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A Descriptive Analysis of Language and Cognition in Congenitally Blind Children Ages 3 Through 9

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A DESCRIPTIVE ANALYSIS OF LANGUAGE AND COGNITION IN CONGENITALLY BLIND CHILDREN AGES 3 THROUGH 9

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Signature David W Anderson

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ABSTRACT

Purpose

This study was designed as an investigation of the semantic and cognitive functioning of congenitally blind children within the age range of 3 through 9 years, to help fill the gap in the existing research concerning the early development of the visually handicapped.

Delays in cognitive development among school age congenitally blind children have been attributed to the limitations imposed by blindness on mobility and interaction with objects and events in the environment. It has been assumed that blind children must rely on less efficient sensory perception and discrimination processes resulting in a conceptualization of the world which may be inconsistent, incomplete, or significantly different from that of sighted children. If the object concept differs for blind children, the meaning of words used to refer to those objects could be expected to differ from the meanings assigned by sighted children.

Problems in word meaning and concept development--and hence, in communication--are an important consideration in mainstreaming efforts in the public schools. Consequently, the present study sought to explore linguistic and cognitive representation of common objects among blind children, along with their understanding and use of dimensional concepts in dealing with those objects.

Procedure

Ten totally and congenitally blind children and ten sighted children of matching age, sex, and socioeconomic status were interviewed individually following a prescribed format. By means of these structured interviews, information was gathered concerning the cognitive functioning of each child, and responses were secured to the lexical semantic tasks. These tasks focused on verbally and tactually derived attributions for selected objects defined as "more tangible" and "less tangible," as well as measures of receptive and expressive use of comparative adjectives of dimension.

Conclusions

1. This analysis suggested that the information gained through tactual means does not differ significantly from that gained through vision. The meaning of common words, and the underlying object concept reflected through the children's attributions, did not appear to be significantly altered by the absence of vision. The younger blind children were found to have an accurate, albeit shallow conception of the "less tangible" objects, probably as a result of reduced opportunity for meaningful interaction/exploration with those objects.

2. The total number of attributions by the sighted children was not significantly larger than that of the blind children. Much similarity in the kind of attributes used was noted between vision groups. The number of visually oriented attributes mentioned by the blind children was extremely small compared to the total number of attributes used. It was concluded, therefore, that the language of the blind children

was based on the object concept they had developed through tactual experience, rather than being a reflection of the language of sighted children.

3. Cognitive delay was evident among the older blind children, leading to the observation that the entire group was functioning at a preoperational level of cognitive development. The blind children's attributions revealed a tactually based conceptualization of the world that was related to their personal experience, but which was not found to differ significantly from the visually based conceptualization of the sighted children. In fact, the mental image/object concepts for both vision groups appeared to draw heavily on egocentric and functional characteristics of the objects.

4. Communication between blind and sighted children regarding the objects used in this study did not appear to be seriously disrupted by the absence of vision. However, the importance of assisting blind children to develop effective and systematic methods for gathering and organizing information through tactual means was underscored. The results of this study emphasize the need for blind children to experience objects and events first hand.

CHAPTER I

INTRODUCTION

Background

Piagetian research has been described as providing one of the most comprehensive analyses of the acquisition and development of cognitive structures (Gottesman 1976). A thorough understanding of the stages of intellectual development in the "normal" child, including the characteristics and attainments of thought at each level of development, is believed necessary in order to assess the cognitive development of handicapped children. Though Piaget himself has never sought to apply his theories and techniques to handicapped individuals, his notion of developmental stages and the achievements and sequence of those stages, have provided a framework for much research into the development and functioning of handicapped children (e.g., Furth 1966; Gottesman 1971, 1973, 1976; Higgins 1973; Inhelder 1968; Simpkins & Stephens 1974; Stephens, Miller, & McLaughlin 1969; Swallow 1976). These studies have confirmed that handicapped children develop through the same sequence of stages as non-handicapped children, though the rate of progress differs.

Piaget's theory (Piaget & Inhelder 1969) suggests that cognitive development proceeds as a result of the child's interaction with his social and physical environment. As a consequence of these interactions, the child constructs his physical and logical-mathematical knowledge about objects and the relationships between objects. These cognitive structures are the individual's way of organizing his world, but undergo continual reorganization and restructuring with continued alterations (Wadsworth 1971). The thought of the young child, hence, is recognized as being qualitatively different from that of the adult.

Lowenfeld (1973) suggested that blindness imposes three basic limitations on the individual in terms of (a) the range and variety of experiences, (b) mobility, and (c) interactions with the environment. The severity of these limitations becomes clear in the light of Piaget's theory--these are among the very factors which contribute to cognitive growth. Indeed, general delays in cognitive development have been reported with school age congenitally blind children (e.g., Gottesman 1971; Stephens 1972; Stephens & Simpkins 1974; Tobin 1972).

Delays have also been observed in the physical and motor development of blind children in such areas as balance and posture, locomotion, reaching, grasping, manipulating, and releasing objects (DuBose 1976; Swallow 1976). Such delays have been attributed to the absence of visual stimulation which would normally cause the child to direct his attention to objects or events in the environment, thereby encouraging interaction and imitation which would foster cognitive development. Consequently, the visually handicapped child appears to be at a disadvantage in the areas of sensory stimulation, concept development, and, ultimately, communication (Scholl 1973).

The lack of mobility and interaction with objects, events, and persons in his environment, coupled with the absence of vision as a means of unifying and organizing sensory information, suggests that the totally and congenitally blind child's conceptualization of the world will be different from that of his sighted peers (Santin & Simmons 1977; Wills 1965). Being forced to construct a model of the world from relatively inconsistent and fragmented bits of information (Santin & Simmons 1977), the blind child operates upon a different "data base" in deriving word and concept meanings. It is possible that the mental image of the object or concept signified by words may be different for the blind child due to the limited and more restricted information gathered through his experiences (Warren 1977). It is also likely that the language used by sighted persons to describe objects or events may not match the ideas generated through the blind child's experience via touch, taste, smell, or hearing (Foulke 1964; Santin & Simmons 1977).

Urwin (1977) further suggested that problems of early language development may be related to hindrances blindness imposes on the development of social relations. Communicative exchanges between the blind child and the sighted parent may be less frequent than for sighted children or may be somewhat shallow because of difficulty focusing on the same object.

Cutsforth (1951) felt that blindness gives rise to verbal unreality, by which he meant that the speech of the visually impaired was characterized by the use of "meaningless visual terminology" which resulted in "incoherent and loose thinking" (p. 69). This assumption has been challenged (Harley 1963; Nolan 1960), however, leading Dokecki (1966) to conclude that visually oriented words used by blind children--words not based on direct sensory experience--need not disrupt their thinking processes. The effect of a blind child's use of the "terminology of the seeing" (Maxfield 1936) continues to be an area for study.

The frequency of "verbalisms" in the language of blind children has been related to the lack of early experiences (Swallow 1976). Because of blindness, the visually handicapped child has greater dependence upon verbally transmitted information (Warren 1977). Yet, the insufficiency of language to compensate for the lack of concrete experience has been asserted (Stephens 1972). Simply because a blind child uses the same word as the sighted child does not mean that the understanding (meaning) of the concept is the same. Lloyd (1972) gave the example of a class of blind children discussing the size of a lion they had encountered in a story being read to them. The children suggested that the lion was from three inches to two feet in length. One child was reported to believe that the picture of the lion given in the book (which he could not see) was life-size, and that the lion's size could be determined by having the teacher trace the children's hands over the outline of the picture (p. 19).

These considerations have led Santin and Simmons (1977) to conclude that the problem of establishing concept-defining attributes and relations is great for congenitally blind children. Possible differences in word and concept meaning between blind and sighted children must be considered for effective verbal communication to ensue, particularly in view of the trend toward mainstreaming (Zweilbelson & Barg 1967). For those instances where integration of blind and sighted children is the case, Tait (1974) has cautioned teachers not to assume that blind children know the meaning of many common words, and to be sure that the blind child is using language which is meaningful to him, not simply parroting the language of others.

Purpose of the Study

The present study was designed to investigate the semantic and cognitive functioning of congenitally blind children within the age range of 3 through 9 years. This age range was selected in order to be representative of the preoperational period of cognitive development as defined by Piaget (Piaget & Inhelder 1969). Previous research (e.g., Stephens & Simpkins 1974) has indicated a significant delay in cognitive development among school age congenitally blind children which has been attributed to the effects of the lack of vision. The present study has sought to explore certain aspects of cognitive development in younger blind children through an analysis of the meanings and attributes assigned to common lexical terms and their conceptualization of the referrents for those terms.

Owing to the limitations imposed by blindness on interaction, mobility, etc., it was suggested that many of the words and/or concepts used by these children may possess idiosyncratic meanings based on significantly different experiences and mental representations of their referrents. This study proposed to examine and describe linguistic and cognitive representation of common objects felt to be within the experience of the subjects involved. Interest was in the type and quantity of attributes assigned to the objects and on the children's conception of selected dimensional adjectives in dealing with those objects. An attempt was made to relate these findings to the children's cognitive functioning as measured by selected Piagetian assessment techniques. The quality and quantity of attributions by blind and sighted children was also compared and contrasted.

Research Questions

When Maxfield (1936) set out to investigate functional and structural aspects of language in preschool visually handicapped children (a previously unexplored area), he maintained that the formulation of hypotheses was unwise, stating that "the establishment of an hypothesis can lead to a *justifying* attitude of mind rather than to an *interrogating* one" (p. 10). Similarly, specific hypotheses were not developed for the present, exploratory study. It was generally assumed, however, that differences in the description of the specified objects would be evident between blind and sighted children.

The absence of prior study into this area of semantics and cognition with blind children necessitated the open-ended, descriptive study that is reported herein. Data was gathered and analyzed with reference to the following research questions:

1. Does the absence of vision affect the child's understanding of common words/concepts?

2. What is the nature of the blind child's representational thought?

   (a) Does the language of congenitally blind children reflect their unique experience and means of mental representation?

   (b) Does the language of congenitally blind children reflect their knowledge of the language of sighted persons?

3. What is revealed in their understanding of common words/concepts regarding the congenitally blind child's conceptualization of the world?

Procedure

Subjects for this study were ten congenitally blind and ten sighted children ranging in age from 3 years 8 months to 9 years

11 months. Subjects were matched on the bases of sex, age, and socio-economic status. All children were determined to be developing normally, except for vision, on the basis of parental responses on the Developmental Profile (Alpern & Boll 1972).

Each child was interviewed individually following a prescribed format. Definitions and descriptions were solicited for ten "more tangible" and ten "less tangible" objects with which it was assumed than the children would have had some experience. This portion of the interview was entirely verbal. For each object specified, the children were required to make a forced-choice between five pairs of dimensional (polar) adjectives as a means of gaining further insight into their mental representation of the object and their understanding of the dimensional concepts themselves. Subjects were also asked to demonstrate the use of the "more tangible" objects (in the absence of the actual object). For ten of the objects, the children were questioned as to the origin of the name of the object, whether the name could be changed without correspondingly altering the object itself, and whether human characteristics were attributed to the objects by the children.

A second section of the interview required the subjects to tactually identify ten objects corresponding to the "more tangible" group, and to describe those objects now in their possession. In this way, comparison between descriptive attribution based on verbal recall and on tactual/visual exploration was made possible.

A third section of the interview pertained to the subjects' comprehension and use of the dimensional adjectives, receptively and expressively. A fourth part involved the comparative form of the polar adjectives. Subjects were required to choose between two of the "less tangible" objects, that which the comparative adjective named.

General cognitive functioning was assessed using Piagetian techniques measuring conservation, classification, and mental imagery. These assessments were used primarily to ascertain whether the subjects were functioning within the preoperational or concrete operational period of cognitive development as defined by Piaget.

Limitations of the Study

Fortunately, the incidence of total, congenital blindness is small. Adding the requirement that the subjects be "normal" in other aspects of development, therefore, precluded the selection of a randomly chosen sample. Subjects were included on the basis of availability and their meeting the criteria of total blindness, congenital blindness, estimated "normal" intelligence, and age. Sighted subjects were selected to match the sex, age, and socioeconomic status of the blind children.

The relatively small sample and lack of randomness in selection of subjects may prohibit generalization of the results. However, the present study was designed to explore these areas of semantic/cognitive functioning among congenitally blind children within this age range to help fill the gap in existing research. It was anticipated that areas for further investigation would be highlighted as a result of this study.

Definition of Terms

Definitions of specific terminology used in this study are as follows:

Congenital blindness. During the planning stage of this study, congenital blindness was defined as blindness from birth or occurring within the first 12 months of life. All visually handicapped children actually involved in the research were blind from birth.

Total blindness. Total blindness was defined as light perception or less. Seven of the blind children were entirely without vision since birth, two had some light perception, and one was able to distinguish some color.

"More tangible" objects. These were operationally defined as objects which could be completely encompassed tactually and held within the hand. Included within this category were: ball, pencil, spoon, block, rope, key, doll, comb, cup, and brush.

"Less tangible" objects. These were operationally defined as objects which could be experienced tactually, but could not be completely encompassed nor held within the hand. These objects were: tree, car, house, yard, bush, street, bus, wall, door, and building.

Attribution. This term refers to the assigning of descriptors (functional, perceptual, etc.) to the objects used in the verbal and tactual attribution tasks.

Dimensional adjectives. The five pair of polar adjectives of dimension were: big/small, long/short, tall/short, wide/narrow, and thick/thin.

Unmarked adjectives. The positive-pole adjectives (big, tall, long, wide, thick) were referred to as unmarked adjectives (E. Clark 1972; H. Clark 1970). These adjectives can be used in a nominal sense to infer the presence of an attribute (e.g., "long" = presence of length) or in a contrastive sense (e.g., "X" is longer than "Y").

Marked adjectives. The negative-pole adjectives (small, short, narrow, thin) were referred to as marked adjectives (E. Clark 1972; H. Clark 1970) in that they are generally used only in the contrastive sense (e.g., "X" is shorter than "Y"). Marked adjectives infer the absence of some attribute (e.g., "short" = absence of length).

CHAPTER II

REVIEW OF THE LITERATURE

The present study proposed to explore the semantic and cognitive functioning of congenitally and totally blind children in an attempt to gain insight into how such children conceptualize the world. Interest was not in language development per se, but with the semantic aspects of language as related to cognitive development in the child. Both terms--cognition and semantics--are understood as referring to meaning. Their distinction is taken from Beilin (1975) who referred cognition to "the processes and structures by which meaning is known, represented, and created" (p. 347). Such meaning occurs within the context of action, play, imagery, or language. The cognitive aspects of meaning that exist in language are identified as semantics. Dale (1976) further underscored the relationship between semantics and cognition:

> The question of How do children express ther ideas? cannot be neatly separated from the question What kinds of ideas do children have to express? Therefore understanding of semantic development requires a deeper understanding of cognitive development (p. 166).

Hence, the review of literature which follows will initially seek to establish the relationship between language and thought. The development of word and concept meanings will be explicated within the broader view of cognitive development which has provided the framework within which the present study was undertaken. Research relative to the cognitive and conceptual development of congenitally blind children will then be reviewed.

Language and Thought

The Basis for Meaning

Bloom and Lahey (1978) suggested three major components of language: content, form, and use. The present study was concerned with the content of language, i.e., its meaning or semantics, "the linguistic representation of what persons know about the world of objects, events, and relations" (Bloom & Lahey 1978, p. 14). The three primary categories of language content delineated by these authors were object knowledge, object relations, and event relations. Object knowledge included knowledge of particular objects and classes of objects. Included within the object relations category are (a) reflexive object relations, which have to do with the relation of the object to itself; (b) intraclass relations consisting of the attributions or properties that discriminate among objects of the same class; and (c) interclass relations which express the locative, action, and/or possession relationships between objects. The third category, event relations, includes both intraevent and interevent relations expressing such relationships as time, sequence, causality, and mood (Bloom & Lahey 1978, pp. 11-15). When the content of language is understood in these terms, it becomes apparent that any discussion of the origin or basis for meaning must center on the underlying cognitive structures of the individual.

The question of whether the knowledge of objects, events, and relations which contribute to language content arises as a mere copy of reality or results from an individual's unique construction of reality has been extensively investigated by Piaget and others in the field of child development. Piaget's studies of the problem of epistemology have led him to conclude, "The essential functions of intelligence consist in understanding and inventing, in other words of building up structures by structuring reality" (Piaget 1969, p. 27). Knowledge of an object is derived from acting upon, or transforming it. Such manipulation of reality is initially carried out through direct sensorimotor actions performed with or upon the object. Older children are able to transform reality via internalized mental operations. As a result of these transformations children discover properties and relations of objects and events in reality (Morehead & Morehead 1974, p. 157).

The elements involved in the content of language as described by Bloom and Lahey relate to the three types of knowledge discussed in Piagetian theory: physical knowledge, logical-mathematical knowledge, and social-arbitrary knowledge. Wadsworth (1978) explained that physical knowledge is derived directly from objects as a result of the child's actions upon them, and relates to the physical characteristics of the objects themselves (e.g., size, shape, weight, etc.). Logical-mathematical knowledge, on the other hand, is constructed from the actions which are performed on objects; i.e., knowledge which is "invented" by the child, irrespective of the properties or characteristics of particular objects. One-to-one correspondence and conservation of substance are examples of logical-mathematical knowledge. Social-arbitrary knowledge differs from the above in that it is abstracted from the child's interactions ("actions upon") other people. Moral values, rules, and language itself are examples of social-arbitrary knowledge.

Knowledge, so considered, is rooted in the actions and coordinations of the sensorimotor period of development (Sinclair 1975), and it is upon those basic structures that "superstructures" such as language are built (Oleron 1977). The coordination of sensorimotor schemes is viewed as a necessary precondition for the acquisition of language (King 1975; Sinclair-de-Zwart 1969).

Contributions of Sensorimotor Intelligence

The relationship of linguistic content to cognitive structures originating during the sensorimotor period of development is underscored by Piaget and Inhelder (1969) who stated:

> The system of sensori-motor schemes of assimilation culminates in a kind of logic of action involving the establishment of relationships and correspondences (functions) and classification of schemes (cf. the logic of action); in short, structures for ordering and assembling that constitute a substructure for the future operations of thought. But sensori-motor intelligence has an equally important result as regards the structuring of the subject's universe . . . it organizes reality by constructing the broad categories of action which are the schemes of the permanent object, space, time, and causality, substructures of the notions that will later correspond to them (p. 13).

Verbal language usually develops toward the end of the sensorimotor period and builds upon those cognitive structures which result from the accomplishments of that period, principally the formation of the object concept, achievement of object permanence, and the development of the symbolic function (Beilin 1975; Corrigan 1978; Cromer 1974; Furth 1966; Morehead & Morehead 1974; Sinclair 1975, 1976; Sinclair-de-Zwart 1969).

The importance of the object concept and object permanence was well stated by Beilin (1975) and by Furth (1966):

> Although objects appear at first to have no permanence, the conception of object permanence becomes the first conceptual invariant in the child's cognitive repertoire. It also marks the clear differentiation of the child himself from the world of objects. Out of this differentiation come three major classes, the self (the agent of action), objects (the objects of action), and the action relation between them (Beilin 1975, p. 340).

> To learn to name a thing presupposes the kind of basic knowledge of the permanence of things which was described as object-constancy or object-formation. Once the child has acquired this intellectual skill of regarding objects-as-being-out-there and not merely as objects-to-react-to, then he can assimilate the name to the object-as-known (Furth 1966, p. 193).

Corrigan's (1978) empirical examination of language development and object permanence evidenced some relationship between the beginnings of stage six of object permanence (roughly 12 months of age in that study) and the onset of single-word utterances. Corrigan also reported that her subjects did not use words signifying the semantic category nonexistence ("allgone") until after they demonstrated that the concept of object permanence had begun to develop.

Moerk (1975) considered the development of the action concept in which the infant learns means-ends sequences, as also being a basic substructure for language development. As the child uses locomotion to approach the object(s) of attention, and becomes involved in actions which affect objects (e.g., dropping the spoon on the floor), the action concept develops. This basic concept is furthered as the child begins to imitate the actions of others and to attempt to motivate others to action. Moerk related the action concept to the linguistic development of the use of transitive and intransitive verbs.

In the same article, Moerk discussed the concepts of relations between persons and objects, and relations between objects and events. Considered as contributory to the development of such concepts are the actions of reaching, grasping, and locomotion leading to the coordination of means and ends by the end of the sensorimotor period, and the development of spatial, causal, and temporal relations. Moerk applied these relational concepts to the linguistic realm in terms of verb-object, subject-object, and subject-verb constructions, and the use of adverbs and prepositions.

