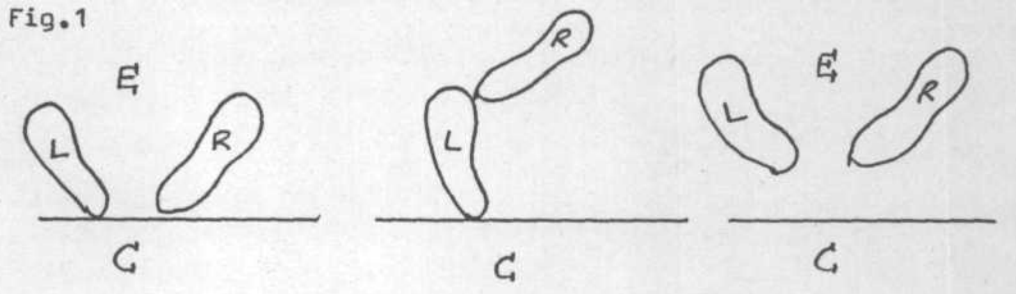
c) Clean floor area.

Task: Given symbols for left and right feet the child has to decide the symbols into action in different situations.

<u>Instructions:</u>

T : Use one pair of foot prints from (a) materials place the foot print as in fig.1. Look these are pieces which look like your feet (pointing to the red one) This is for your left foot (Pointing to the left foot) and this (Point to the right foot) child need not name left and right direction but convince him what red and green foot prints stands for. 'See if you can stand keeping your left foot like this. Help child to stand ao that his feet are in position as in

Fig.1



$T_1 S_1$: Change the position of the foot prints as in Fig (2), 'see if you can stand like this'. After child finishes allow hint to stand normally and ask child to close his eyes.

S_2 : Take care not to give any clues whether he is right or wrong Change the position of the foot prints as in Fig.3 say 'Now see if you can stand like this'. Score after child finishes.

$T_2 S_1$: Place 8 foot prints (1) in a line a random order as shown in figure. Say walk on these foot prints. Remember that you should always keep your left foot (point to the left foot) on red and right foot (Point to the right foot) on black'. Watch how child walks,do not interrupt in tha middle, count the number of mistakes if any.

S_2 : Arrange the foot prints as in Fig.2 Now you walk on these foot prints. Count the no. of mistakes if any and score.

T_3 : Introduce the doted pair of foot prints, instruct the child Again this red one is for your left this green one is for your right. But for these dots you have to stamp your foot twice on this, 'arrange all the 12 prints in a random order. Ask the child to walk on them. Watch if correctly decodes the symbols, score

Scoring Max. 8

T_1:S_1: Score 1 each for placing correct foot in correct position.
S_2

T_2:S_1: Score 2 each for complete success
S_2
Score 1 each for one or two errors
Score 0 for more than two errors

T_3 : Score 2 for complete success
Score 1 if dotted ones are stamped twice with proper feet but with errors in placing another plain foot prints.
Score 0 if he does not succeed in decoding the dotted pair of foot prints.

2. Decoding signs into actions:

Materials: A set of 6 cards showing signs to decode into actions.

Task: Given some signs like each one standing for an action. Eg., (Jump in air once, both feet) tha child has to decode the signs into required actions when given in various combinations.

Instructions: Present the cards one by one mentioning the action represented and instructing the child to perform the action accordingly (if necessary demonstrate the action once). Three trials with each first in the order taken then in random order.

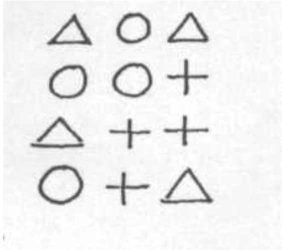
— Jump in air once both feet up once

- Sit and stand up once

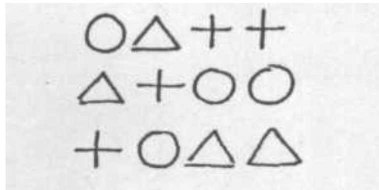
Make sure that child is not confused with the signs before proceeding to situation 1. Now I am going to present these signs in combinations. I want you to perform the action carefully remembering them in right order.

Present the cards one by one with given order.

T_1 : Three signs 4 combinations



T_2 : 4 signs and 3 combinations:



If child repeatedly goes wrong in the action, present the practice card and instruct the actions once more and produse with the next item where child had stopped.

Scoring: Max.4

T_1 : Score 2 if all the 4 combinations ara correctly decoded.

Score 1 if 2 or 3 combinations are correctly decoded.

Score 0 if only one combination or none are correct

T_2 : Score 2 if all the 3 combinations are correctly decoded.

Score 1 if 2 combinations are correctly decoded.

Score 0 if only one combination or none is correctly decoded.

VI BELONGINGNESS

1. Classification of pictures

Materials: A set of 16 picture cards to form 4 sets as follows:

a) 4 common fruits: apple, orange, banana and lemon

b) 4 vehicles: truck/train, scooter, car, cycle

c) 4 Birds: Crow, Eagle/Roaster, Sparrow, Parrot

d) 4 animals: cat, dog, cow, horse

(May be other fruits/vehicles/birds/animals familiar to children)

Task: Given a collection of pictures cards, the child has to classify them into required sets.