The Symbolic Function

The symbolic, or semiotic, function originates during the latter part of the sensorimotor period (Piaget & Inhelder 1969). This ability to symbolize refers to the ability to make something stand for or represent an object or event not perceptually present (Bowerman 1974). This is accomplished by means of a signifier which is differentiated from the actual object or event. Piaget listed five behaviors characteristic of the symbolic function: deferred imitation, symbolic play, drawing, mental image, and language.

Deferred imitation, or imitations of actions or events in the absence of the original, marks the beginning of symbolic functioning and is evidenced after the establishment of the object concept (Furth 1970). Language stands as the most advanced form of symbolic functioning and makes use of arbitrary and conventional (socially shared) signs--words--to represent objects and events. Language thus becomes a means of communicating and representing what is known as well as being an object to be known in itself (Sinclair 1975).

As a psycholinguist working within a Piagetian framework, Sinclair (1976) concluded that the capacity for symbolic representation of absent objects or events is essential to thought. She qualified this statement by adding that language per se is not necessary for thought, merely some form of representation or symbolization. The studies of Furth (1966) and Oleron (1977) with deaf individuals amply support this view regarding thought without language. The advantage of symbolic representation is that it enables thought to be detached from action, thereby increasing the range and rapidity of thought (Cromer 1974; Piaget & Inhelder 1969; Wadsworth 1978).

Language Acquisition

Sinclair (1976) suggested that the action patterns acquired during the sensorimotor period provide the child with "the necessary assumptions to start language learning" (p. 212). She drew a parallel between language acquisition and the development of physical and logical-mathematical knowledge:

> It can be supposed that the two poles of human knowledge are also reflected in language behavior; a parallel can be drawn between the acquisition of lexical items and knowledge of properties of physical reality, on the one hand, and between syntactic structure and logical organization of action and thought on the other (Sinclair 1976, p. 212).

Furth (1966) held that symbolic thinking of the preoperational stage is actually a period of transition between the pre-representational thinking of the sensorimotor period of action, and the formal thinking characteristic of operational intelligence (p. 184). The preschool child is typically functioning at the preoperational level of cognitive development and, when confronted with ready-made verbal signs (words which have no inherent meaning or similarity to that for which they stand) must assimilate those signs into his own thought structures by assigning meaning based on his own experience. The essentially arbitrary nature of these signs frequently makes it difficult for children to grasp and use (share) them appropriately (Voyat 1972).

Edmonds (1979) asserted that children acquire words via "the process of imitating adult words <u>as children perceive them</u>" (p. 31). She explained that this means that the child attempts to match his use of the words with his own internal image of the adult word. However, since children's organization (construction) of the world is qualitatively different from the adult's, Edmonds concluded that, though the child may produce the same word as the adult, the meaning of the word for the individual child may be idiosyncratic and personal, or shared only by the immediate family.

Initially, therefore, words will lack specificity of meaning (from an adult standpoint). At the onset of the preoperational period the child's symbols--imitation, play, imagery, and/or words--will be of a highly personal nature and will be tied closely to the actions of the sensorimotor period. It is only through repeated verbal interaction with others and continuous reorganization and development of cognitive structures (leading to the development of social-arbitrary knowledge), that socially shared meanings for verbal signs increases.

> The child's first verbal productions in the sense of recognized words are far from signs in the sense of belonging to a linguistic system. They are more like symbols which are isolated representations of a scheme; for example, "cup" may mean a container or "I want a drink" (King 1975, p. 294).

Preoperational Stage

Just as there are many developmental changes occurring in the sensorimotor and preoperational levels of functioning which contribute to linguistic-semantic growth, there are also certain characteristics of the preoperational period which get in the way of development. The child's reasoning during this stage is characterized by egocentrism which causes the child to "assume that everyone thinks as he does, and that the whole world shares his feelings and desires" (Pulaski 1971, p. 40). Such reasoning makes it impossible for the child to understand the meanings of words used by others (even his peers) if their experience with objects or events has been significantly different. The child will apply his meaning of the word, or interpret events of the basis of his experience, thereby limiting true communcation. It is only gradually that his linguistic and cognitive understanding improves to the point that words and concepts hold the socially accepted meaning.

In addition, egocentrism causes the child to regard his perspective as immediately objective and absolute, causing him to believe all things to be equally real, e.g., words, pictures, dreams, feelings (Pulaski 1971). This attitude of realism convinces the child that what is real for him must exist in the objective world. When applied to words which name objects, Piaget (1967) referred to this notion as <u>nominal realism</u>. Recent studies (Williams 1976, 1977) have confirmed that this belief that the name of an object is intrinsic to the object and not changeable can be observed in children 6 to 7 years of age.

The cognitive functioning of children during the preoperational stage is further characterized by reliance on perceptual information and transductive reasoning. Judgments tend to be made on the basis of how things appear and, generally, the child's attention is focused on a perceptually dominant feature. Such perceptual centration appears to prevent the preoperational child from realizing that an object can possess more than one property at the same time (Stephens & Simpkins 1974). As a result, concept development at the preoperational stage remains immature.

The Role of Language in Thought

From a Piagetian perspective, some form of representational skill is necessary for cognitive development to proceed during the preoperational period, but that skill need not be verbal language (Wadsworth 1978). Rather than being the source of logical reasoning, language is viewed as being structured by logic (Sinclair-de-Zwart 1969; Voyat 1972).

In discussing the cognitive basis for language learning in infants Macnamara (1972) asserted that "the infant uses meaning as a clue to language, rather than language as a clue to meaning" (p. 1). Basing his conclusion on the work of Piaget and Sinclair, Macnamara observed that at the time infants begin to learn verbal language, cognitive ability is already evident. Although language plays a role in thought, "the basic process of cognition seems to be a function of an active organizational mechanism, deriving from actions that the child brings to his experience" (Voyat 1972, p. 250). Of course, the child is not equipped with a complete set of cognitive structures at the time when language begins, but language does not play a direct role in the acquisition of knowledge until the development of formal operations. Wadsworth (1978) concluded: "Language is never the source of knowledge. Physical knowledge and logical-mathematical knowledge cannot be acquired through language (reading, listening); they are acquired through active experience with objects" (p. 71).

Sinclair-de-Zwart (1969) suggested that language be studied as a part of the symbolic function, within the framework of the child's total cognitive activity rather than as an autonomous object of knowing (p. 335). Poulsen (1977) further posited that an evaluation of the child's understanding of his world is made possible by assessing the presence and quality of his symbolic functioning. The present research has sought to explore the linguistic and cognitive functioning of congenitally blind youngsters from this perspective.

Development of Word and Concept Meaning

Bloom and Lahey's (1978) discussion of the three major components of language (content, form, use) stressed the interaction of the three in expressing the full meaning of verbal pronouncements. Present concern, however, was with "lexical semantics" (Perfetti 1972)--the meaning attributed to individual words, and what this reveals of the congenitally blind child's conception of his world. Grammatical and syntactical relationships were not considered in the analysis of the data.

In his discussion of concept formation, Elkind (1969) specified two kinds of content. Extensive content refers to the realm of objects that a concept denotes and includes all the exemplars of the concept. An example is the concept category "DOGS" which includes Terriers, Beagles, Great Danes, Dachshunds, etc. Intensive content refers to the common feature(s) connoted by all the exemplars of the concept;

e.g., "DOGS" are furry animals, have four legs, etc. In distinguishing between these two kinds of content, Elkind suggested that intensive content is what is being assessed in verbal definition procedures, which was the approach used in the present study.

Semantics and Cognition

Bierwisch's (1970) discussion of semantics highlighted the relationship of components of linguistic meaning to the individual's mental representation of physical objects and events. According to Bierwisch, the world is perceived and organized in accord with the cognitive and perceptual abilities of the individual; the semantic features by which the object or event is "known" would then correspond to the individual's perception, which may or may not be an exact representation of reality.

> The semantic features do not represent, however, external physical properties, but rather the psychological conditions according to which human beings process their physical and social environment. Thus they are not symbols for physical properties and relations outside the human organism, but rather for the internal mechanisms by means of which such phenomena are perceived and conceptualized (Bierwisch 1970, p. 181).

Thus, the manner in which a child perceives and mentally represents objects or events gives structure to the lexical meanings of words for that child (Bloom 1975).

In the view of theorists such as Bloom, Piaget, and Sinclair, language acquisition can be described as "a matter of mapping linguistic structures on previously acquired averbal cognitive concepts" (Blank & Allen 1976, p. 260). The infant first determines the meaning a speaker intends to convey, independent of language, and then works out the relationship between the meaning and the words (Macnamara 1972). Consequently, cognitive concepts which initially develop during the sensorimotor period form the basis for the acquisition of the child's first words (linguistic concepts). Dale (1976) theorized that there is an ongoing, complex interaction between the development of semantic and cognitive concepts.

Semantic Features Hypothesis

The notion that the meaning of individual words consists in a list of semantic features or components has been suggested by a number of theorists (e.g., Bierwisch 1970; Katz 1972; Nida 1975). E. Clark (1972, 1973, 1974, 1977a, 1977b) built upon this idea and developed the semantic features hypothesis according to which the meaning of individual lexical units (words) is acquired by successively adding semantic features.

Clark (1977b) stated that it is "the child's cognitive, nonlinguistic knowledge that provides him with his first hypotheses about what words might mean--what the mapping is between what he knows and the words that others use" (p. 147). She identified the cognitive basis for language as consisting primarily of perceptual information gathered through the various sense modalities, particularly perceptual attributes involving shape, movement, size, sound, and texture (1974; 1977b). The first meanings a child attaches to words is founded upon the perceptually based knowledge he has of objects in the world and their relation to one another and to himself (1977a; 1977b).

When confronted with a new word, the child makes an hypothesis as to what that word might mean: "A word refers to some identifiable (perceptually salient) characteristic of the object" (Clark 1974,

p. 116). On the basis of this hypothesis the child then employs the following strategy:

> Pick out whatever seems to be the most salient characteristic(s) perceptually, and assume (until given counter-evidence) that that is what the word refers to. Act on this assumption whenever you want to name, request, or call attention to something (1974, p. 116).

On occasion the meaning of a word, so assigned, will correspond to the adult's meaning of the term. In many instances, however, this will not be the case; the child's initial use of the word will reflect less than the full, adult meaning because the child has not acquired all of the features, or components, that make up the meaning of the word. The tendency will be for the child to learn general features first, with more specific features being added over time. Clark (1973) stated: "The acquisition of semantic features, then, will consist of adding more features of meaning to the lexical entry of the word until the child's combination of features in the entry for that word corresponds to the adult's" (p. 72).

In stressing the perceptual basis for the acquisition of word meanings, Clark's theory differs from theories based on Piaget's concepts (e.g., Sinclair 1975, 1976; Sinclair-de-Zwart 1969) which stress the child's actions as the groundwork for meaning. As discussed earlier, basic cognitive concepts of object, agent, space, time, and causality develop as a consequence of the child's continued interaction with the environment. A parallel can be seen in the child's early verbal productions which contain the semantic roles of agent, object, action, and location. Such a view suggests that concepts are formed on the basis of functional rather than perceptual characteristics:

"Those things are similar that can be acted upon in the same way" (Nelson 1974, p. 274).

Functional Core Concepts

Nelson (1974, 1977) rejected the semantic features hypothesis for the acquisition of meaning and proposed that children's concepts are built up through interactions with people and things: "The child is never in a position of having to construct relationships among static objects; he lives in, interacts with, and utilizes information from a world of dynamic relations from the onset" (1974, p. 280).

From this perspective, concern is not with the accumulation of invariant common attributes, as in the semantic features hypothesis, but with the individual function and identity. The functional core concept presents a model which:

> . . . emphasizes that an object is first identified as having important functional relations; that these relate the object to self and other people through a set of acts; and that perceptual analysis is derivative of the functional concept, not a priori essential to it (1974, p. 284).

Hence, the central meaning of a concept will be <u>functional</u>, reflecting the action-relationship between the child, the object, and other individuals as experienced by the child. Consequently, the functional core will vary from child to child and from child to adult (Nelson 1974). Later, perceptual-descriptive information relating to the invariant identifying characteristics of "members" of the concept-group will be added to the core meaning. A word-name will ultimately be assigned to the concept, but the definition of that word will be determined by its functional core meaning for the individual (Nelson 1974). Blank and Allen (1976) labeled Nelson's model a "concept-matching" scheme in which the child learns to match words he hears with objects and relations already understood on a nonverbal level (p. 275).

Words, Meanings, Concepts

The semantic theories reviewed herein are consistent in suggesting that the concept exists prior to the learning of a word-name to label the concept. The major distinction between theories is in regard to the basis upon which meaning is derived: perceptually gathered features (Clark), information gathered from action (Sinclair), or functional-relational information (Nelson). It is probable that the distinction between theories is not that significant or real, that they are not mutually exclusive (Dale 1976). Rather, it is here suggested that they can be considered as one by reasoning that perceptual information is gathered as a result of the sensorimotor actions upon the objects within a functional-relational context.

The theories also have in common the notion that concepts are initially individualistic. As Carroll (1964) stated, "Concepts are, after all, essentially idiosyncratic in the sense that they reside in particular individuals with particular histories of experiences that lead them to classify those experiences in particular ways" (pp. 183-184). The "true" meaning of a word is socially-standardized (Carroll) and, for communication among individuals to be effective, the initial idiosyncratic concept must conform to societal usage. Nelson (1977) explained:

> We have two levels of conceptual organization, one social and linguistic, the other personal and cognitive. There are, in addition, two layers of concepts at each level--one stable and defining, the other flexible and inclusive. To learn the

> meaning of a word, the child must eventually match his own core concept meaning to the narrow linguistic concept. If these do not match, the word may be used inappropriately (p. 132).

Semantic Growth

Semantic growth can be viewed as a progression from the general to the specific, broad to narrow, simple to complex. As the child's experience with objects, events, people, and language continues, his conception of the world and its elements and relationships also undergoes change. With linguistic and cognitive development, concepts become more complex, "more loaded with significant aspects" (Carroll 1964, p. 183). Discrimination of the features or critical attributes of objects, and the learning of lexical terms to identify them, leads to more precise and specifiable concepts. At the same time, the child becomes more able to differentiate likenesses and differences in objects or events and to form classifications accordingly. Hierarchical and multiple classification results from cognitive growth and adds structure to linguistic (semantic) development.

Dimensional Adjectives

As stated previously, the semantic features hypothesis predicts that the most common features of a word will be acquired first. This will result in a period during which antonyms are regarded by the young child as synonomous. Donaldson and Balfour (1968) found this to be the case in meanings assigned to the words/concepts "more" and "less" by a group of 3 and 4 year old children. They reported that the children recognized that both terms had reference to quantity (the general, common feature) but that the children assigned to both terms the meaning of "more."

The semantic features hypothesis has particular value in that it provides a framework in which to examine and interpret data regarding the acquisition of word meanings (Dale 1976; Eilers, Oller, & Ellington 1974). The acquisition of spatial-comparative adjectives such as big/little, long/short, tall/short, wide/narrow, and thick/thin, has been studied repeatedly from this perspective (Brewer & Stone 1975; Donaldson & Wales 1970; E. Clark 1972, 1974, 1977b; H. Clark 1970; Eilers et al. 1974). H. Clark (1970) submitted that polar adjectives can be described as being either positive or negative, depending on the extent of dimension implied. The positive, or unmarked member of the pair indicates physical extension along a dimension, e.g., big, tall, long, wide, thick. According to H. Clark, such terms have two possible uses: (a) nominal, in which the term refers to the existence of the dimension itself--as in "long" meaning "of the dimension length"; and (b) contrastive, in which comparison against a standard is implied--as in "long" meaning "longer than average" (p. 270).

Negative, or marked adjectives (little, short, narrow, thin), however, have only the contrastive meaning; they cannot be used in the neutral (nominal) sense. The question "How long is that board?" is semantically comparable to "What is the length of the board?" In this example, long is used in the nominal sense; the negative pole, short, could not be used similarly (e.g., "What is the shortness of the board?"). In H. Clark's view,

> The nominal long is semantically prior to both the contrastive long and the contrastive short. We must posit the dimension length before we can speak of measurement on the dimension - long (= "much length") and short (= "little length"). We might characterize the nominal long as superordinate to the contrastive long and the contrastive short (p. 271).

E. Clark's (1972, 1974, 1977b) application of the semantic features hypothesis to the acquisition of polar adjectives of dimension was based upon H. Clark's reasoning. She concluded from her work with young children that children "consistently learn to use and understand positive terms before negative ones" (1974, p. 120). This is so, she surmised, because the child has an a priori preference--a sort of inborn attraction--for objects representative of greater extent, thus making it easier to map positive terms than negative (1974, 1977b).

The semantic features hypothesis holds that meaning increases as additional features are linked with words. The acquisition of spatial dimensional adjectives will follow an order from the simplest to the most complex; i.e., those with the fewest conditions or features will be acquired first. Clark (1972) hypothesized that children group words that share common features of meaning into a "semantic field." She further hypothesized that children will substitute words based on these shared features. Such substitutions will frequently be incorrect from an adult standpoint because the child's meaning for more specific terms may be shy some of the significant features. As a result, words may be overgeneralized in the child's usage. On this basis, Clark predicted the following order for the acquisition of dimensional adjectives: big/small before tall/short and long/short; long/short before thick/thin and wide/narrow. Using a word game involving verbal opposites, Clark (1972) tested 30 children ranging in age from 4 years 0 months to 5 years 5 months and found support for this hypothesis. She concluded that the order of acquisition was accurately predicted by relative semantic complexity.

Brewer and Stone (1975) tested 28 children (CA 3 years 6 months to 5 years 3 months) as to their understanding of spatial dimensional adjectives by having them choose from four objects that one which represented the test word. Brewer and Stone found the same order of acquisition for adjective pairs as Clark (1972) had reported. Also, the unmarked, positive adjective tended to be acquired before its marked antonym. They reported, however, that the most common error made by the children was to select the object representing the same polarity (marked or unmarked) as the word requested, rather than an error on the dimension itself (e.g., long for tall). They concluded that polarity is acquired before dimension, making polarity the more common feature.

Eilers, Oller, and Ellington (1974) attempted to evaluate the acquisition of word meaning for dimensional adjectives in children younger than previously studied, i.e., 2 and 3 year old children. In the first of their experiments, children were asked to give the examiner the _____ object (filling in the blank with one of the polar adjectives). The second experiment had two parts: (a) subjects received more elaborate instructions similar to those of the first experiment; e.g., "Here are two cans. One is big and one is little. Give me the little one" (p. 199); (b) evaluation was made of the non-semantic size preferences of the children by giving simple instructions such as "Here are two cans. Give me one" (p. 200). Eilers et al. found support for the prediction of the semantic features hypothesis that the trend in understanding dimensional adjectives is from general to complex (specific) terms. But their findings did not support the belief that marked antonyms (negative pole) are interpreted as having the same meaning as unmarked (positive pole) antonyms in their early development. The second experiment conducted by Eilers et al. indicated that spontaneous size preferences of the children may interfere with the "purity" of this type of research and that semantically irrelevant factors (such as a natural attraction to the big or small object) cannot be ignored in the interpretation of results.

As useful as the semantic features hypothesis may be in setting up research to investigate the acquisition of certain terms, it is far from perfect. In trying to comprehend semantic development, this review has considered only a small representation of the research into the acquisition or development of word meanings; just enough to establish a base from which the present research was built. The following lengthy quotation from Dale (1976) summarizes:

> There is no single framework that covers all children, all word meanings, and all patterns of development. . . . Some words are usefully described as bundles of semantic features (the dimensional terms, before and after), whereas others have to be discussed in terms of focal concepts (the color words) or relations among components (verbs of possession). And finally, in some instances development is the acquisition, gradual or sudden, of features and relations that permit performance more nearly approximating the adult norm, whereas in other instances (big) performance may actually deteriorate for a time. In some instances semantic development is tied rather closely to the child's level of cognitive maturity (left/right, the articles), whereas in others cognitive factors do not seem to play a role in determining the point of mastery. . . . Semantic development is as varied as the concepts that language encodes (p. 189).

Studies with Congenitally Blind Children

Cognitive Development

Lowenfeld (1973) suggested that blindness imposes three basic limitations on the individual in terms of (a) the range and variety of experiences available, (b) mobility, and (c) interaction with the environment. Piagetian theory holds that social and physical interaction are key elements in cognitive growth. As a result of interacting with the environment, information gathered through the child's sensory and motor avenues is "stored" in representational form (symbolic play, mental image, language). The blind child, however, lacks the "integrating, instantaneous, and simultaneous provision of information" that vision allows, such that "information comes to a blind child in fragmented fashion and is difficult to verify" (Davidson 1976, p. 18). Consequently, the blind child must rely on less sophisticated sensory discrimination processes (Gottesman 1976). Warren (1977) observed:

> The totally blind child must, of course, build up concepts of the world on the basis of other than visual information, while visual information is extremely useful in building concepts for the sighted child. Hearing is of more limited value than vision, and touch is inappropriate for the experience of distant, very large, very small, fragile, or dangerous objects. Color cannot be directly experienced at all. These various limitations make the total experience of the blind child more restricted (p. 83).

Delays have been observed in the physical and motor development of blind children involving balance and posture, locomotion, reaching, grasping, manipulating, and releasing objects (DuBose 1976; Swallow 1976). These delays are attributed to the lack of visual stimulation which would call the child's attention to events or objects in his environment and thus encourage interaction and imitation. Scholl (1973) concluded that the child's "visual impairment places him at a disadvantage in the areas of sensory stimulation, concept formation, and communication" (p. 81). Thus, it has been hypothesized that the cognitive development of the congenitally blind, as defined and measured by Piagetian theory, will be delayed.

Studies of Cognitive Development

The development of cognitive functioning in congenitally blind children has been repeatedly studied using measures adapted from those developed by Piaget to assess the major concepts of conservation, classification, and seriation (e.g., Brekke, Williams, & Tait 1974; Friedman & Pasnak 1973; Gottesman 1973, 1976; Higgins 1973; Miller 1969; Stephens & Simpkins 1974; Tobin 1972). The findings of these studies have confirmed that congenitally blind children follow the same developmental pattern as sighted children but at a slower rate. While vision is not essential for the development of these operations (Gottesman 1973), delays in their development occur because tactual experience alone is not sufficient to overcome the deficit in cognitive visual functioning (Miller 1969). Underscoring the importance of the kind, quality, and number of concrete experiences provided for blind children as a means of stimulating interaction with the environment and fostering cognitive growth, several of the studies reported differences in performance in favor of blind subjects chosen from a non-residential setting over against those selected from a residential school (Brekke et al. 1974; Gottesman 1976; Tobin 1972).

A major study of the cognitive development of blind children was that undertaken by Stephens and Simpkins (1974; also reported in Simpkins & Stephens 1974). Subjects for this study consisted of 75 congenitally blind children ranging in age from 6 to 18 years. The researchers administered 26 reasoning tasks designed to measure conservation, classification, symbolic imagery, and formal operations. The results obtained from this research were compared with previously collected data from sighted children of the same ages (Stephens, Miller, & McLaughlin 1969). Analysis of the results confirmed the findings of other researchers that cognitive growth in congenitally blind children occurs at a slower rate than in sighted children. Stephens and Simpkins interpreted their results as suggesting a severe deficit in cognitive functioning among blind children. Significant differences were obtained on 19 of the 26 reasoning variables, all in favor of the sighted subjects. It was concluded that logical thought involving spatial orientation, mental imagery, class inclusion, and classification were areas of particular difficulty for the visually handicapped.

Construction of Reality

The totally blind child's lack of mobility and consequent deprivation of experiences and interactions with his environment impedes the development of physical and logical-mathematical knowledge (Swallow 1976). It follows, then, that such children will understand and organize their world differently than will sighted children (Wills 1965). Wills (1965), writing from a psychoanalytic viewpoint, described young blind children as experiencing difficulty in distinguishing reality from fantasy and as being inclined to animistic thinking (assigning life to inanimate objects). She further reported that a partial understanding of common objects based on limited direct experience with the objects is common among blind children; typically, her subjects based their judgments upon insufficient or incomplete perceptual clues.

Santin and Simmons (1977) argued that the congenitally blind child develops and organizes his perception of the world differently than the sighted child. They held that the blind child is forced to construct a model of the world based on "inconsistent, discrete, and generally unverified fragments of information" (p. 427) which form a different "data base" than that from which sighted children work.

Stephens, Smith, Fitzgerald, Grube, Hitt, and Daly (1977) discussed in detail the effect of the absence of vision on cognitive development during the sensorimotor and preoperational periods, basing their implications on the research of Stephens and Simpkins (1974) and Adelson and Fraiberg (1974). They concluded that because of limited interaction with objects, blind children will display poor understanding of the consequences of behavior, delays in the differentiation of self from the environment (cf. Fraiberg 1977), a lack of incidental learning, a delay in the development of purposeful behavior, and limited self-initiated experimentation and active exploration of the properties of objects and events. Stephens et al. (1977) concluded:

> The cumulative effect that visual impairment has on the cognitive growth and development of the child becomes increasingly evident during the preoperational stage. . . . The ability to use language as a means of promoting the understanding of concepts develops slowly because the visually impaired child has not yet had ample opportunity to engage in concrete experience. . . . Consequently, the visually impaired child may become more reliant on existing schemas and tend to retain an egocentric view of his experiences longer than his sighted peers. . . . Because of his visual deficit the child relies more heavily on concrete physical experience than does the sighted child. As a consequence there is increased likelihood that concepts are tied more closely to action than to symbolic representation and mental manipulation (p. 36).

Symbolic Functioning

The foregoing quotation from Stephens et al. (1977) suggests that symbolic representation in congenitally blind children is affected by blindness. Fraiberg (1977) also found blindness to be an impediment to the development of representational ingelligence.

Swallow (1976) suggested that qualitative and quantitative differences in the thinking of blind children may be partly attributable to the symbolic function and language. She reasoned that the absence of vision would inhibit the development of deferred imitation which normally marks the beginning of symbolization. Symbolic play is said to be the means by which children adapt to the world of grown-ups, a bridge between concrete experiences and abstract thought (Swallow 1976). According to Piaget (1962), symbolic or make-believe play implies the representation of an object(s) no longer present, and is both imitative and imaginative. The congenitally blind child, however, is restricted in his observation of and encounters with others and is, therefore, "severely limited in the variety of living experiences which form the basis of play" (Swallow 1976, p. 279). Investigations of the play behavior of blind children (Singer 1966; Singer & Streiner 1966; Tait 1972) have confirmed that their play behavior is less imaginative or creative and is more concrete and related to immediate personal experiences.

Mental imagery was found to be an area of weakness among congenitally blind school children (Stephens & Simpkins 1974). Kephart, Kephart, & Schwarz (1974) compared blind and sighted children aged 5 to 7 years as to the range of information they had accumulated about themselves and their immediate environment (house, yard, street, and town). Their study revealed that the blind possess fragmented concepts and restrictive environmental information. The absence of vision as a means of gathering and unifying information about their body and environment was cited as the reason for their limited or misinformation.

Kephart et al. (1974) suggested that auditorily and tactually gathered information was not sufficient to compensate for the visual deficit.

Language is also a part of the symbolic function and allows an individual to represent reality through words that are distinct from that which they signify (Hampshire 1977-78). The concepts acquired during the sensorimotor period serve as roots for the beginnings of language. For the congenitally blind child, however, such "roots" may produce different "flowers of meaning" than those of the sighted child (a) because of the lack of mobility and interaction with objects, events, and persons in the blind child's environment, and (b) because the language used by sighted persons to describe what the blind child experiences through touch, smell, taste, or hearing may not match his sensory experience (Foulke 1964; Santin & Simmons 1977). Stephens (1972) emphasized that language is not sufficient to compensate for the lack of action and concrete experience.

Urwin (1977) reported that many blind children begin speaking slowly and that their speech is frequently restricted to their own body movements, familiar routines, or ready-made phrases "which they may or may not use appropriately to context" (p. 140). Urwin agreed that problems in early language development result from restricted opportunities for active exploration, but added that inadequate social exchanges between the blind child and his sighted parents also interferes with communication. For example, difficulty in focusing on the same object is possible because the child might not "know" the object or event to which the adult is making reference. Burlingham (1961, 1965) also felt that there was a tendency for blind children to use words which were meaningless or which had different meanings for them. She concluded, "concepts may be completely misunderstood or only partially understood; or words may be used merely to imitate or to parrot the sighted" (1961, p. 134). Likewise, Santin and Simmons (1977) hypothesized that blind children may attend to the sounds which comprise the language but not grasp the meaning intended by a speaker. They suggested, "Early language of the blind child does not seem to mirror his developing knowledge of the world, but rather his knowledge of the language of others" (1977, p. 427).

Concept Development

> A lack of recognition of the qualities of objects in isolation prevents the child from forming a meaningful notion of the object and its purpose. Without realistic concepts about his environment, the blind child does not learn to predict, anticipate, or trust the physical world (Rogow 1976, p. 314).

In so stating the problem, Rogow (1976) has emphasized the effects of blindness on concept development and cognitive development in general. Details regarding form, size, and spatial relationships of objects which are normally gathered through vision (Lowenfeld 1973) must be determined through tactual and kinesthetic examination by the blind child, which are generally viewed as being less efficient sense modalities (Santin & Simmons 1977; Warren 1977). Understanding the true nature of the environment and its contents is of particular importance when providing orientation and mobility instruction to the blind children who, in Hapeman's (1967) description, tend "to lack the necessary concrete knowledge of their environments and the necessary basic concepts of distance, direction and environmental changes" (p. 41).

Zweibelson and Barg (1967) posited three levels of concept formation which they applied to the analysis of word meaning:

"1. the term concrete level of concept formation is used where a specific characteristic of the object is considered to be the content;
"2. the functional level of concept formation stipulates the function the object performs, or what one does with it;
"3. the abstract level refers to the general term connoting or summing up all the essential common characteristics of the object" (p. 218).

These researchers sought to determine differences in levels of concept formation between eight blind and eight sighted children between the ages of 11 and 13 years. Each child's response to items on the Similarities and Vocabulary subtests of the Wechsler Intelligence Scale for Children were rated on the basis of whether the responses were concrete, functional, or abstract. Zweibelson and Barg reported that, as hypothesized, blind children did not use abstract concepts to the extent noted in the responses of the sighted children. Rather, the blind subjects' responses were primarily on a concrete and functional conceptual level. Given the trend toward mainstreaming visually handicapped children in the public schools, this difference in conceptual attainment must be considered in order for meaningful communication to ensue.

Boldt (1969) also examined conceptual development in blind and sighted children between the ages of 7 and 17 years. Boldt was concerned with the development of concept formation regarding "scientific and technical phenomena" (p. 5) related to the teaching of science to blind children. Three general levels of concept formation were observed. Level I was described as a "naive subjective relation to the phenomena which are understood from the meaning received from their immediate experiential importance for the subject" (p. 6). Warren's (1977) review of Boldt's study drew a parallel between this level and the sensorimotor period of development in Piagetian theory. Boldt's Level II shows "a certain change of objectivity of the phenomena" (p. 6), but the child's explanations are still closely tied to his subjective experience. Level III constitutes real scientific thinking: "In a truly causal sense, the phenomena are accepted in total objectivity" (p. 6). Boldt's analysis of the data suggested that the blind and sighted progress through the same stages but that the blind children, particularly the congenitally blind, show retarded conceptual development. These findings correspond to those of Stephens and Simpkins (1974) and others, reported earlier.

Verbal Unreality

Burlingham (1965) stated that in the language of blind children, two kinds of words can be observed--those which have meaning for him based on his personal experience, and those which are verbalizations acquired from hearing others speak but which are without meaning for him. Cutsforth (1951) used the term "verbalism" to refer to the use of words or abstract concepts "not verified by concrete experience" (p. 48). In Cutsforth's view, speech and language can broaden the blind child's development through the social relationships they promote and because language provides a means of controlling objects no longer present or within reach. On the other hand, Cutsforth also suggested that the use of sighted language leads to verbal unreality:

> Names to things pass current between the blind child and his seeing associates as though they carried the same meaning for both. But the name of the thing seen, although it may be the same word, has a different meaning from the name of the thing felt or heard. To a far greater extent probably than in the

> seeing, words become a source of self-stimulation, turning the child again toward himself and making him, as do his touch experiences, almost exclusively his own environment. Thus the acquisition of speech serves both to objectify and to socialize the life of the blind child and at the same time to isolate him still further from the seeing world in which he lives. This is the beginning of verbal unreality (Cutsforth 1951, p. 11).

Cutsforth (1951) believed that this situation has profound negative consequences, principally "the unwarranted use of meaningless visual terminology" with the result that "nothing but incoherent and loose thinking is possible" (p. 69).

Cutsforth's conclusion was based on a study he conducted in 1932 which grew out of his concern that blind children were being taught "to overvalue the non-experiential meaning of a socially acquired concept--to live by words rather than by reality" (1932, p. 86). He referred to this tendency as verbal-mindedness, and sought to investigate its prevalence in congenitally and adventitiously blind children (CA 9 to 21 years). Subjects were asked to respond to the name of an object with some quality of that object. Their responses were classified under nine groupings: color, brightness or other visual characteristic, taste and smell, auditory aspects, abstract qualities, texture, size and shape, temperature, and weight. Cutsforth reported a high percentage of visual responses (color, brightness or other visual characteristic) for congenitally blind (48.2%) and adventitiously blind (65%) children. Tactually based qualities (texture, size, shape, temperature, and weight) comprised the second largest group of responses--35.7% for congenitally blind and 24.2% for adventitiously blind subjects. Cutsforth reasoned that the comparative lack of variety in responses from other-than-visual sensory modalities was indicative of a tendency among blind children to underestimate the value of their own experience (1932, p. 88).

The notion of verbal unreality has been challenged, however. Nolan (1960) replicated some of Cutsforth's original work with verbalisms and concluded that a significant problem did not exist among the blind children he studied (CA 9 to 20 years). Harley (1963) tested 40 blind children (CA 6 to 14 years) having light perception or less to explore the relationship of verbalisms to age, intelligence, experience, and personal adjustment. Harley differentiated between "visually oriented verbalisms" meaning the use of words referring to a visual quality of the object of concern (e.g., color), and a "verbalism" evidenced by the child's being able to give a verbal definition of the word but not being able to tactually identify the object. In this respect, Harley expanded the work of Cutsforth (1932, 1951) and Nolan (1960) who studied only the "visually oriented verbalisms." Harley found no significant evidence of a relationship between visually oriented verbalisms and any of the variables. However, he reported that verbalisms were related to age, intelligence, and experience as predicted. As each of these variables increased, verbalisms decreased. Harley submitted that this is so because with increased age comes a greater accumulation of experiences with common objects and, with continued experience comes increased familiarity and facility in tactually examining objects.

Dokecki (1966), from his review of the research regarding verbalisms, concluded that "There is no empirical evidence that would lead one to assume that nonsensory based language need disrupt the thinking process" (p. 529) as Cutsforth (1951) had proposed. Hampshire (1977-78) suggested that the tendency for blind children to show more concern for "things" in their speech than for people, and to ask more questions than seeing children (Maxfield 1936) is a means of compensating for the absence of visual experience. He further suggested that this compensatory use of language could be the reason for verbalisms.

DeMott (1972) studied the affective meaning of 15 concepts using a semantic differential technique in which the subjects were required to rate each concept along a 5-point continuum for 15 adjective combinations (e.g., for the "slow/fast" adjective combination, subjects could respond: very slow, slow, neither slow nor fast, fast, very fast). A total of 143 blind, partially sighted, and sighted children ranging in age from 6 through 20 years were interviewed. The subjects were also given a verbalism test in which they were first required to define the words, then to tactually identify objects corresponding to those words (as had been done in Harley's work). Unfortunately, DeMott did not present the results of this portion of his work.

DeMott concluded from the semantic differential procedure that there were no significant differences between the blind and sighted groups in terms of affective meanings for the concepts measured. DeMott posited that the blind derive sufficient clues from the context in which the words are used so as to assign affective meaning which is essentially equivalent to the affective meanings for the sighted.

Warren (1977) was critical in his review of DeMott's research. Warren cited two qualifications in the interpretation of DeMott's results: (a) the differences in affective meaning which were observed for some of the concepts may have been dismissed too lightly; (b) the differences DeMott reported in the blind children's use of the 5-point rating scale may be significant. DeMott's study showed that the blind subjects tended to give more neutral, midscale ("neither X nor Y") responses than their sighted peers. Warren suggested that this may indicate that the concepts were "less strongly invested with affective meaning" (p. 160) for the blind subjects, even though an averaging of responses showed no significant differences according to DeMott. Hence, Warren concluded that there is continued need for research into the question of verbalisms among blind children.

Summary

The research has shown that the cognitive development of congenitally blind children is delayed as a result of the limitations imposed by blindness. It has been suggested that information about their environment is gathered by the blind child via less efficient sensory means than is true for the sighted child, resulting in fragmented and/or restrictive concepts of objects and the world. Vision is believed to provide a unifying aspect to one's experience enabling a more immediate integration and interpretation of that experience. Given the relationship between experience, cognition, and language, the assumption has been made that congenitally blind children may use words that have little or no meaning for them (verbalisms), or for which they possess a significantly different meaning based on their unique experience and mental representation of objects or events. The present study has sought to investigate representational thought and language in the congenitally blind.

CHAPTER III

DESIGN OF THE STUDY

Introduction

This chapter will explain the procedures undertaken in the present study. Topics to be discussed are: planning the investigation, the research population, the gathering of data, and treatment of the data.

Planning the Investigation

The review of the literature revealed that cognitive development among totally, congenitally blind children is delayed as a result of the limitations imposed by blindness on mobility and interactive experiences with objects and events in the environment. It is generally assumed that information comes to blind children in fragmented fashion because of their reliance on less sophisticated sensory discrimination processes (e.g., Davidson 1976; Gottesman 1976; Kephart, Kephart, & Schwarz 1974; Santin & Simmons 1977). The ensuing difficulties in unifying and organizing experientially gained information may lead to the construction of a model of the world which is inconsistent, incomplete, and significantly different from that of sighted children. Given the relationship between language and cognition, differences in lexical semantics (meanings assigned to individual words) would be expected between blind and sighted children. Problems in the areas of word meaning and concept development--and hence, in communication--become an important consideration in the light of the current emphasis on integration and mainstreaming in the public schools.

If the blind child's experience with objects and events is significantly different from that of sighted children, his interpretation of the experience and assignation of meaning to the object or event will be idiosyncratic and personal. Some inhibition or delay in the development of socially-shared meanings for the words or concepts which represent those objects or events would follow. Cutsforth's (1932, 1951) proposal that blind children merely adopt the language of their sighted peers without fully grasping the meaning of that language would then seem plausible.

The present investigation was designed to explore the symbolic functioning of blind children. It was assumed that the children's attribution of descriptors to selected objects would reflect their mental representation of those objects. By comparing the responses of blind and sighted children it was hoped that insight would be gained into the effect of the absence of vision on children's understanding of common words and concepts, and into the nature of blind children's representational thought.

The theoretical framework developed in Chapter II suggests that language is structured by cognition. Any differences in object concept caused by the absence of vision should be evidenced in the blind child's attribution of characteristics to the objects used in this study. Absence of significant and numerous differences in attributions would indicate that the absence of vision does not significantly alter the object concept from that which the sighted child possesses. If, however, the language of totally, congenitally blind children is simply a reflection of their knowledge of the language of sighted children (Santin & Simmons 1977) then there should be little difference in attribution between vision groups and a high percentage of visually oriented terminology in the language of the blind. Through this examination of their understanding of common words and concepts, knowledge might be gained regarding the congenitally blind child's conceptualization of the world.

Research Population

The ten blind subjects ranged in age from 3 years 8 months to 9 years 11 months, with a mean age of 6 years 10 months. A breakdown by sex, age, degree and cause of blindness is presented in table 1.

TABLE 1

DESCRIPTIVE DATA ON BLIND SUBJECTS

Subject	Sex	Age	Degree of Blindness	Cause of Blindness
#006	F	3-8	Total	Retinal blastoma
#002	M	4-5	Total	Retrolental fibroplasia
#007	F	5-4	Total	Retrolental fibroplasia
#001	M	6-4	Total	Retrolental fibroplasia
#008	F	6-11	Total	Retrolental fibroplasia
#020	F	7-3	LP only	Unknown
#010	F	7-4	Total	Unknown
#018	F	8-0	LP only	Unknown
#009	F	9-0	Color only	Athalmos/scarring
#003	F	9-11	Total	Retrolental fibroplasia

Individuals in this group were gathered from Minnesota and North Dakota through the cooperation of the public schools, State Services for the Blind, and the North Dakota State School for the Blind. Criteria for inclusion in the study were that the children be: (a) congenitally blind, meaning blind from birth or by one year of age; (b) totally blind, meaning light perception or less; and (c) of estimated "normal" intelligence. All but three of the children were without any vision. Two had some light perception, and one had some color vision. All subjects were blind from birth.