Instructions:

Lay out one by one all the 16 cards in a random order establishing vocabulary for the pictures. Ensure that all the pictures are clearly visible. Say form sets of pictures, each set containing pictures that go together/that are alike in some way that represents the things of the same kind. If child hesitates or does not succeed in grouping at least one set suggest. 'See here is an apple, remove the card from the scattered pictures and keep in front of child, 'see if any other card show things like this' Do not suggest to put all the fruits together. If child fails to understand the above suggestion, suggest with the picture of car. 'See here is a car', Ask if the apple and the car are of the same kind. No. So put the car in different place and ask for other cards that may go uith it. Give ample time. Encourage child to classify all the 16 cards.

When child finishes ask,Is that right? Allow for correction.

Scoring: Max.8

Score 8: for correct classification into 4 sets without suggestion

Score 7: for correct classification into 4 sets uith the ones as indicated above.

Score 6: for correct classification into 3 sets ie, Fruits (4)

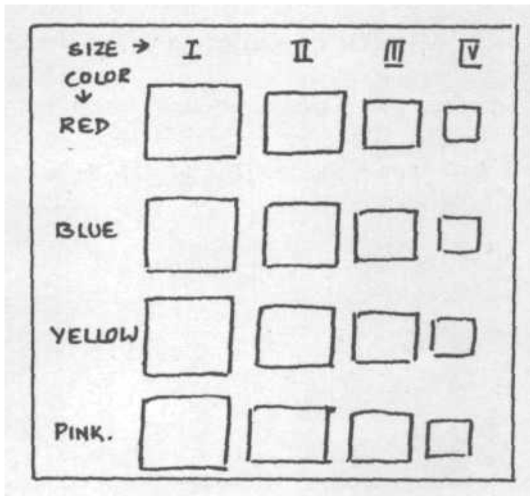
Vehicles (4) and animals and Birds (8) with or without suggestion

Score 2: each set if only one or two sets (4 cards) correctly classified with or without suggestion

Score 1: each set if only three cards are correctly put together in a set without suggestion.

2. Classification of Shapes:

Materials: 16 squares cut out in hard board in 4 sizes and 4 colours, each colour having one square in each size.



Task: Given a set of squares of 4 different colours in four different sizes. The child has to classify them according to two criteria i.e, by colour and by size.

Instructions:

Examiner sits opposit child with the shape randomly scattered on the table or floor. Examiner then asks child to sort the squares into groups. 'Group these pieces that go together or 'put the pieces together that are alike in some way' If child cannot sort the pieces either by colour or by shape and simply plays with the pieces Examiner suggests the criterian by sorting one set by color and asks the child to continue. At no time the child is told the names of the colours E. assists if necessary and eventually places one or two pieces left (if any) into the required groups to complete sorting of 16 pieces.

Discontinue if child does not succeed in sorting all the 16 nieces even after suggesting the criterian (ie by colour). If the child is successful in sorting by any one criterian without suggestion (ie, he can sort by colour or by size first) shuffle the pieces and present them in random order and say 'if you can sort them in some other way'. If child repeats the first criterion say 'you have already done it like that you can find a different way of putting them into groups. Each group containing things of the same kind/in same way.

a) If necessary examiner suggests the 2nd criterion if the child has completed sorting by colour first say 'see here some are big, some are very big, some small.... Assists to classify one set (biggest set) and ask the child to continue.

b) If child has completed sorting by size first, say'watch what I do' sort one set by colour (4 pieces of red) say 'see if you can continue with the retraining pieces.

Score after child completes sorting all the 16 pieces.

Scoring:

Score 8: for correct classification by colours and by size without any suggestion

Score 7: for correct classification following suggestion for second criteria

Score 4: for correct single classification with or without suggestion but cannot succeed in second classification inspite of suggestion.

3. Identification of Odd things in a group

Materials: Following picture cards in three sets:

a) Eye, Hand, Nose and a banana fruit (any one of the fruit pictures)

b) Lion, Tiger, Elephant and a Fish

c) Axe, Knife, Handsaw and a Pencil

Task : Given a set of pictures the child has to identify the picture in the set, which does not belongs to that group.

Instructions:

T_1 : Lay down the cards (a) set one by one (eleciting/introducing the names) present in the order as in Fig.1. Say 'Look at these pictures this is a picture of.... this is a picture of.... etc. Ensure that he knows the object (or animal) in the picture, three of these are of the same kind, one is a different kind which is that? (different one). No class name should be used. Discourage child from questioning. Insists that child think before identifying when child picks out a picture, ask 'why is it different?' (asked - for only confirmation). If child gives some other reason, can you think about it? Insists child to answer.

T_2 : Present (b) set of pictures in the order.

Lion, Tiger, Elephant, Fish. Proceed as in situation (1).

T_3 : Present child set of pictures in the order saw, pencil, Axe, Knife. Proceeding as in situation (1).

<u>Scoring:</u>

T1) Score 2 if correctly identified with a correct reason
T2)
T3) Score 1 if correctly identifies but unable to explain the reason in some way.

The child need not be penalised for not naming the pictures, following reasons are accepted; correct. Even hints in broken sentences are correct, if the reason is correct.

T_1 : This is a banana (or a fruit) but these are parts of body.

of

This banana we do not have we get it from shop (or a tree) but these retraining pictures we have with us

T_2 : This is a fish, which lives in water, these are animals which live on land

or

This (fish) has no legs, can swim in water, but these have legs to walk

T_3 : This we write from a pencil, these are tools to cut OR something. We cannot cut anything using this (Pencil) but we can cut using these (remaining tools).