The sighted children were selected from the Grand Forks, North Dakota area to match the blind subjects on the bases of age, sex, and socioeconomic status. Sighted subjects ranged in age from 3 years 8 months to 9 years 9 months, with a mean age of 6 years 10 months (see table 2 for breakdown by age and sex). The differences between ages for matched subjects in no case exceeded four months. Statistical comparison of the blind and sighted groups showed no significant difference for CA ($t = 0.02$, $p > .05$).

TABLE 2

DESCRIPTIVE DATA ON SIGHTED SUBJECTS

Subject	Sex	Age
#012	F	3-8
#013	M	4-5
#011	F	5-3
#014	M	6-3
#017	F	6-11
#021	F	7-3
#015	F	7-8
#019	F	8-2
#016	F	9-0
#004	F	9-9

All 20 children were rated by their parents on the Developmental Profile (Alpern & Boll 1972). In this way, it was determined that the children were developing within normal ranges in the areas of self-help skills, social skills, academic skills, and communication skills despite the absence of vision in the blind subjects. The mean ages on the Developmental Profile ranged from 4 years 2 months to 9 years 6 months for the blind subjects, and from 4 years 9 months to 9 years 11 months for the sighted children. Statistical comparison of the groups showed no significant difference in Profile age ($t = 1.19$, $p > .05$).

Determination of socioeconomic status was based on parental occupation, educational level of the father, and educational level of the mother. Statistical comparison of the blind and sighted groups (chi square technique) revealed no significant differences on any of the socioeconomic variables.

Gathering the Data

The Interviews

Each child was interviewed individually by the examiner. The interviews were conducted in a setting which was familiar to the children, usually the child's home. Four of the sighted children were interviewed at the day nursery which they attended regularly. Suitable time was allowed to establish rapport with each child before beginning the actual interview. All data was gathered over one or two sessions, with "break times" provided as necessary for the younger children. Each interview was recorded on cassette tape and transcribed as soon after the interview as possible. A standard protocol was followed during the interviews (see Appendix), although the clinical interview approach allowed the examiner to expand upon the basic protocol in following the lead of the children's comments.

The Instrument

Language assessment. That segment of the interview dealing with the assessment of language was divided into four basic parts. Part I was entirely verbal and was designed to elicit attribution and description of the ten "more tangible" (MT) and ten "less tangible" (LT) objects. Three basic questions were presented to the children, progressing from a general level to a more specific level:

1. What is a ____? Tell me about a ____?
2. What is (does) a ____ for (do)? What can you do with (to) __?
3. What does a ____ look like?

In all cases, children were encouraged to give as complete a response as possible by asking "What else can you tell me about a ____? What else can you do with ____?" or by prodding them to "Tell me more." For some children, all three questions were answered spontaneously in response to question 1, so that it was not necessary to present each question in turn.

For each of the 20 objects the children were asked to respond to a forced-choice question involving polar adjectives of dimension ("Is it big or small? tall or short? wide or narrow? long or short? thick or thin?"). In addition, for each of the MT objects the children were asked to demonstrate the use of the object ("Show me how you use a ____? or "Show me what you do with a ____.") in similar fashion to the Manual Expression subtest of the ITPA (Kirk, McCarthy, & Kirk 1968). These procedures were designed to further reveal the children's mental representation (conceptualization) of the objects and concepts in question.

The children's understanding of the origin of object names, and their belief in nominal realism and animism were assessed by asking:

1. Why is it called a ____? Where did that name come from?

2. Can we call it anything else? Can we call it a ____?

3. Can a ____ feel? hear? think?

This series of questions was asked for five of the MT and five of the LT objects: BALL, SPOON, DOLL, KEY, CUP, TREE, HOUSE, CAR, WALL, and BUSH. Responses to these questions provided additional insight into the children's conception of the objects and the world, as well as further revealing their level of cognitive development.

Part II of the language assessment asked the children to tactually identify actual objects corresponding to the MT items described verbally in Part I. Sighted subjects were instructed to keep their eyes closed while tactually examining the objects for identification purposes. By comparing the number of objects the blind children could describe in Part I with the number of objects they could identify in Part II, any tendency toward verbalism could be determined (Harley 1963). Once the objects had been identified, the children were asked to tell everything they could about the items while still in their possession (sighted children were permitted to use vision at this point). This enabled comparison of attribution based on verbal recall (Part I) with attribution based on tactual and/or visual examination (Part II).

Receptive and expressive use of dimensional adjectives were assessed in Part III. Subjects were presented with two objects that were identical along all dimensions but one, and were asked these questions:

1. Tell me about these two ___. What can you tell me about these?

2. This ____ ix X; this one is _?_.

This portion of the interview was designed to measure expressive use of dimensional adjectives. Evaluation was made as to whether dimensional comparisons were made spontaneously (in response to question 1) or were elicited (question 2), and whether the terms were used correctly. If the correct comparatives were used spontaneously, question 2 was not asked.

Similarly, receptive comprehension of the polar adjectives of dimension was assessed by presenting the children with two objects, identical except along one dimension. Tactual examination of the items was permitted in order for the children to respond to standard questions such as "Which is the longer ____?" The comparative form of the adjectives (" + er") was used in each instance. Thus it could be determined whether the children understood the basic meaning of the dimensional terms. The objects used in Part III were the same as those used in Part II, Tactual Identification and Attribution. The cups, balls, spoons, keys, etc. were common objects purchased in a local discount store and were assumed to be within the experience of the children tested.

In Part IV, subjects were verbally presented with a statement requiring them to choose between two of the LT objects the one which a comparative adjective named; for example, "Which is longer, a car or a bus?" This portion of the interview served to further define the children's mental image of the objects in question and to yield additional data regarding the meaning they assigned to the dimensional adjectives.

Cognitive assessment. Six Piagetian assessments were employed to evaluate the cognitive functioning of the 20 children. The procedures used were patterned after those normally employed in Piagetian-based research (e.g., Stephens & Simpkins 1974). Minimal adaptations were required for the blind subjects to assure that they could tactually observe the transformations or manipulations of the materials.

The reasoning experiments provided assessment of conservation and concrete reasoning, symbolic imagery, and logical-classification. In the administration of the tasks, the children were first given an opportunity to become familiar with the materials used and each child was encouraged to explain his responses to the questions of judgment ("Why? "How do you know?" "Tell me more." etc.) The basic protocol used in the assessment of cognitive ability is given in appendix A.

Conservation of substance was measured by presenting the child with two balls of clay. After the child had agreed that the balls contained the same amount of clay, one was successively transformed into a hot dog shape, a pancake shape, and into a number of pieces. All transformations were made by the children themselves. The question was then raised whether the amount of clay was still the same in each clay object, or if one had more or less than the other.

Conservation of length was measured by two procedures. In the first, children were asked to select the two rods of equal length from a group of four rods. The equal rods were then placed on the table parallel to one another and, with the blind child's hands on top of the rods to enable tactual observation of the movement, one rod was moved a few inches to the right and the subjects were asked whether they believed the rods to be still of equal length. This procedure was repeated with movement of one rod to the left, then with simultaneous movement of both rods in opposite directions. The rods were slightly flattened on one side to prevent rolling so that the blind children were better able to examine the materials.

The second procedure to measure conservation of length made use of two ropes of equal length and thickness. The ropes were placed on the table, parallel to each other as had been done with the rods. The children were given the opportunity to tactually examine the ropes and agree that they were of equal length. Following this, one of the ropes was successively transformed into an "M" shape, a "W" shape, and a "" shape and the child was asked whether the two ropes were still of equal length or if one was longer than the other.

Concrete reasoning was further assessed via an adaptation of the term-to-term correspondence procedure (Wadsworth 1978). Six buttons were arranged in a straight line, each separated by a one-inch space. The children were instructed to select from a group of nine blocks enough blocks to "go with" the buttons; i.e., the subjects were told to place a block in front of each button. Some assistance was required from the examiner as the blind children attempted to match the items. After the children agreed that there were the same number of buttons as blocks, the row of buttons was moved closer together and the question posed, "Now are there as many buttons as there are blocks? Or are there more buttons or more blocks?" A second transformation involved moving the blocks close together while the buttons remained spread out and asking the question as before. The examiner manipulated the blind children's hands as the transformations were made and in the tactual examination of the materials.

Symbolic imagery was assessed by using three differently shaped wooden beads strung on a stiff wire. The shapes were examined by the children and assigned names of their choosing (e.g., round, square, etc.). Assistance was provided as necessary in inserting the beads into a hollow tube. The task required that the children maintain an image of the beads (i.e., their position on the wire) through a series of transformations (rotations) in order to predict which of the three beads would emerge first from the other end of the tube, and to explain why. The rotation of beads task was repeated several times with the tube being rotated 180 degrees and/or 360 degrees to the right or left and the prediction made. The blind children held the tube during these transformations in order to follow the rotations.

Logical-classification was measured by two similar procedures involving square-shapes and circle-shapes. In the first, the children were presented with five round and three square shapes, all of which were covered with rough sandpaper to facilitate tactual examination. The task required that the children determine whether there were more round or more rough shapes. The second experiment involved five round, rough shapes and three round, smooth shapes. The children were again asked whether there were more rough or more round shapes, and to explain the basis for their judgment.

All of the materials used in the reasoning experiments were gathered and/or constructed by the examiner. Adaptations in procedure or materials to accommodate the visually handicapped were adopted from Stephens and Simpkins (1974).

Treatment of the Data

Scoring Procedures

Parts I and II of the language assessment were coded in terms of the type of attributes ascribed to the objects. Thirteen possible categories for creditable responses were delineated; table 3 lists those attribute categories and defines their content. Incorrect responses and the total number of correct responses were also tallied. The means of classifying responses was patterned after the Verbal Expression subtest of the ITPA (Kirk, McCarthy, & Kirk 1968). For each subject, the total number of creditable attributes mentioned in each category was determined for the MT objects, the LT objects, and for the combined group of 20 objects used in Part I.

The manual expression portion of Part I was evaluated in terms of whether or not appropriate gestural responses were made, and whether or not these were accompanied by verbal explanation. The forced-choice responses (dimensional adjectives) were coded as to whether an unmarked adjective (score = 0) or a marked adjective (score = 1) was selected as characteristic of the object. If no choice was made, or if the child indicated that both adjectives could apply to the object, a score of 2 was coded.

Expressive use of comparatives (Part III) was evaluated with reference to the number of spontaneous comparisons made (correct and incorrect) and the dimension specified (size, length, height, width, or thickness), and as to the number of correct comparisons made to elicitation. The receptive comprehension of comparatives was simply

TABLE 3

CATEGORIES OF ATTRIBUTION ON PARTS I AND II

Category	Criteria for Inclusion
1. Label	Naming the common class to which the object belongs (e.g., "toy" for block or ball) or a specific object within a class (e.g., "Pine" or "Spruce" for tree).
2. Color	Any reference to the specific color of the object or to the fact that it has color. For multi-colored objects, credit is received for each color specified (e.g., "the ball is white with red and blue stars" = 3 points).
3. Shape	Any response making references to the general shape of the object (e.g., round, curved, etc.) or to the shape of a major part of the object (e.g., "round cup with a curved handle").
4. Composition	Any statement as to the composition of the object that is not grossly incorrect (e.g., "a rubber ball, filled with air").
5. Function	Any reference to the major purpose of the object (e.g., "a cup is to drink out of") or a generalization (e.g., "a ball is to play with"). Creditable responses will generally be expressed as a verb or a derivation thereof.
6. Action	Reference to actions which can be performed upon or with the object (e.g., "climb a tree") secondarily to its major function (e.g., "pour sand with a cup"). Creditable responses will generally be expressed as a verb or a derivation thereof.
7. Major Parts	Labeling or otherwise identifying or referting to a part of the object (e.g., "eraser, metal thing around it"). Any clear reference to a part of the object is acceptable whether or not it is named by the child.

TABLE 3--Continued

Category	Criteria for Inclusion
8. Numerosity	Use of a number in describing an object or some part of an object (e.g., "4 corners, 1, 2, 3, bedrooms"), or the implication of number (e.g., "a house has lots of windows")
9. Dimension	Use of one or more of the dimensional terms (polar adjectives) in describing the object or a major part of the object (e.g., "the ball is big; the pencil is long and thin").
10. Other Physical Characteristic	Any reference to texture, weight, brightness, or other miscellaneous characteristic of the object or its parts not creditable in another category (e.g., "the pencil has words on it").
11. Comparison	Any response comparing the object to another object having some similarity of color, shape, function, composition, etc. (e.g., "a ball is like an orange").
12. Person, Place, or Thing	Any response making reference to a person, place, or thing commonly associated with the stimulus object, or which the child logically associates with the object because of his experience (e.g., "you use a pencil with paper; eat ice cream with a spoon").
13. Negative Responses	Any response negatively stated (e.g., "it's not too big; I don't play with dolls").

scored as correct or incorrect and the total number of correct responses tallied. Part IV (verbal comparison of the LT objects) was also scored dichotomously and totaled.

The Piagetian reasoning tasks received both a dichotomous score (pass/fail) and a scale score relative to the level of concept attainment (based on Stephens, Smith, Fitzgerald, Grube, Hitt, & Daly 1977).

Point-scale scores for all but the symbolic imagery task (rotation of beads) were as follows:

1 = concept absent

2 = concept in transition

3 = concept attained

The symbolic imagery task was coded as follows:

1 = incorrect response

2 = correct response with no reason given

3 = correct response with reason given

Statistical Analysis

The small sample size (n = 20) precluded the use of advanced statistical procedures to analyze the data. Statistical analysis was limited to a series of t tests to determine differences between the blind and sighted groups. Vision groups were compared for differences on:

1. the Piagetian reasoning tasks
2. verbal and tactual attribution/description (Parts I and II)
   a. between groups
   b. between older blind and sighted
   c. between younger blind and sighted
   d. between younger and older blind
   e. between younger and older sighted
   f. between MT and LT objects for the blind and sighted
3. manual expression for the MT objects
4. expressive and receptive use of comparatives (Part III)
5. verbal comparison on the LT objects (Part IV)

On the basis of the children's performance on the conservation of substance task, subjects were grouped as "conservers" and "non-conservers." These groups were then compared (t tests) to determine if differences existed, as in tests #2a, 3, 4, and 5, above. In addition, t tests were made to compare the verbal attribution and description for the MT objects (Part I) with the tactual attribution and description (Part II) among the blind subjects and the sighted subjects.

The literature review suggested that concepts can be formed on several bases. Consequently, the 13 attribute categories in this study were combined to form three groups: (a) egocentric, combining the Comparisons category and the Person-Place-Thing category; (b) functional, comprised of the Function and Action categories; and (c) perceptual, representing the sum of the attributes in the Color, Shape, Major Parts, Numerosity, Dimension, and Physical Characteristics categories. The egocentric group was formed on the basis that comparisons and the mention of a person, place, or thing associated with the objects would be more personal and related to the individual's experience. Such responses would, therefore, be more egocentric than references to functional or perceptual characteristics. Comparison across vision and conservation groups on these combined attribute categories were made (t tests) as in tests #2a, 2d, and 2e, above. Comparisons of verbal and tactual attribution (Parts I and II) on the basis of these combined attribute groups were also made.

The children's responses to the forced-choice questions of dimension (Part I) were subjected to analysis using the chi square statistic. This enabled analysis of interrelationships among the subjects' choices of dimensional adjectives in describing the 20 objects.

Descriptive Analysis

Because of the essentially exploratory nature of the present study, the data was analyzed descriptively with regard to the type and quality of attribution. Any tendency toward verbalisms was noted. The children's responses were narratively discussed in relation to their performance on the Piagetian reasoning tasks. Note was also taken of any suggestion of nominal realism and/or animism on the part of the blind or sighted children.

CHAPTER IV

ANALYSIS OF THE DATA

The present study was regarded as exploratory in nature owing to the relative lack of data regarding the early cognitive and semantic development of visually handicapped children. Consequently, specific hypotheses were not formulated at the outset, other than the general assumption that differences would be observed between the blind and sighted children on the cognitive tasks and attribution tasks as a result of the limitations imposed by blindness. In the absence of directional hypotheses, two-tailed tests of significance were used in all statistical procedures. Unless otherwise stated, all statistical comparisons were made via t tests. This chapter presents (a) a statistical and descriptive analysis of the performance of the blind and sighted children on the cognitive tasks, and (b) statistical and descriptive comparisons of the blind and sighted children on the lexical-semantic tasks.

Cognitive Functioning

From the review of the literature on cognitive development of visually handicapped children, differences between the blind and the sighted children were expected on the reasoning tasks used in this study. A comparison of the group means on the dichotomous (pass/fail) score and the point-scale score related to the level of concept attainment showed this to be the case. Table 4 presents the means and related t values for the two groups on the six cognitive variables.

TABLE 4

MEANS AND t VALUES FOR COGNITIVE TASKS

		Dichotomous Score			Level of Concept Attainment		
Variable	Group	Mean	t	p	Mean	t	p
Cons. Substance							
	Blind	0.3	2.06	.05	1.2	2.06	.05
	Sighted	1.5			2.0		
Term-to-term Corr.							
	Blind	0.7	1.13	NS	1.7	1.13	NS
	Sighted	1.2			2.2		
Cons. Length (Rods)							
	Blind	0.1	2.20	.05	1.0	2.45	.05
	Sighted	1.2			1.8		
Cons. Length (Ropes)							
	Blind	0.0	3.00	.01	1.0	3.00	.01
	Sighted	1.5			2.0		
Rotation of Beads							
	Blind	2.9	2.90	.01	8.6	3.51	.01
	Sighted	4.3			12.7		
Class Inclusion							
	Blind	0.2	2.05	NS	1.1	2.42	.05
	Sighted	0.9			1.9		

NOTE: n of each group = 10; 18 df for each test.

As indicated in table 4, significant differences in favor of the sighted group appear on the dichotomous scoring for all but two of the cognitive variables (term-to-term correspondence and class inclusion). When the groups are compared with respect to the level of concept attainment, a significant difference also occurs for the class inclusion task.

This may be explained by the fact that two of the blind children responded correctly to one part of the task, but on an apparently intuitive basis. In comparison, five sighted children responded correctly to the tasks and indicated a genuine understanding of the classification concept by the explanation given for their responses.

Conservation and Concrete Reasoning

By listing the actual number of children who "passed" the assessments of conservation and concrete reasoning, the group differences revealed by the t tests become more clear. Table 5 shows the number of blind and sighted children who evidenced achievement of the concepts measured.

TABLE 5

NUMBER OF SUBJECTS SHOWING CONSERVATION AND CONCRETE REASONING

Group	Cons. of Sub.	Term-to-Term	Cons. Length (Rods)	Cons. Length (Ropes)
Blind	1	4	0	0
Sighted	5	6	4	5

Correlation of the data contained in table 5 with the ages of the children shows that no child from either group under 6 years of age is represented. This is consistent with previous research (Stephens, MaHaney, & McLaughlin 1972; Wadsworth 1978) which indicates that the average age at which these concepts are attained is 6 or 7 years. The sighted children, therefore, give evidence of "normal" cognitive development along Piagetian lines: those under CA 7 years appear to be functioning at a preoperational level; those over CA 7 years appear to be operating at a concrete stage. On the other hand, when considered as a group, the blind children are seemingly functioning at a preoperational level of development. As table 5 indicates, only one blind child (the oldest--CA 9 years 11 months) demonstrated conservation of substance, although this child failed to give evidence of concrete reasoning on the remaining conservation tasks. These findings are consistent with previous research showing cognitive delays in school age congenitally blind children. The blind group's performance on the term-to-term correspondence task approximated that of the sighted group.

For purposes of analyzing the attribution data in relation to cognitive development, the 20 subjects were grouped as "conservers" and "nonconservers." This division was made on the basis of the children's performance on the conservation of substance task only, a classic measure of conservation. By this criteria, 6 conservers (one blind and five sighted children) and 14 nonconservers were identified.

Symbolic Imagery

A statistically significant difference between the groups on the rotation of beads task was obtained (table 4). Out of a possible 50 responses, the blind children responded correctly 29 times whereas the sighted children responded correctly 43 times. When matching subjects were compared, the sighted child in all but two pairs had more correct responses than the blind child. In the remaining two instances, the blind and sighted partners had an identical number of correct responses. The data suggests that the blind children may have some difficulty establishing a valid mental image of novel objects and/or in maintaining and mentally manipulating that image through a series of transformations.

Verbal and Tactual Attribution

Blind Group vs. Sighted Group

Overall comparison. Table 6 presents the mean number of responses by the blind and sighted groups in each of the attribute categories for the verbal and tactual attribution tasks (protocol Parts I and II). Data from the verbal attribution task is broken down in this, and all subsequent analyses, to show the number of responses per attribute category for the "more tangible" (MT) objects, the "less tangible" (LT) objects, and the total number of verbal attributes (TVA) in each category that were assigned to the 20 objects.

The analysis shows a significant difference between the blind and sighted groups on the attribute category Color. On both the verbal (MT, LT, TVA) and tactual attribution tasks, the sighted children made more references to the color of the objects than the blind. Given the visual limitations of the blind children this result is not surprising. Table 6 also shows that in describing the MT objects, the blind group made significantly more responses than their sighted peers in the attribute category Person-Place-Thing.

When this data is considered with regard to the combined attribute groups--egocentric, functional, and perceptual attributes--the results are as shown in table 7. Statistical comparison of the groups revealed a significant difference between the blind and sighted groups in the number of

TABLE 6

MEAN NUMBER OF RESPONSES BY VISION GROUP ON VERBAL AND TACTUAL ATTRIBUTION TASKS

Group[a]	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person-Place-Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE															
Blind	1.5	0.2	4.0	1.9	8.2	11.4	7.9	5.3	7.7	2.5	2.2	11.1*	0.6	59.5	0.4
Sighted	0.8	3.1*	4.2	1.9	8.8	9.5	8.8	0.3	4.7	3.1	1.3	6.7	0.6	53.8	0.1
LESS TANGIBLE															
Blind	2.0	1.0	0.6	0.7	6.9	10.0	9.0	1.2	6.4	1.3	1.2	8.9	2.2	51.6	0.5
Sighted	0.9	3.6*	0.9	2.5	7.5	12.4	13.0	2.0	5.0	1.1	1.5	11.8	0.4	62.6	0.6
TOTAL VERB. ATTR.															
Blind	3.5	1.2	4.6	2.6	15.1	21.4	17.1	1.5	14.1	3.8	3.4	20.0	2.8	111.1	0.9
Sighted	1.7	6.7**	5.1	4.4	16.3	21.9	21.8	2.3	9.7	4.2	2.8	18.5	1.0	116.4	0.7
TACTUAL ATTR.															
Blind	10.1	0.9	2.3	2.6	4.2	8.7	13.5	0.7	5.3	6.6	0.5	3.5	3.8	62.7	0.4
Sighted	10.5	9.8**	2.7	1.3	4.9	8.6	14.8	1.9	3.2	12.8	1.0	4.6	1.0	76.7	0.2

[a]n = 10 for each group

*$p \leq .05$

**$p \leq .01$

TABLE 7

MEAN NUMBER OF RESPONSES BY BLIND AND SIGHTED IN COMBINED ATTRIBUTE CATEGORIES ON VERBAL AND TACTUAL TASKS

Group[a]	Egocentric	Functional	Perceptual
MORE TANGIBLE			
Blind	13.3*	19.6	22.6
Sighted	8.0	18.3	24.2
LESS TANGIBLE			
Blind	10.1	16.9	19.5
Sighted	13.3	19.9	25.6
TOTAL VERB. ATTR.			
Blind	23.4	36.5	42.3
Sighted	21.3	38.2	49.8
TACTUAL ATTR.			
Blind	4.0	12.9	29.3
Sighted	5.6	13.5	45.2

[a]*n* = 10 for each group

*$p \leq .05$

egocentric attributions made to the MT objects, the blind having a higher group mean than the sighted. As defined in Chapter III, the egocentric attribute group is comprised of Comparisons and references to a Person-Place-Thing which the child associates with the object in question. Since the blind group made significantly more Person-Place-Thing responses in their description of the MT objects (table 6), it was not surprising to find a similar difference for the broader egocentric attribute group. The blind children also used more functional attributes in their discussion of the objects, while the sighted group used more perceptual attributes.

In their description of the LT objects alone, the sighted children used more attributes in each of the combined categories than did the blind group.

Other response trends evident from tables 6 and 7 (not statistically significant) are as follows. The blind group made more Label, Dimension, and Negative Response attributions in their verbal descriptions of the objects in contrast to the sighted children's greater number of responses in the attribute categories Shape, Composition, Function, and Major Parts in describing the MT and LT objects.

Certain response trends on the tactual attribution task are evident, although statistical significance is not shown. The sighted children have higher means scores in the attribute categories Label, Shape, Function, Major Parts, Numerosity, Physical Characteristics, Comparisons, Person-Place-Thing, and in the total number of attributes. The three combined attribute groups (egocentric, functional, perceptual) all have higher mean scores for the sighted children (table 7). The blind children, on the other hand, suggested a higher number of responses in the categories Composition, Action, and Dimension, and made more negative and incorrect responses than the sighted.

Statistically significant differences in the <u>total</u> number of attributes mentioned on each part of the verbal attribution and on the tactual attribution tasks between the blind group and the sighted group did not occur (table 6). However, it is informative to consider the differences in these figures between the matching age-pairs, as is presented in table 8. Several observations can be made from that data: The two oldest blind children consistently attributed more characteristics to the objects than their sighted age mates. For the MT objects,

TABLE 8

TOTAL NUMBER OF ATTRIBUTES ASSIGNED ON EACH TASK BY MATCHING AGES

Age	Vision Group	Verbal Attribution MT	LT	TVA	Tactual Attribution
3-8	Blind	21	22	43	58
3-8	Sighted	20	23	43	46
4-5	Blind	32	16	48	32
4-5	Sighted	31	38	69	51
5-4	Blind	55	27	82	43
5-3	Sighted	24	45	69	44
6-4	Blind	78	52	130	60
6-3	Sighted	79	108	187	104
6-11	Blind	50	53	103	60
6-11	Sighted	65	76	141	82
7-3	Blind	64	44	108	67
7-3	Sighted	55	59	114	81
7-4	Blind	61	47	108	70
7-8	Sighted	60	63	123	94
8-0	Blind	69	60	129	62
8-2	Sighted	102	87	189	104
9-0	Blind	88	102	190	91
9-0	Sighted	49	69	118	90
9-11	Blind	77	93	170	83
9-9	Sighted	53	58	111	71

the differences in the number of attributes mentioned do not show a consistent pattern in favor of the blind or the sighted children, but for the LT objects the differences per age level favor the sighted partner for all but the oldest two sets of children. Examination of the totals listed in the TVA and Tactual Attribution columns reveals a tendency for the sighted partner to assign more attributes to the objects than the blind partner.

Older blind vs. older sighted subjects. For purposes of comparison, the two vision groups were divided into younger and older subjects, the division point being a CA of 7 years. Each subgroup, therefore, contained five subjects. This enabled comparison across vision groups by age, and across age groups by vision (see below).

Comparison of the mean scores in each attribute category for the older blind and sighted subjects (table 9) again shows a significantly greater number of references to Color by the sighted children. Also, the older blind children referred to an associated Person-Place-Thing more often than the older sighted children, the differences attaining statistical significance in their discussion of the MT objects. None of the remaining differences in mean scores achieved significance.

Table 10 shows the mean number of responses by the older blind and older sighted children for each of the combined attribute groups. As indicated thereon, no statistically significant differences in the number of responses were found between the two groups on the verbal attribution tasks. The older blind children responded with more egocentric attributes than the older sighted, particularly for the MT objects. Little difference between older blind and sighted groups was found for the perceptual attributes for the verbal attribution tasks. However, on the tactual attribution task, the older sighted children suggested significantly more perceptual attributes for the objects than the older blind children.

TABLE 9

MEAN NUMBER OF RESPONSES ON VERBAL AND TACTUAL ATTRIBUTION TASKS BY OLDER BLIND AND SIGHTED

Group[a]	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person-Place-Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE															
Blind	1.2	0.4	5.4	3.4	8.0	12.4	11.0	0.6	11.4	4.0	2.0	11.8*	0.2	71.8	0.4
Sighted	0.8	4.8*	4.0	2.0	9.0	12.0	13.4	0.4	5.8	3.6	1.6	6.0	0.4	63.8	0.0
LESS TANGIBLE															
Blind	2.6	1.4	1.2	1.2	6.8	11.2	12.0	2.0	11.0	2.6	2.4	10.8	3.6	69.2	0.2
Sighted	1.8	3.6*	1.4	2.8	9.0	13.0	15.0	2.4	5.2	1.8	1.4	9.6	0.2	67.2	0.2
TOTAL VERB. ATTR.															
Blind	3.8	1.8	6.6	4.6	14.8	23.6	23.4	2.6	22.4	6.6	4.4	22.6	3.8	141.0	0.6
Sighted	2.6	8.4*	5.4	4.8	18.0	25.0	28.4	2.8	11.0	5.4	3.0	15.6	0.6	131.0	0.2
TACTUAL ATTR.															
Blind	10.4	1.8	3.8	5.0	4.2	7.2	17.0	1.2	8.4	10.6	0.4	3.4	1.2	74.6	0.4
Sighted	10.6	14.2**	4.4	2.2	3.8	4.0	21.2	2.8	5.2	15.8	0.8	2.4	0.6	88.0	0.0

[a] n = 5 for each group

*$p \leq .05$

**$p \leq .01$

TABLE 10

MEAN NUMBER OF RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY OLDER BLIND AND SIGHTED

Group[a]	Egocentric	Functional	Perceptual
MORE TANGIBLE			
Blind	13.8	20.4	32.8
Sighted	7.6	21.0	32.0
LESS TANGIBLE			
Blind	13.2	18.0	30.2
Sighted	11.0	22.0	29.4
TOTAL VERB. ATTR.			
Blind	27.0	38.4	63.4
Sighted	18.6	43.0	61.4
TACTUAL ATTR.			
Blind	3.8	11.4	42.8
Sighted	3.2	7.8	63.6*

[a]n = 5 for each group

*$p \leq .05$

Younger blind vs. younger sighted subjects. The mean number of responses on the verbal and tactual attribution tasks by the younger blind and sighted children is presented in table 11. A significant difference between the group means occurs on the TVA for the category Label indicating that the younger blind children tended to respond with an object or class name more often than their sighted peers. All other differences between the younger vision groups on the verbal attribution tasks are not statistically significant. It should be noted, however, that the sighted children responded with a larger total number of attributes for the LT objects and for the TVA.

TABLE 11

MEAN NUMBER OF RESPONSES ON VERBAL AND TACTUAL ATTRIBUTION TASKS BY YOUNGER BLIND AND SIGHTED

Group[a]	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE															
Blind	1.8	0.0	2.6	0.4	8.4	10.4	4.8	0.0	4.0	1.0	2.4	10.4	1.0	47.2	0.4
Sighted	0.8	1.4	4.4	1.8	8.6	7.0	4.2	0.2	3.6	2.6	1.0	7.4	0.8	43.8	0.2
LESS TANGIBLE															
Blind	1.4	0.6	0.0	0.2	7.0	8.8	6.0	0.4	1.8	0.0	0.0	7.0	0.8	34.0	0.8
Sighted	0.0	3.6	0.4	2.2	6.0	11.8	11.0	1.6	4.8	0.4	1.6	14.0	0.6	58.0	1.0
TOTAL VERB. ATTR.															
Blind	3.2*	0.6	2.6	0.6	15.4	19.2	10.8	0.4	5.8	1.0	2.4	17.4	1.8	81.2	1.2
Sighted	0.8	5.0	4.8	4.0	14.6	18.8	15.2	1.8	8.4	3.0	2.6	21.4	1.4	101.8	1.2
TACTUAL ATTR.															
Blind	9.8	0.0	0.8	0.2	4.2	10.2	10.0	0.2	2.2	2.6	0.6	3.6	6.4	50.8	0.4
Sighted	10.4	5.4*	1.0	0.4	6.0	13.2	8.4	1.0	1.2	9.8	1.2	6.8*	1.4	65.4	0.4

[a] $\underline{n} = 5$ for each group

*$p \leq .05$

Two statistically significant differences occur on the tactual attribution data. The tendency for the sighted children to make greater reference to the Color of the objects is repeated, and the younger sighted children also made more responses in the Person-Place-Thing category than the younger blind subjects. The average for the total number of attributes assigned by the younger sighted subjects is higher than that of the younger blind children, though not to a statistically significant degree.

Table 12 shows the mean number of responses by the younger blind and younger sighted children in the three combined attribute categories.

TABLE 12

MEAN NUMBER OF RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY YOUNGER BLIND AND SIGHTED

Group[a]	Egocentric	Functional	Perceptual
MORE TANGIBLE			
Blind	12.8	18.8	12.4
Sighted	8.4	15.6	16.4
LESS TANGIBLE			
Blind	7.0	15.8	8.8
Sighted	15.6	17.8	21.8
TOTAL VERB. ATTR.			
Blind	19.8	34.6	21.2
Sighted	24.0	33.4	38.2
TACTUAL ATTR.			
Blind	4.2	14.4	15.8
Sighted	8.0	19.2	26.8

[a]n = 5 for each group

No statistically significant differences between younger vision groups were found for the verbal or tactual attribution tasks, although the difference between means is large in some cases. For the MT objects, the younger blind children described a larger number of egocentric and functional attributes than their sighted peers, but fewer perceptual attributes. For the LT objects, however, the younger blind children used fewer of all three classes of attributes than the younger sighted children, especially egocentric and perceptual attributes. The difference in the number of perceptual attributes mentioned on the tactual attribution task approached significance ($p = .06$), favoring the sighted children.

Conservers vs. Nonconservers

Table 13 presents the mean number of responses on the verbal and tactual attribution tasks for the conservers and nonconservers. As indicated thereon, the only statistically significant difference in attribution for the MT objects is in the category Major Parts: Conservers made significantly more references to parts of the objects than nonconservers. This difference is also statistically significant (in the same direction) for the TVA and the tactual attribution task. For the LT objects, the conservers again made more responses of this nature, but not to a statistically significant degree. A significant difference in favor of the conservers was found on the tactual attribution task for the Physical Characteristics category.

Conservers also responded with significantly more color attributes on the TVA and tactual attribution tasks. However, since five of the six conservers were sighted children, this finding is probably attributable to vision rather than to conservation.

The total number of responses to the tactual attribution task differs significantly between conservers and nonconservers, the

TABLE 13

MEAN NUMBER OF RESPONSES BY CONSERVATION GROUP ON VERBAL AND TACTUAL ATTRIBUTION TASKS

Group	n	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE																
Conserv.	6	1.0	4.2	4.5	2.2	8.8	12.7	13.3*	0.3	6.7	3.3	1.7	6.8	0.5	66.0	0.0
Noncons.	14	1.2	0.6	3.9	1.8	8.4	9.5	6.2	0.3	6.0	2.6	1.8	9.8	0.6	52.6	0.4
LESS TANGIBLE																
Conserv.	6	2.2	3.3	1.2	3.2	8.8	12.8	14.3	2.2	8.3	2.2	1.8	8.8	2.3	71.5	0.2
Noncons.	14	1.1	1.9	0.6	0.9	6.5	10.5	9.6	1.4	4.6	0.8	1.1	11.0	0.9	50.9	0.7
TOTAL VERB. ATTR.																
Conserv.	6	3.2	7.5*	5.7	5.3	17.7	25.5	27.7*	2.5	15.0	5.5	3.5	15.7	2.8	137.5	0.2
Noncons.	14	2.4	2.4	4.5	2.7	14.9	20.0	15.9	1.6	10.6	3.4	2.9	20.8	1.5	103.6	1.1*
TACTUAL ATTR.																
Conserv.	6	10.7	11.8*	4.2	3.0	3.8	6.0	20.7**	2.3	5.0	15.7*	0.7	2.5	0.8	87.2**	0.0
Noncons.	14	10.1	2.6	1.8	1.5	4.9	9.8	11.4	0.9	3.9	7.1	0.8	4.7	3.1	62.2	0.4

*$p \leq .05$

**$p \leq .01$

conservers having the higher number. Similarly, on each part of the verbal attribution task (MT, LT, TVA), the total number of responses was higher for the conservers, although the differences were not significant. Table 13 also shows a significantly higher number of incorrect attributions by the nonconservers on the verbal attribution task (TVA).

Comparison of conservers and nonconservers on the combined attribute groups (egocentric, functional, and perceptual) is shown in table 14. A statistically significant difference is found on the tactual attribution task in the perceptual attribute group, conservers

TABLE 14

MEAN NUMBER OF RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY CONSERVATION GROUP

Group	n	Egocentric	Functional	Perceptual
MORE TANGIBLE				
Conserv.	6	8.5	21.5	32.3
Noncons.	14	11.6	17.9	19.4
LESS TANGIBLE				
Conserv.	6	10.7	21.7	31.5
Noncons.	14	12.1	17.0	18.7
TOTAL VERB. ATTR.				
Conserv.	6	19.2	43.2	63.8
Noncons.	14	23.7	38.9	38.4
TACTUAL ATTR.				
Conserv.	6	3.2	9.8	59.7*
Noncons.	14	5.5	14.6	24.6

*$p \leq .01$

having the higher mean. As the table indicates, the conservers had higher mean scores in the functional and perceptual attribute groups on each portion of the verbal attribution task (MT, LT, TVA). Nonconservers, however, gave more functional attribute responses on the tactual attribution task than conservers. Nonconservers also gave more egocentric attribute responses for both the verbal and the tactual attribution tasks, but not to a statistically significant degree.

Comparisons over Age

Younger vs older blind children. The mean number of responses for the verbal and tactual attribution tasks for the two age groups of blind children (CA less than 7 years; CA greater than 7 years) are given in table 15. Statistical comparison of the groups revealed several significant differences, all in favor of the older blind children. For the MT objects, the number of responses by the older blind children is significantly higher in the categories Composition and Dimension. In addition, the difference in total number of attributes assigned to the MT objects approached significance ($p = .06$). The difference between age groups in the total number of attributes used does attain statistical significance for the LT, TVA, and tactual attribution tasks; in each instance, the older blind children have the higher number of responses.

Although statistically significant differences did not occur in each attribute category, there is a definite trend for the older blind to ascribe a greater variety of attributes to the objects. The number of attributions by the older blind children exceeded that of the younger blind in the categories Color, Shape, Composition, Action, Major Parts, Numerosity, Dimension, Physical Characteristics, and Person-Place-Thing for both the MT and LT objects.

TABLE 15

MEAN NUMBER OF RESPONSES ON VERBAL AND TACTUAL ATTRIBUTION FOR YOUNGER AND OLDER BLIND

	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE															
Younger	1.8	0.0	2.6	0.4	8.4	10.4	4.8	0.0	4.0	1.0	2.4	10.4	1.0	47.2	0.4
Older	1.2	0.4	5.4	3.4*	8.0	12.4	11.0	0.6	11.4*	4.0	2.0	11.8	0.2	71.8	0.4
LESS TANGIBLE															
Younger	1.4	0.6	0.0	0.2	7.0	8.8	6.0	0.4	1.8	0.0	0.0	7.0	0.8	34.0	0.8
Older	2.6	1.4	1.2	1.2	6.8	11.2	12.0	2.0	11.0	2.6	2.4	10.8	3.6	69.2*	0.2
TOTAL VERB. ATTR.															
Younger	3.2	0.6	2.6	0.6	15.4	19.2	10.8	0.4	5.8	1.0	2.4	17.4	1.8	81.2	1.2
Older	3.8	1.8	6.6*	4.6*	14.8	23.6	23.4	2.6	22.4*	6.6	4.4	22.6	3.8	141.0*	0.6
TACTUAL ATTR.															
Younger	9.8	0.0	0.8	0.2	4.2	10.2	10.0	0.2	2.2	2.6	0.6	3.6	6.4	50.8	0.4
Older	10.4	1.8	3.8**	5.0***	4.2	7.2	17.0	1.2	8.4	10.6*	0.4	3.4	1.2	74.6*	0.4

[a] n = 5 for each group

*$p \leq .05$

**$p \leq .01$

***$p \leq .001$

On the TVA, significant differences between the older and younger blind children were found in the categories Shape, Composition, Dimension, all in favor of the older group. Significant differences in the same direction were found on the tactual attribution task in the categories Shape, Composition, and Physical Characteristics.

Table 16 lists the means for the younger and older blind children for the three combined attribute groups. The older blind children show a higher mean score in all three attribute groups on the verbal attribution

TABLE 16

MEAN NUMBER OF RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BETWEEN YOUNGER AND OLDER BLIND CHILDREN

Group[a]	Egocentric	Functional	Perceptual
MORE TANGIBLE			
Younger	12.8	18.8	12.4
Older	13.8	20.4	32.8**
LESS TANGIBLE			
Younger	7.0	15.8	8.8
Older	13.2*	18.0	30.2
TOTAL VERB. ATTR.			
Younger	19.8	34.6	21.2
Older	27.0	38.4	63.4*
TACTUAL ATTR.			
Younger	4.2	14.4	15.8
Older	3.8	11.4	42.8**

[a]$\underline{n}$ = 5 for each group

*p $\leq$.05

**p $\leq$.01

task (MT, LT, TVA). The differences between means is statistically significant in the egocentric attribute group for the LT objects, and in the perceptual attribute group for the MT objects and the TVA. The older blind children also have a significantly higher number of perceptual attribute responses on the tactual attribution task. The younger blind children have a higher, but not statistically different, number of responses on the tactual attribution task in the egocentric and functional attribute groups.

Younger vs. older sighted children. Table 17 lists the mean number of responses to the verbal and tactual attribution tasks by the younger and older sighted children. The number of attributes ascribed to the MT objects by the older group in the Action and Major Parts categories was significantly different from that of the younger sighted children, in favor of the older subjects. For the LT objects, the difference between groups was significant in the Label and Physical Characteristics categories (also in favor of the older children). No statistically significant differences were found for the TVA. The total number of attributes assigned to the objects on the verbal attribution task (MT, LT, TVA) and on the tactual attribution task was higher for the older sighted children.

Comparison of the groups on the tactual attribution task revealed a statistically significant difference in several attribute categories. The older sighted children made significantly more responses in the Color, Major Parts, and Dimension categories. Significant differences in favor of the younger sighted children occurred in the categories Function, Action, and Person-Place-Thing.

TABLE 17

MEAN NUMBER OF RESPONSES ON VERBAL AND TACTUAL ATTRIBUTION BY YOUNGER AND OLDER SIGHTED

Group[a]	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
MORE TANGIBLE															
Younger	0.8	1.4	4.4	1.8	8.6	7.0	4.2	0.2	3.6	2.6	1.0	7.4	0.8	43.8	0.2
Older	0.8	4.8	4.0	2.0	9.0	12.0*	13.4*	0.4	5.8	3.6	1.6	6.0	0.4	63.8	0.0
LESS TANGIBLE															
Younger	0.0	3.6	0.4	2.2	6.0	11.8	11.0	1.6	4.8	0.4	1.6	14.0	0.6	58.0	1.0
Older	1.8*	3.6	1.4	2.8	9.0	13.0	15.0	2.4	5.2	1.8*	1.4	9.6	0.2	67.2	
TOTAL VERB. ATTR.															
Younger	0.8	5.0	4.8	4.0	14.6	18.8	15.2	1.8	8.4	3.0	2.6	21.4	1.4	101.8	1.2
Older	2.6	8.4	5.4	4.8	18.0	25.0	28.4	2.8	11.0	5.4	3.0	15.6	0.6	131.0	0.2
TACTUAL ATTR.															
Younger	10.4	5.4	1.0	0.4	6.0*	13.2**	8.4	1.0	1.2	9.8	1.2	6.8**	1.4	65.4	0.4
Older	10.6	14.2*	4.4	2.2	3.8	4.0	21.2*	2.8	5.2**	15.8	0.8	2.4	0.6	88.0	0.0

[a] n = 5 for each group

*p ≤.05

**p ≤.01

Table 18 lists the means for the younger and older sighted children for the three combined attribute categories. No statistically significant differences were found for any of the verbal attribution data (MT, LT, TVA). However, the younger sighted children had a higher number of egocentric attributes on the verbal attribution task than the older children. This pattern is reversed for the functional and perceptual attribute groups in which the older sighted had a higher number of responses.

TABLE 18

MEAN NUMBER OF RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY YOUNGER AND OLDER SIGHTED CHILDREN

Group[a]	Egocentric	Functional	Perceptual
MORE TANGIBLE			
Younger	8.4	15.6	16.4
Older	7.6	21.0	32.0
LESS TANGIBLE			
Younger	15.6	17.8	21.8
Older	11.0	22.0	22.0
TOTAL VERB. ATTR.			
Younger	24.0	33.4	38.2
Older	18.6	43.0	61.4
TACTUAL ATTR.			
Younger	8.0**	19.2**	26.8
Older	3.2	7.8	63.6**

[a]$\underline{n}$ = 5 for each group

**p $\leq$.01

Statistically significant differences for the three combined attribute groups on the tactual attribution task were found (table 18). For the egocentric and functional attribute groups, the younger sighted children had a significantly higher number of responses. The older sighted children, on the other hand, had a significantly higher number of perceptual attribute responses.

More Tangible vs. Less Tangible
Object Attribution

Table 19 compares the mean number of attribution responses by the blind and the sighted children to the MT and LT objects. Also listed are the means for the older blind and sighted groups and for the younger blind and sighted groups. As indicated thereon, both the blind and the sighted children made significantly more responses in the Shape category in their discussion of the MT objects than when describing the LT objects. When the scores are compared by age groups, it becomes evident that it was the older blind and sighted children who contributed most to this difference.

Also shown in table 19 is the fact that the younger blind children made significantly more Comparisons when dealing with the MT objects than they did with the LT objects. In addition, the MT objects drew more attributions by the blind in the categories Composition, Function, Action, Dimension, Physical Characteristics, Person-Place-Thing, and the total number of attributes. The LT objects drew more attributions from the categories Label, Color, Major Parts, and Numerosity, as well as more negative and incorrect responses.

The older sighted children remarked about the Physical Characteristics of the MT objects significantly more than they did for the LT objects. The sighted group as a whole made significantly more references to a Person-Place-Thing in association with the LT objects than with the MT objects, however.

TABLE 19

MEAN NUMBER OF RESPONSES FOR MORE TANGIBLE AND LESS TANGIBLE OBJECTS

Group/Task	n	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
ALL BLIND SUBJECTS																
More Tang.	10	1.5	0.2	4.0**	1.9	8.2	11.4	7.9	0.3	7.7	2.5	2.2	11.1	0.6	59.5	0.4
Less Tang.	10	2.0	1.0	0.6	0.7	6.9	10.0	9.0	1.2	6.4	1.3	1.2	8.9	2.2	51.6	0.5
ALL SIGHTED SUBJECTS																
More Tang.	10	0.8	3.1	4.2**	1.9	8.8	9.5	8.8	0.3	4.7	3.1	1.3	6.7	0.6	53.8	0.1
Less Tang.	10	0.9	3.6	0.9	2.5	7.5	12.4	13.0	2.0	5.0	1.1	1.5	11.8*	0.4	62.6	0.6
OLDER BLIND																
More Tang.	5	1.2	0.4	5.4*	3.4	8.0	12.4	11.0	0.6	11.4	4.0	2.0	11.8	0.2	71.8	0.4
Less Tang.	5	2.6	1.4	1.2	1.2	6.8	11.2	12.0	2.0	11.0	2.6	2.4	10.8	3.6	69.2	0.2
OLDER SIGHTED																
More Tang.	5	0.8	4.8	4.0**	2.0	9.0	12.0	13.4	0.4	5.8	3.6*	1.6	6.0	0.4	63.8	0.0
Less Tang.	5	1.8	3.6	1.4	2.8	9.0	13.0	15.0	2.4	5.2	1.8	1.4	9.6	0.2	67.2	0.2
YOUNGER BLIND																
More Tang.	5	1.8	0.0	2.6	0.4	8.4	10.4	4.8	0.0	4.0	1.0	2.4*	10.4	1.0	47.2	0.4
Less Tang.	5	1.4	0.6	0.0	0.2	7.0	8.8	6.0	0.4	1.8	0.0	0.0	7.0	0.8	34.0	0.8
YOUNGER SIGHTED																
More Tang.	5	0.8	1.4	4.4	1.8	8.6	7.0	4.2	0.2	3.6	2.6	1.0	7.4	0.8	43.8	0.2
Less Tang.	5	0.0	3.6	0.4	2.2	6.0	11.8	11.0	1.6	4.8	0.4	1.6	14.0	0.6	58.0	1.0

$^{*}p \leq .05$

$^{**}p \leq .01$

Although the differences between the total number of attributes did not reach statistical significance, the blind children made a higher number of attributions to the MT objects than they did to the LT objects. Contrariwise, the sighted children had a higher total number of attributions for the LT than MT objects.

Verbal Attribution vs.
Tactual Attribution

Blind subjects. One purpose of the present study was to compare and contrast attribution based on verbal recall with attribution based on tactual exploration. Table 20 shows the mean number of responses by the blind children on the verbal attribution--more tangible task (protocol Part I) and on the tactual attribution task (protocol Part II). Also presented in Table 20 is a breakdown of this data by age groups (younger and older blind). In each instance, a statistically significant difference was obtained in the Label, Function, and Person-Place-Thing categories. However, the fact that the blind children of both age groups referred more often to the class to which the object belonged during the tactual attribution task is the result of their having to identify the object, and can be dismissed as incidental to the task itself. On the other hand, more frequent reference was made to the specific function or purpose of the object and to a person, place, or thing which they associated with the object, during the verbal task than was the case during tactual exploration. Also, when considering the entire group of blind children, a statistically significant difference was found in the Comparison category, more responses of this nature being made during the verbal task.

TABLE 20

MEAN NUMBER OF RESPONSES BY BLIND SUBJECTS ON VERBAL AND TACTUAL ATTRIBUTION TASKS

Group	n	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
ALL BLIND SUBJECTS																
Verbal	10	1.5	0.2	4.0	1.9	8.2***	11.4	7.9	0.3	7.7	2.5	2.2*	11.1***	0.6	59.5	0.4
Tactual	10	10.1***	0.9	2.3	2.6	4.2	8.7	13.5	0.7	5.3	6.6	0.5	2.5	3.8	62.7	0.4
OLDER BLIND SUBJ.																
Verbal	10	1.2	0.4	5.4	3.4	8.0**	12.4	11.0	0.6	11.4	4.0	2.0	11.8***	0.2	71.8	0.4
Tactual	10	10.4***	1.8	3.8	5.0	4.2	7.2	17.0	1.2	8.4	10.6	0.4	3.4	1.2	74.6	0.4
YOUNGER BLIND SUBJ.																
Verbal	10	1.8	0.0	2.6	0.4	8.4**	10.4	4.8	0.0	4.0	1.0	2.4	10.4*	1.0	47.2	0.4
Tactual	10	9.8***	0.0	0.8	0.2	4.2	10.2	10.0	0.2	2.2	2.6	0.6	3.6	6.4	50.8	0.4

*$p \leq .05$

**$p \leq .01$

***$p \leq .001$

Table 21 translates this data into the three combined attribute groups. The number of egocentric attributes differs significantly in favor of verbal attribution for both age levels of blind children.

TABLE 21

MEAN NUMBER OF VERBAL AND TACTUAL RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY BLIND CHILDREN

Task	n	Egocentric	Functional	Perceptual
ALL BLIND SUBJECTS				
Verbal	10	13.3***	19.6**	22.6
Tactual	10	4.0	12.9	29.3
OLDER BLIND SUBJ.				
Verbal	5	13.8**	20.4	32.8
Tactual	5	3.8	11.4	42.8
YOUNGER BLIND SUBJ.				
Verbal	5	12.8*	18.8	12.4
Tactual	5	4.2	14.4	15.8

*p $\leq .05$

**p $\leq .01$

***p $\leq .001$

Also, a significant difference in the mean number of functional attributes used during the verbal task was evident when the group is considered as a whole. The mean number of functional attributes given by the younger blind subjects was higher for the verbal recall portion than for the tactual examination portion of the interview, though the difference does not achieve statistical significance. A greater number of perceptual attributes was shown for the tactual attribution task for both age levels, but this, too, was not statistically significant.

Sighted subjects. Similar observations can be made from the data on the sighted children shown in tables 22 and 23. The significantly higher number of Label attributes mentioned during the tactual attribution task is the result of their having to identify the objects, and can be dismissed as being incidental to the task itself. Table 22 shows that the older sighted children remarked about the Color of the objects significantly more often during the tactual exploration than during verbal recall (tactual examination of the objects was, of course, accompanied by visual examination by the sighted subjects).

The number of Function and Action responses by the older sighted children during the verbal recall portion of the interview was significantly higher than the number made during tactual exploration. The younger sighted children, on the other hand, showed a significantly different number of Action responses during tactual exploration. Further significant differences in favor of tactual exploration were obtained for the older sighted children in the categories Major Parts, Numerosity, and Physical Characteristics. Finally, the total number of attributes assigned to the objects by all the sighted children was significantly different on the tactual attribution than on the verbal attribution task, the higher number being for tactual attribution.

Table 23 shows a significant difference in the number of perceptual attributes mentioned by the older sighted children between tactual and verbal tasks. The younger sighted children gave more perceptual attribute responses on the tactual task also, but not to a significant degree. The older sighted children showed a significantly higher number of functional responses on the verbal attribution task than on the

TABLE 22

MEAN NUMBER OF RESPONSES BY SIGHTED SUBJECTS ON VERBAL AND TACTUAL ATTRIBUTION TASKS

Task	n	Label	Color	Shape	Composition	Function	Action	Major Parts	Numerosity	Dimension	Physical Characteristic	Comparison	Person Place Thing	Negative Response	TOTAL	Incorrect
ALL SIGHTED SUBJECTS																
Verbal	10	0.8	3.1	4.2	1.9	8.8***	9.5	8.8	0.3	4.7	3.1	1.3	6.7	0.6	53.8	0.1
Tactual	10	10.5***	9.8*	2.7	1.3	4.9	8.6	14.8	1.9*	3.2	12.8**	1.0	4.6	1.0	76.7*	0.2
OLDER SIGHTED SUBJ.																
Verbal	5	0.8	4.8	4.0	2.0	9.0***	12.0**	13.4	0.4	5.8	3.6	1.6	6.0	0.4	68.3	0.0
Tactual	5	10.6***	14.2*	4.4	2.2	3.8	4.0	21.2*	2.8*	5.2	15.8**	0.8	2.4	0.6	88.0	0.0
YOUNGER SIGHTED SUBJ.																
Verbal	5	0.8	1.4	4.4	1.8	8.6	7.0	4.2	0.2	3.6	2.6	1.0	7.4	0.8	43.8	0.2
Tactual	5	10.4***	5.4	1.0	0.4	6.0	13.2*	8.4	1.0	1.2	9.8	1.2	6.8	1.4	65.4	0.4

$*p \leq .05$

$**p \leq .01$

$***p \leq .001$

tactual task. A large number of egocentric attributes for the verbal task was shown for both age groups of sighted children.

TABLE 23

MEAN NUMBER OF VERBAL AND TACTUAL RESPONSES IN COMBINED ATTRIBUTE CATEGORIES BY SIGHTED CHILDREN

Group	n	Egocentric	Functional	Perceptual
ALL SIGHTED SUBJ.				
Verbal	10	8.0	18.3	24.2
Tactual	10	5.6	13.5	45.2*
OLDER SIGHTED SUBJ.				
Verbal	5	7.6	21.0**	32.0
Tactual	5	3.2	7.8	63.6**
YOUNGER SIGHTED SUBJ.				
Verbal	5	8.4	15.6	16.4
Tactual	5	8.0	19.2	26.8

*p $\leq .05$

**p $\leq .01$

Qualitative Analysis of Verbal Attribution Data

Table 24 lists examples of the responses in the major attribute categories made by the blind children on the verbal attribution and description task (protocol Part I). When compared with the examples of responses by the sighted children given in table 25, obvious similarities are evident. Many of the descriptive attributes are identical for both vision groups. A common experience among the blind and sighted is reflected by the descriptors in the Function and Action categories, for both MT and LT objects. The duplication of Action responses for BALL, ROPE, SPOON, YARD, and HOUSE provide examples of this trend.

TABLE 24

SELECTED RESPONSES ON VERBAL ATTRIBUTION TASK BY BLIND CHILDREN

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Characteristic	Comparison	Person-Place or Thing
BLOCK	bristle blocks street	colors	square round circle "bridge" shapes	wood plastic cordoroy	play with build	fall down pound stand up lay down sleep on kiss make things put together set things on	corners	hard holes smooth rough soft	chimney 2-legged table	towers baby nail buildings
PENCIL			round straight	wood rubber	writing erase	sharpen make things stand up roll	point eraser sharp thing	sharp hard	crayons ink pen leg	drawings hand paper
BALL	baseball hardball		round	rubber air inside	play with	dribble roll hit throw bounce catch break windows		holes bell inside hard soft	oranges	basketball clay players windows
ROPE	jump rope		straight round		play with	jump tie swing climb pull	ends	bends soft	wire	bad guys dog
SPOON			round flat	metal	eat with	scoop play stir drop dish up pick up make toy	handle round point stick end			David ice cream silverware drawer soup food dirt jello
DOLL	toy GI Joe Snuggles baby dolly Drowsy				play with	push dress change hold put in doll house put in cradle feed pull string	feet head hair body eyes nose mouth arms clothes		person	toybox jammies girls batteries doll house cradle bottle

TABLE 24—Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
KEY	housekey car key	silver	pointed round flat different shapes	metal	lock/unlock open	start cars put it in turn it play with get in house	round point long point hole end pointy things tip bottom	"sounds"	spoon pole "head"	cars doors house truck Benji-Bug key ring chain string rope trunk
BRUSH	tooth-brush hair-brush		flat		brush hair brush floor brush teeth brush off comb hair	hold it whip	bristles handle prickles pointy things stick	pointed	combs bristle patch	hair floor shampooer teeth kids windows doll's teeth
CUP			round		drink	put stuff in tips over pour into scoop play	handle bottom "thing" (inside) sides	smooth		water milk juice coffee ice sand rootbeer float covers
COMB			straight		comb hair	makes hair flat put water on get snarls out	teeth handle prickles stick straight things top side bottom	pointy curvy rough smooth	brush	hair water brush
TREE	Spruce Pine Evergreen Christmas tree	green brown	round		it grows	climb saw pick apples put decor-ations on cut down look at live on make fire-wood	seeds apples branches bark leaves needles pine cones	smells	garden hose	Christmas decorations presents ground bird's nest tree house outside squirrels
HOUSE	haunted house farm house	colors		wood	living in	sleep in be warm in paint cook hide in sit in	siding roof LR bedrooms kitchen hallway rooms	pretty	cage	stairs tables couches rugs beds toys Stacy's

TABLE 24--Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
CAR	machine	colors	rectangle	metal	drive in ride in	sit in paint go places	seat belt wheels tires motor door windows lights steering wheels battery heaters		house	gas people keys
YARD	backdoor		square	wooden	to go in and out keep rain out keep it warm going inside and outside	close break shutting swinging locking	stop handle knob hinge screw	painted	screen	closet bedroom bathroom Janet's room
BUS	schoolbus	color black yellow			ride in drive take to school	sit in pick up kids open and close windows	steps seats windows door wheel	painted	car van	school people Grover (story) bus driver kids
WALL		white colors		wood plaster	hold up roof, house keeps house together keeps it warm so rain won't come in so won't fall into other's house	put paper on put smoke alarms on trail along stand by lean on		hard painted	door	wallpaper smoke alarm house roof
BUILD-ING	house store apartment building church building			brick		buy stuff live in go into look around walk in eat in check out groceries	doors walls roof upstairs basement ceiling bathroom floor	hard	house	chairs

TABLE 24--Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BUSH		green			it grows	pricks you scratch you get stuck in pick berries pull up	brambles leaves stem branches prickles	heavy	tree	garden plants flowers berries snow lilacs
STREET	road		square	concrete	drive on walk on	go across play in	side corners	rough bumpy	driveway yard	people cars trucks house buses railroads

TABLE 25

SELECTED RESPONSES ON VERBAL ATTRIBUTION TASK BY SIGHTED CHILDREN

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BLOCK	toy	colorful green colored	square round triangle rectangle shapes	wooden	play with build	make things pretend with gets painted	sides corners	hard some have letters or numbers on		tower towns garage buildings
PENCIL		orange black yellow red blue colors	round flat	wood metal	write erase draw	sharpen take home write and remember can break	eraser lead pointed end top	pointed		paper bad marks
BALL		pink different colors	circle round	rubber	play with	bounce throw roll catch hit		decorated		foot ball air
ROPE	jump rope skipping rope lasso	brown different colors	round	strings together	make lasso	pulling jump skip make loops twirl tie twist cut hold things together climb	strings ends (handles)	strong		cowboys Indians tree branches horses
SPOON		silver	round curved half way like a ball	metal	eat with	pounding dig scoop play bend dish up	handle end to dish up stick	smooth "hump"	"bowl"	food dirt sand
DOLL	dummy rag doll			plastic	play with	dress walk put in cradle hug throw pretend cuddle sleep with	eyes legs nose feet ears head arms face stomach	welded together happy face	person people baby "us"	cradle Heidi batteries girls
KEY		gold brown silver	round	metal	lock unlock	fit into door and turn play with start car	"shapes" stick part top bottom	weird designs grooves shiny		doors house windows car key hole people

TABLE 25--Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BRUSH	tooth brush paint brush	pink white black "woody" colors		plastic metal	brush hair brush clothes scrub paint	get tangles out stick in paint stick in toothpaste	bristles handle hairy things plastic around	"face" on it decorations soft hard	comb fork	hair teeth bathtub clothes paint picture toothpaste dog
CUP		colors	round circle goes way down	plastic glass	drink	hold it put stuff in dig pour fill with water	handles top bottom	pictures "things" on it "hole" in top	bowl	water dirt milk juice paintbrush
COMB		silver black	straight round slanted	plastic	combing	get tangles out	bristles sticks prickles pointy things edge end	sharp curved pointy	brush fork	hair Jason's Pud (a dog)
TREE		brown green		wood	it grows makes house pretty make beauti- ful	sit in climb chop down get apples look at have picnic under birds in it swing play	leaves stump roots bark trunk branches	shade	plants "hair" (leaves)	apples birds houses nest fire bugs tree house
HOUSE		colors green white yellow brown	square	bricks wood glass cement rocks	live in gets people nice & warm stay in when cold	play sleep watch TV cook, eat in paint get into mischief	windows door roof upstairs downstairs rooms walls	cold or hot inside		people TV toys sofa furniture dishes table lamps pictures
CAR		yellow green colored	metal	driving riding in	steer sit sleep go places it can move fool around	engine steering wheel fan radio seats doors glove com- partment muffler			box	people trips groceries Grandma's

TABLE 25--Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
YARD	acres space backyard frontyard	green		play in	run walk drive on planting bushes ride horse slide rake	grass weeds dirt hills			sidewalk	house trees football golf flowers bushes gate swing set rabbits table sprinkler slide
DOOR		brown	rectangle long	wood glass	going in and out getting into a house walk through keep out cold	opening and closing swing slam put stuff on lock paint	knob handle window	designs on it		house kids
BUS		color black yellow	long square	metal	ride in drive take you to school getting around	sit in holds kids pay to get on	seats windows doors wheels	numbers on it "B-U-S" on it horrible horn	car truck	people driver uptown school cities home kids
WALL		orange yellow green blue	shapes square	cement wood bricks	privacy keep out bad guys keeps house from house divides places keeps house together	painting bang on hang things hammer lean against put phone on	inside	on each side of room	paper	school house chalkboard wallpaper phone clock pictures room
BUILD-ING	clinic place			metal brick		live, work, play, walk in go school in sleep in stay over in	windows offices	painted	house "eyes" (windows) school	people doctors storages Grandma's Day Care
BUSH		green brown			grows to look pretty for "looks" to make yard pretty	hide pull berries off birds climb & make nest play around pick flowers bump into & get hurt	branches leaves stems bark flowers	pretty prickly	trees	cherries birds nest weeds roses flowers yard cats
STREET	highway	gray brown black yellow white	any shape flat	tar cement rocks	riding on driving on cars go on	walk over play in ride bikes play catch jump rope job cross	lines		sidewalk	traffic cars bikes

Similar concepts regarding the purpose of the objects is also evident, as illustrated by these responses regarding WALL:

Sighted: "to keep house from house"
"divides places"

Blind: "so you won't fall into another person's house"

The description of the Major Parts of some of the objects is also more alike than dissimilar between vision groups. This fact is quite evident in the responses to the words PENCIL, CAR, TREE, and DOLL.

An obvious difference between the blind and the sighted is in the reference to Color. The difference in the number of such responses was found to be statistically significant in favor of the sighted. Examination of the actual responses made by the blind children reveals that their Color responses were primarily references to the fact that the object has color, rather than mention of the specific colors as was the case with the sighted children. In those instances when a specific color was attributed to an object by the blind group, the color term was most often given by the one blind child who had some color vision.

The blind group gave more responses in the Label category, several of which appear to reflect their personal experience; for example, the mention of "bristle blocks," "Christmas trees," "farm house," and specific dolls. One blind child recognized that BLOCK and YARD have more than one meaning and offered both. None of the sighted children made similar observations.

The tendency of the blind children to relate the stimulus objects to their personal experience is also seen in their reference to siblings ("David," "Janet"), to particular toys (the "cordoroy and foam" block one child used "to sleep with" and "to kiss"), and in the comment that a WALL can be used for trailing. Such personal touches were not altogether absent from the responses of the sighted children, but occurred more frequently in the comments of the blind children.

The Physical Characteristics of the various objects suggested by the blind children were primarily of a textural nature: "hard," "soft," "rough," "smooth," "bumpy," "curvy," etc. By contrast, the sighted children not only used such textural terms but also mentioned visual characteristics such as "decorations," "designs," "happy face," "letters," etc. One blind child also referred to the "smell" of a TREE, a characteristic which was not mentioned by any of the sighted children. The influence of vision on the sighted children's concept of some of the objects can be seen in such responses as these for TREE and BUSH: "for looks," "to make the yard pretty," "to make the house beautiful."

The blind children made more Comparisons in describing the objects than the sighted children. Evaluation of the comparisons shows that they tended to be made on the basis of the shape and/or function of the objects, as in the following examples:

BALL:	"an orange"
PENCIL:	"crayons," "an ink pen," "a leg"
HOUSE:	"a cage"
WALL:	"a door"
CAR:	"a house"
TREE:	"a garden hose" (presumably a reference to a tree branch or to a young tree)

The sighted children's reference to using a DOLL and BLOCK for "pretend" play was not paralleled in the responses of the blind children. This may correspond to the findings of other research that the play behavior of congenitally blind children is less imaginative and more concrete.

In all, the number of "visual" responses by the blind children formed a very small percentage of their total number of attributions (3%). These responses include the references to color and the visually oriented attributions "pretty," "stays green," and "painted."

Qualitative Analysis of Tactual
Attribution Data

Table 26 presents examples of the responses by the blind children in selected attribute categories on the tactual attribution task for comparison with responses by the sighted children as presented in table 27. When these responses are contrasted, similar observations can be made as those discussed above for the verbal attribution data. Similarities of experiences between vision groups are reflected in many of the Actions and Major Parts suggested by the children. Aside from the duplication of responses in the Action category, there appears to be a subtle difference between vision groups. The actions mentioned by the blind group can be considered more concrete, often actions which can be performed with or upon the objects. For example,

BLOCK: "twirl it," "turn it," "it can slip across the table"
PENCIL: "roll it," "it can make noise"
CUP: "it can turn over," "you can hit the table with it"
COMB: "twirl it," "push it," "takes out snarls"

In contrast, the responses of the sighted children, where they differed from those of the blind, seemed to be more abstract:

BLOCK: "saw it up," "make holes in it"
COMB: "put it in the bathroom," "trap things"
ROPE: "put it in the house," "pretend it's a snake"
SPOON: "bend it"

The influence of vision was also evident in the Action responses of the sighted children. For example,

TABLE 26

SELECTED RESPONSES ON TACTUAL ATTRIBUTION TASK BY BLIND CHILDREN

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BLOCK	block	brown	square	wood plastic	build play with	makes noise twirl turn can slip across table put in box	sides edges top points corners	hard slippery sharp pointy smooth	like a board	
SPOON	spoon tool	silver	round flat	tin metal	eat with	scoop play make noise hit with it dig with it put stuff on stir hold	handle top end	pointed smooth bends rough "goes in a little things punched in it		David porridge food
PENCIL	pencil	yellow		wood	draw erase write mark	carry in pocket make noise roll hit tickle it	eraser point lead "corners"	hard rolls pointy sharp flat flat (side) lines (edges) name on it	like a spoon	books school
KEY	key	silver	round "heart"	metal	lock	stick in door make noise hit table drive with it start things	hole side teeth top	hard rough smooth curvy pointy	stick	door car doorknob
DOLL	doll girl baby		round	plastic cotton		walk stand brush hair pull	feet head hair legs hands arms shirt shoes neck tummy toes ears mouth clothes	dressed falling apart hard soft arms move wiggles		
CUP	cup glass	white	circle round	plastic	drink	put tea in make noise turn over hit table spill pour echoes	handle inside back bottom stand	hole hard clean hollowed		tea milk juice water

TABLE 26—Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BALL	ball	white	round	rubber air filled	play with	throw roll bounce spin dribble catch kick	crack thing (seam)	soft hard striped stuffed	orange	
COMB	comb	blue		plastic	comb hair brush	make noise take out snarls twirl push	teeth points bristles platform "line" (back)	pointy curved braille line rough smooth		hair
BRUSH	brush big comb	black white		plastic	brush hair make hair flat	put water on make noise beat	prickles bristles handle back top platform	sharp hard smooth rough says something curvy		hair
ROPE	rope jumping rope					make knots tie it make loops jump it	tape ends	smooth soft furry bends "lines"		people

TABLE 27

SELECTED RESPONSES ON TACTUAL ATTRIBUTION TASK BY SIGHTED CHILDREN

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
BLOCK	block	tan "woody"	square diamond	wood	build play with make something	saw up make holes paint make noise make grooves	corners sides bottom top edges	sharp smooth half circles (grain) spots rough hard straight		tower garages houses pet ants
SPOON	spoon	silver light color	round circle oval straight curved	metal	eat with	wash it scoop soup bend hold dig	bottom part you eat with part you hold curved part	shiny bump words on it decorations smooth see self in		soup sand meatballs
PENCIL	pencil	black silver yellow tan reddish woody	round straight	wood metal	write draw	put in drawer make things make stuff disappear	eraser lead end metal part bottom top	painted words on it numbers on it smooth pretty sharpened		
KEY	key	silver light color	"flower"	metal	unlock	open door put around neck turn start cars stick in door	hole grooves lines bumps sides back	sharp shiny see self in designs smooth words on it bumpy different shapes	mountain leaf	door windows latch house
DOLL	Barbie Marie dummy doll	red brown yellow peach		kind of rubber like	play with	moves bring outside can smile eyes open and shut rattles can make her walk	nose hair mouth eyes feet lips arms legs blouse skirt sweater eyelashes	soft bright smooth arms move pretty	human person	

TABLE 27--Continued

Object	Label	Color	Shape	Composition	Function	Action	Major Parts	Physical Character-istics	Comparison	Person-Place or Thing
CUP	cup mug Snoopy Cup	white black	round square	plastic	drink	wash play pour put coffee in	handle holes side top	Snoopy Woodstock pictures deep words on smooth shiny		milk coffee water
BALL	ball	colors red blue white	round	rubber	play with	bounce throw roll catch golf juggle put inside house	crack line (seam) top bottom spot for air to go in	sunshines on it lightnings on it words on it smooth decorations		air house wall floor
COMB	comb	black	curved		comb hair brush hair	wash it put it in bathroom scratch "trap" things	teeth bristles prickles sticks front line	unbreakable words on it circles on it one tooth is broken smooth painted	fork	hair bathroom
BRUSH	brush ladies comb	black blue white orange gold red colors	roundish	plastic	brush comb hair		bristles points sticks pad back black things bottom top	designs flowers missing a bristle smooth pretty words on it hump	spoon	hair
ROPE	rope skipping rope	white		strings		can tape it jump tie put in house skip swing make loops pretend snake	tape "ropes"	tight smooth shiny bumps puffy (ends)	snake "washer"	house horses

BLOCK: "paint it"
DOLL: "she can smile," "her eyes open and shut"

The blind children's reliance on tactual input could be seen in their responses in the categories Physical Characteristics and Comparison. As on the verbal attribution task, these responses related primarily to textural characteristics ("smooth," "pointy," "goes in a little") and to shape (BLOCK: "like a board"; BALL: "an orange"). The reference by one blind child to the PENCIL's having a "name on it" was also based on tactual examination, although it is possible that the child may have been told at some time that a pencil often has words imprinted on it.

In contrast, the domination of visual input for the sighted was profoundly evident in their responses in several categories. For example:

Label: "Snoopy cup," "Marie doll," "Barbie doll"
Shape: "flower," "leaf," "mountain"
Physical Characteristics: "shiny," "words on it," "decorations," "see self in it," "missing bristles"

The use of visual terminology by the blind was minimal on the tactual attribution task (2%). Such terms were limited to Color and the Physical Characteristics "clean" and "striped." The blind child who had some color vision was responsible for many of the visually oriented responses.

Nominal Realism and Animism

In seeking to assess the children's concept of the objects during the verbal attribution portion of the interview, the subjects were asked to respond to a series of questions dealing with the origin and meaning of the object's name, nominal realism, and animism. Five MT and five LT objects were included in this analysis. The type of data gathered did not lend itself to statistical analysis; therefore, examples of the responses are listed in tables 28 and 29, and the following summary discussion is presented.

Origin of Names

Table 28 shows some of the responses the blind and sighted children made to the question "Why is it called a _____?" Many of the children from both vision groups simply replied, "I don't know" or made no response at all. Of the responses that were obtained, there appeared to be little difference between the thinking of the blind and the sighted children.

The types of responses given can be classified according to the same attribute categories used in scoring the verbal and tactual attribution data. The most frequent response made for the blind children was to express the reason for an object's name in terms of its Function or an Action involving the object. For example,

BALL: "so you can play with it"
KEY: "because it unlocks doors"
TREE: "cause you plant it"
CAR: "so you can ride in it"

Mention of the Major Parts as the reason for the object's name was also common for the blind children (HOUSE: "because it has rooms"), as was attributing the name to a Physical Characteristic of the object (TREE: "it means tall and pretty") or to its Shape (BALL: "because it's round"). Dimension, Comparison, and Label were also used by the blind in explaining the origin of an object's name.

A distinct tendency among some of the sighted children was to respond to the question with the statement, "because it looks like a _____." Function and Action as an explanation for object names appeared

TABLE 28

EXAMPLES OF RESPONSES TO ORIGIN OF NAME QUESTION "WHY IS IT CALLED A _____?"

Object	Blind	Sighted
BALL	it's round so you can play with it	it's round and bounces if you want to play with it
SPOON	you eat with it it's round like a spoon	it's sort of like a bowl it looks like a spoon
DOLL	so you can play with it it's a play thing it's cute like a doll it's a toy	a doll is a person that's not real it's a dummy it looks like a doll it doesn't look like a real baby
KEY	it unlocks things it opens a door it's a thing to start things	it looks like a key means to open a door it's small
CUP	you drink out of it it's a glass means drink water out of it	it looks like a cup it's circled
TREE	you plant it you put decorations on it it's very fat and high... I think up to the sky it means tall and pretty	it has bark on it it looks like a tree someone discovered the name...I think in a forest
HOUSE	it has rooms it's a place where you live you live in it and it has hard walls a house is to play in	you live in it then people will get warm and comfortable and they can sleep
CAR	so you can ride in it it moves and has four tires you drive it	you want to go somewhere it looks like a car it has wheels
WALL	it's a big tall board you hear things out of it it used to be called a fence	you don't want people to come in it looks like a wall
BUSH	it grows in a garden it has prickly things on it it has leaves you get stuck in it it's heavy and you can't jump on top 'cause it's very high	it's a short tree it looks like a bush

less frequently in the responses of the sighted children. Explanations for the objects' names that were given by the sighted children related to such attributes as Shape, Dimension, and Comparison.

Nominal Realism

Table 29 lists exemplary responses of the blind and sighted children to the question "Can we change the name of the object?" Again, there was no generalized tendency in either group to respond positively, indicating recognition that the name is not a part of the object itself but is a socially agreed upon symbol, or negatively, indicating a belief in nominal realism.

Frequently, no response at all was given to the question. Some of the younger children, both blind and sighted, indicated that changing the object's name was acceptable, but when a new name was suggested by the examiner, that name was rejected as inappropriate or the child stated that in so changing the name "we would get in trouble." As Table 29 suggests, there was less of a tendency among the blind than among the sighted to dissociate the name from the object; i.e., to allow that changing the name of the object does not alter the object itself. Occasionally, a blind child would permit a name change provided that the new name was a synonym (HOUSE: "home") or that the new name connoted an object that was similar to the original (TREE: "bush").

The sighted group, considered as a whole, was more ready to accept a name change, stating that the object would still serve its intended function or would still be the same even though the name was different. Even in some instances when a sighted child refused to allow a name change,

TABLE 29

EXAMPLES OF RESPONSES TO NOMINAL REALISM QUESTION "CAN WE CHANGE THE NAME?"

Object	Blind	Sighted
BALL	no; not be a ball anymore	no; my mom will get mad no; people won't know what you're talking about no; wouldn't be shaped like a ball yes, but it wouldn't be the right name
SPOON	yes; you can still eat with it no; can't eat with it if not a spoon	no; that's the way it's supposed to be maybe, but you'd get them all mixed up no, 'cause be a different shape doesn't sound right, but you can still eat off of it
DOLL	no; would look like something else no; then can't play with it	no; would be something else...would be in a different shape yes; still be a doll; still be something to cuddle
KEY	yes, but that would be dumb no; wouldn't be a key no more no; not open doors yes, call it whatever you like	no; already has a name no; not open doors if call it something else yes; still open doors
CUP	yes; still drink out of it no; can't drink out of it if you change the name	no; already has a name no; can't drink out of it OK; we'd drink out of PUCS instead
TREE	no; wouldn't be a tree no more yes; a bush	no; been called tree for a long time no; already has a name yes; still be a tree
HOUSE	no; not nice to the people yes; a home yes; still live in it no; not be a house no more	no; already has a name no; the people would die yes; but house is the best name no; wouldn't look like a house
CAR	no; wouldn't be a car	no; people wouldn't know what we're talking about OK; people still get places yes; still drive it
WALL	yes; call it anything you want	no; if change, people can get in no; would look like something else
BUSH	yes; a tree	no; it would look like something else

the reason given implied a recognition of the social aspect of language, as in these examples:

BALL: "no; people would not know what you're talking about"
SPOON: "no; because that's the way it's supposed to be"
HOUSE: "no; it already has a name"

Comparison with the ages of the children showed that it was largely the older sighted children who would permit the name to be changed. When the data regarding nominal realism was examined in the light of whether concrete reasoning was demonstrated by the children on the Piagetian tasks, it became evident that those who would allow the name to be changed tended to be those who were functioning at a concrete operational level of cognitive development. The one blind child who "passed" the conservation of substance task, however, showed nominal realism in her discussion of the objects. This finding helps to explain why there were more responses in the sighted group affirming that object names can be changed. Nominal realism appears to be related to preoperational thought in the blind and sighted children involved in this study.

Animism

In response to the question "Can a ____ feel, hear, think?" most of the blind and sighted children replied negatively, denying humanistic qualities to the objects. The most common reason for this denial was the affirmation that the object has "no hands, no ears, no brains." Thought was, for some of the blind children, associated with speech and was denied to an object because "it has no mouth" or because "it can't talk."

An exception to this general trend was found among the responses of both the blind and the sighted children regarding the object's ability to feel things. Some of the children (up to and including a sighted child of CA 7 years 8 months) attributed feeling to some of the objects. Examples of this type of response are:

BALL:	"can feel rolling down the stairs" (blind)
	"can touch (feel) the ground" (sighted)
SPOON:	"feels soup" (blind)
	"feels the plate" (sighted)
KEY:	"can feel if it's opening the door" (blind)
	"can feel when you put it in the engine" (sighted)
CUP:	"can tell if it's getting water in it" (blind)
TREE:	"can feel it when you climb it" (sighted)
HOUSE:	"can feel kids playing inside" (sighted)

In addition, all three animistic qualities were attributed to the DOLL by three of the blind children "because the doll has a mouth, ears, and eyes." This response was not noted among any of the sighted children. Whether or not an individual was classed as a conserver did not appear to be related to the answers given on this part of the interview. For the most part, animism was not strongly accepted by the blind or the sighted.

Manual Expression

Blind vs. Sighted Group

During the verbal attribution portion of the interview (Part I) the subjects were asked to demonstrate how they would use the MT objects (without the actual object being present). Appropriate gestural responses were recorded along with any tendency to respond verbally to the manual expression task. Table 30 displays the mean number of verbal and gestural responses and the related t values for the blind and sighted groups, and for the conservation/nonconservation groups. Comparison of the means for the blind and sighted groups shows a statistically significant difference for both types of response, but in different directions. The blind group tended to respond verbally more than the sighted group; the sighted group, on the other hand, made more gestural responses than the blind children.

TABLE 30

MEANS AND t VALUES ON MANUAL EXPRESSION TASK

Group	n	Verbal Response Mean	t	p	Gestural Response Mean	t	p
Blind	10	5.9	3.12	.01	5.7	2.12	.05
Sighted	10	2.2			8.4		
Older Blind	5	6.0	0.10	NS	7.0	1.17	NS
Younger Blind	5	5.8			4.4		
Older Sighted	5	3.0	1.21	NS	8.8	0.67	NS
Younger Sighted	5	1.4			8.0		
Older Blind	5	6.0	1.52	NS	7.0	1.00	NS
Older Sighted	5	3.0			8.8		
Younger Blind	5	5.8	3.04	.05	4.4	2.03	NS
Younger Sighted	5	1.4			8.0		
Conservers	6	3.3	0.64	NS	8.8	1.78	NS
Nonconservers	14	4.4			6.3		

Comparisons over age. Comparisons of the mean number of responses of the older blind children with the younger blind children showed no statistically significant differences between the groups. Similarly, comparison of younger and older sighted children revealed no significant differences.

Comparisons by age across vision groups. Table 30 shows that there is no significant difference in the number of verbal or gestural responses between the older blind and the older sighted children. Nevertheless, the number of verbal responses was higher for the blind children, while the blind children made fewer gestural responses than their sighted peers. A significant difference was found, however, between the number of verbal responses made by the younger blind children and those of the younger sighted children, indicating a tendency for the younger blind children to respond verbally to the task. A reverse direction in the number of gestural responses is evident--the younger sighted outnumbered the younger blind children--but not to a statistically significant degree ($p = .08$).

Conservers vs. Nonconservers

Table 30 also shows the mean number of verbal and gestural responses and related t values for conservers and nonconservers. No statistically significant differences were revealed by this comparison, although it can be seen that the conservers gave fewer verbal and more gestural responses than the nonconservers.

Quality of Manual Expression

In those instances when the blind children did respond gesturally, the quality or appropriateness of the gestures did not appear to differ from the manual responses of the sighted children to any appreciable degree. Four blind children responded neither verbally nor gesturally a total of 13 times. These children ranged in age from 3 years 8 months to 7 years 3 months. On the other hand, four sighted children failed to make any response 10 times. These children ranged in age from 4 years 5 months to 9 years 0 months.

Items to which no response was given included the BLOCK, PENCIL, BALL, and ROPE for both vision groups; KEY, SPOON, COMB, CUP, and BRUSH for the blind children; and DOLL for the sighted children. The statistical difference between vision groups described above may suggest a lack of understanding on the part of the blind children of the concept "show me" rather than a deficiency in object concept itself. Such lack of understanding can be attributed to the absence of vision.

Object Identification

Part II of the structured interview required the children to tactually identify the ten objects before describing them. By subtracting the number of objects identified from the number of objects the children were able to describe in Part I (verbal attribution--more tangible objects), determination could be made of any tendency toward verbalism among the blind. Statistical comparison of the number of objects correctly identified by the blind and sighted groups showed no significant difference between vision group ($t = 1.12$, $p > .05$).

Qualitative Analysis

In only one instance was a child completely unable to identify through tactual examination an object which had been described during the verbal attribution segment of the interview: the youngest blind child (CA 3 years 8 months) was unable to name the ROPE. This child also identified the DOLL as "baby" and the BRUSH as "a big comb." A second blind child (CA 4 years 5 months) labeled the CUP as a "glass." One sighted child (CA 4 years 5 months) described the BRUSH as a "ladies comb." These responses were considered incorrect when tallying the number of objects identified, but it is recognized that the children's labels for the objects fall within the same general class as the stimulus objects. Consequently, verbalism did not appear to be a significant problem for these children, at least in terms of the objects used in the present study.

Receptive and Expressive Use of Comparatives

Receptive Comprehension

Blind vs. sighted groups. No significant differences between the blind and sighted groups were evident following comparison of the groups for receptive comprehension of comparative adjectives of dimension. Table 31 shows the number of correct responses for each comparative adjective by the two vision groups. As is evident from table 31, both the blind and the sighted groups had minor difficulty with "thicker." The blind children also experienced some difficulty with "thinner" and "narrower."

Conservers vs. nonconservers. Table 31 also shows the number of correct responses made by the conservers and nonconservers. Statistical comparison of the groups did not indicate significant differences for any single dimensional adjective. However, the difference between group means for the total number of correct responses was statistically significant, with the conservers showing the higher number of responses. Only one conserver--the blind child--responded incorrectly to one of the questions ("narrower"). Conversely, the nonconservers had difficulty with the terms "wider," "smaller," "thicker," "thinner," and "narrower."

Expressive Use of Comparatives

Blind vs. sighted children. Table 32 lists the mean number of responses by the blind and sighted children to the questions on the expressive use of comparatives task. As shown on the table, the sighted children made significantly more spontaneous comparisons than the blind.

TABLE 31

NUMBER OF CORRECT RESPONSES TO RECEPTIVE COMPREHENSION OF DIMENSION ADJECTIVES

Group	n	Longer	Shorter Length	Bigger	Wider	Smaller	Thicker	Thinner	Taller	Narrower	Shorter Height	TOTAL CORRECT
Blind	10	10	10	10	9	9	8	7	10	7	10	90
Sighted	10	10	10	10	10	10	7	10	10	9	10	96
Conserv.	6	6	6	6	6	6	6	6	6	5	6	59*
Noncons.	14	14	14	14	13	13	9	11	14	11	14	127

*p ≤.05

TABLE 32

MEAN NUMBER OF RESPONSES ON EXPRESSIVE USE OF COMPARATIVES TASK

Group	n	Number of Spontaneous Comparisons	Correct Spontaneous Comparisons	Spontaneous Comparisons by Length	by Thickness	by Size	by Height	by Width	Number of Elicitations Required	Response to Elicitation
Blind	10	3.1	1.2	0.2	0.6	2.0	0.3	0.0	4.0	2.6
Sighted	10	5.4*	2.6*	0.1	1.4*	3.1	0.2	0.6**	3.5	2.4
Conserv.	6	6.2**	2.7*	0.2	2.0***	3.0	0.5	0.5	3.0	2.5
Noncons.	14	3.4	1.6	0.1	0.6	2.4	0.4	0.2	4.1*	2.5

*p $\leq .05$

**p $\leq .01$

***p $\leq .001$

Also, in making those comparisons, the sighted children responded with the more appropriate (precise) dimensional term significantly more often than the blind children. Examination of the data indicates that, for both vision groups, the greatest tendency in making spontaneous comparisons was to refer to the general size of the object (i.e., big or small). Also, sighted children responded with terms along the dimensions "thickness" and "width" more readily than the blind children. No significant differences between groups were noted in the number of times comparisons had to be elicited, nor in the number of correct responses to elicitation.

Conservers vs. nonconservers. Also shown in table 32 are the group means for conservers and nonconservers on these tasks. Statistically significant differences in favor of the conservers are shown in the table for the number of spontaneous comparisons made, and for the number of correct spontaneous comparisons. Again, the means indicate that both groups tended to spontaneously compare the objects on the basis of general size. Conservers also were found to compare objects by thickness significantly more often than nonconservers. The close parallel between these findings and those discussed above (blind vs. sighted) probably relate to the fact that the conservation group was composed mainly of sighted children.

Table 32 shows that the nonconservers required significantly more comparison-elicitations than the conservers. This corresponds to the finding that conservers made more spontaneous comparisons. Both groups responded equally well to the elicitation questions.

Qualitative Analysis of Receptive and Expressive Data

As indicated by the statistical analysis, there was a decided trend when spontaneously comparing the objects as to their dimension for both vision groups to use terms denoting general size in reference to the dimensions height, width, length, and thickness. When the blind children were presented with the objects and instructed to "Tell me about these two ____," the tendency was for them to center their attention on one of the objects and to describe it in terms of its physical characteristics, specific function, or possible uses. The sighted children, on the other hand, more readily compared the objects on the basis of dimensional differences which were, of course, immediately apparent upon visual inspection. Hence, Table 32 shows a statistically significant difference between vision groups in the number of spontaneous comparisons of dimension. Dimensional distinctions were, apparently, less obvious to the blind children who had to rely on tactual examination of the objects.

Of the blind children's responses to the elicitation question designed to encourage dimensional comparison and to determine whether the children used the correct dimensional term expressively (e.g., "This one is thick; this one is ____?"), 35% were incorrect. Of these, five errors were along the dimension "height," three related to "thickness," three were for "width," two were for "size," and one was for "length." Wide/narrow and thick/thin were also the dimensional concepts for which the blind group had difficulty on the receptive comprehension task. That these dimensional concepts were weakly understood by the blind group is suggested by this data. The sighted group also had some difficulty with the concepts of width and thickness.

Verbal Comparison of Less Tangible Objects

Blind vs. Sighted

Table 33 presents the mean number of correct responses for the blind and sighted groups to the verbal comparison task for less tangible objects (protocol Part IV). As indicated by the table, no statistically significant differences between groups were found.

TABLE 33

MEAN NUMBER OF CORRECT RESPONSES ON VERBAL COMPARISON TASK

Group	n	Longer	Wider	Smaller	Thicker	Taller	Shorter (Length)	Bigger	Narrower	Shorter (Height)	Thinner	TOTAL CORRECT
Blind	10	0.9	0.8	0.9	0.5	0.8	0.4	0.9	0.8	0.6	0.5	7.1
Sighted	10	1.0	0.9	1.0	0.8	0.8	0.6	0.8	0.6	0.9	0.7	7.1
Conserv.	6	1.0	1.0	1.0	1.0*	1.0	0.7	1.0	0.7	1.0	1.0*	7.7
Noncons.	14	0.9	0.8	0.9	0.5	0.7	0.4	0.8	0.7	0.6	0.4	6.9

*p $\leq$.05

Conservers vs. Nonconservers

The mean number of correct responses by conservers and nonconservers is also presented in table 33. Statistical comparison of the means showed a significant difference in favor of the conservers for the comparatives "thicker" and "thinner." It is likely that this is attributable to the predominance of sighted children in the conservation group, since the average number of responses to these terms was higher for the sighted than for the blind.

Qualitative Analysis of Verbal Comparison Data

Both vision groups performed equally well on the task in terms of the number of correct responses, as shown via statistical comparison. However, table 33 also shows that the blind group did not receive a "perfect" score on any single variable; i.e., on none of the verbal comparisons did all ten blind children respond correctly. By contrast, the sighted group received a "perfect" score for the comparisons "longer" and "smaller."

The largest number of errors by the blind children were for the comparisons "thicker" (five errors), "shorter-length" (six errors), "shorter-height" (four errors), and "thinner" (five errors). Taken at face value, this would indicate that at least some of the blind children conceived of a BUSH as thicker than a TREE, a STREET as shorter than a CAR, a TREE as shorter than a BUSH, and a HOUSE as thinner than a TREE.

An alternative explanation is that these errors might be the result of conceptual weaknesses regarding the dimensional terms themselves. From the analysis of the blind children's receptive comprehension of dimensional adjectives (cf. table 31), it was learned that the blind group did have some difficulty with the concepts "thick" and "thin." They did not appear to have receptive difficulty with the dimensions "length" or "height" on that task, however. Review of table 32 and the data from the expressive use of comparatives task shows that spontaneous use of terms signifying these dimensions was not pronounced. Also, the number of errors that were made in response to the elicitation questions shows that these dimensional concepts were not well established. It may be, therefore, that the errors on the verbal comparison task reflect shallow understanding of the dimensional terms, especially as they apply to the less tangible objects TREE, BUSH, CAR, STREET, and HOUSE. The same may be true for the sighted children who made fewer, but similar errors on this task.

Forced-Choice of Dimensional Adjectives

To determine whether or not a systematic relationship existed among the children's responses to the forced-choice task involving polar adjectives of dimension, a chi square analysis was done and contingency coefficients calculated to assess the strength of the relationships. Results of this analysis for the blind and the sighted children is presented in table 34.

As can be seen in table 34, a statistically significant relationship exists for both vision groups among the response variables size x height, size x width, size x length, size x thickness, and height x length. In addition, for the blind children a significant relationship exists on the variables height x width. On the other hand, height x thickness and width x thickness were significantly related for the sighted children. This indicates that for those variable combinations for which significant relationships were found, there was a tendency for the groups to select adjectives of the same polarity in describing the objects; e.g., "big and tall" or "small and short" rather than "big and short" or "tall and small." Since size was significantly related to the other four dimensions, it can be stated that if a child (from either vision group) initially replied that the object

TABLE 34

CHI SQUARE ANALYSIS OF FORCED-CHOICE DATA

	Blind				Sighted			
Variables	χ^2	Significance	Contingency Coefficient	Rank[a]	χ^2	Significance	Contingency Coefficient	Rank[a]
S x H	32.44	.001	0.44	1	39.40	.001	0.43	1
S x W	14.19	.001	0.31	2	10.16	.001	0.24	6
S x L	8.91	.01	0.26	5	29.75	.001	0.38	4
S x T	3.95	.05	0.18	6	18.11	.001	0.31	5
H x W	12.29	.001	0.27	4	0.38	NS	0.06	
H x L	13.73	.001	0.28	3	34.46	.001	0.40	3
H x T	0.00	NS	0.02		7.29	.01	0.20	7
L x W	0.73	NS	0.08		3.31	NS	0.14	
L x T	1.49	NS	0.11		0.00	NS	0.01	
W x T	0.60	NS	0.07		38.80	.001	0.42	2

NOTE. df = 1 for all tests

[a]Rank = in order of strength of relationship for significantly related variables

is "big," positive-pole adjectives would generally be selected in response to the remaining dimensional choices.

The strength of the relationships indicated by the contingency coefficient (C) varies. The strongest relationship for both vision groups was for size x height (C = 0.44 for the blind; C = 0.43 for the sighted). The results of this analysis suggest that both vision groups tend to relate the global terms of size ("big/small") to the dimensions "height," "width," "length," and "thickness." This corresponds to previous findings on the expressive use of comparatives task (protocol Part III).

Table 34 reveals a stronger relationship among the sighted subjects for size x thickness and size x length than among the blind children. Moreover, for the sighted group, a relationship existed for height x thickness and width x thickness--variables for which there was not a significant relationship among the blind. On the surface, this indicates a greater tendency for the sighted to respond with dimensional adjectives of the same polarity for these variables. It may also suggest a more adequate understanding of these dimensional concepts by the sighted children. In only one instance was there a significant relationship among variables for the blind children that was not also significant for the sighted: height x width.

The absence of a statistically significant relationship for height x thickness, length x width, length x thickness, and width x thickness among the blind may be a reflection of the difficulty revealed on the receptive and expressive use of comparative tasks. Altogether, these data suggest that for some of the blind children these concepts of dimension are not fully developed.

Qualitative Analysis

For all but one variable combination in which there was a significant relationship, the largest percentage of responses was the selection of the unmarked, positive-pole adjective (e.g., big and tall, big and wide, tall and long, etc.). The single exception to this pattern was by the blind children on the height x width correlation, for which the largest percentage of responses indicated the marked, negative-pole adjectives (short and narrow).

Although the children were encouraged to select one of the opposite pole adjectives for each forced-choice question, on a number of occasions the children were unable to make a choice and responded "Both," "It could be either," or "Part of it is big and part of it is small," etc. Inspection of the data reveals that the blind children considerably outnumbered the sighted in the number of times a choice was not made. In both vision groups, the older children (CA greater than 7 years) responded in this manner more frequently than the younger children. Furthermore, for each vision group, comparisons by the general attribute of size received the highest percentage of responses in which it was recognized that "some of them are big and some of them are small," etc. (i.e., 26% for the blind; 6.5% for the sighted).

Chapter IV has presented an analysis of the performance of the blind and sighted children on the several cognitive and semantic tasks. The children's responses were statistically analyzed for comparison between vision groups and descriptively examined as to the quality of responses on the attribution/semantic tasks by the congenitally blind children. The concluding chapter will provide a summary discussion of the information gained through this study from the theoretical framework developed in chapter II and some of the research reported therein. The present data will be considered in relation to the research questions posed at the outset. Areas for continued investigation will be raised and implications for the early education of visually handicapped children will be suggested.

CHAPTER V

SUMMARY, DISCUSSION, CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

Summary

The present research was designed as an exploratory investigation of the semantic and cognitive functioning of congenitally blind children within the age range of 3 through 9 years. More specifically, this study proposed to explore and analyze the mental representation of selected objects common to the experience of all the children. This was accomplished through a study of the descriptors attributed by the children to the objects. Interest was in the type, number, and quality of attributes assigned to the objects, and of the children's conception of selected dimensional adjectives in dealing with those objects.

The literature has suggested that, owing to the limitations imposed by blindness, many of the words and/or concepts used by congenitally blind children may possess idiosyncratic meanings based on significantly different experiences and mental representations of their referrents. For this reason, a matching group of sighted children was included in the study in order to compare the responses across vision groups. In this way, it was hoped that insight would be gained into the effect of the absence of vision on children's understanding of common words and concepts, and into the nature of blind children's representational thought.

The ten congenitally blind children involved in the study were gathered from North Dakota and Minnesota through the assistance of the public schools, the North Dakota State School for the Blind, and State Services for the Blind in St. Cloud, Minnesota. The children were totally and congenitally blind, and were of estimated "normal" intelligence. Parental responses on the Developmental Profile (Alpern & Boll 1972) indicated that all the children were developing within normal ranges in the areas of self-help skills, social skills, academic skills, and communication skills.

All children were interviewed individually following a standard protocol. By means of these structured interviews, data was gathered relative to the cognitive functioning of each child and responses were secured to the various lexical semantic tasks. Cognitive assessment centered on Piagetian measures of conservation and concrete reasoning, symbolic imagery, and classification. The lexical semantic tasks focused on verbal attribution for selected objects defined as "more tangible" and "less tangible," and measures of receptive and expressive use of dimensional adjectives in dealing with those objects. Children's responses to the semantic tasks were considered in the light of their cognitive functioning.

Summary and Discussion of Major Findings

In this and the following section (Conclusions), the major findings of the study will be summarized and discussed within the theoretical framework developed in chapter II and its relation to some of the literature reviewed therein.

Cognitive Development

The performance of the congenitally blind children on the cognitive reasoning tasks used in the present study tends to support the conclusions of previous researchers (e.g., Brekke, Williams, & Tait 1974; Gottesman 1973, 1976; Stephens & Simpkins 1974) that cognitive delays are observed in visually handicapped children. The age range of the children included in this investigation extended into what would normally be considered the concrete operational period of development, the beginnings of which are usually associated with a CA of 7 years. This period of development is characterized by internalization of actions and ideas regarding objects, classes of objects, and the relationships between and among objects. The concepts of conservation and reversibility, and multiple classification can be observed in children functioning at a concrete operational stage of cognitive development.

Evidence of conservation and concrete reasoning was found among the older sighted children (those from CA 7 years 3 months through 9 years 9 months) but not among the blind children. The oldest blind subject (CA 9 years 11 months) demonstrated conservation of substance but failed to show evidence of concrete reasoning on the remaining conservation tasks. It is likely that this child was in a period of transition at the time this data was collected, and that given appropriate structured experiences with objects could move swiftly into the concrete operational stage of development. On the basis of this child's having "passed" the conservation of substance task, she was included among the "conservers" for subsequent statistical comparisons. However, considering overall cognitive functioning as measured by the Piagetian experiments used in this study, it was concluded that the congenitally blind group was functioning at a preoperational level, thereby evidencing cognitive delay for the five older blind children.

Stephens and Simpkins (1974) found symbolic imagery to be an area of weakness among congenitally blind school age children. The blind subjects in the present study likewise demonstrated difficulty on the Piagetian assessment of mental imagery (rotation of beads). Mental manipulation of the tactually based image of the objects used in the experiment proved troublesome for these subjects. This evaluation yielded a statistically significant difference between vision groups on the mental imagery task.

Statistical comparison also showed a significant difference in the level of concept attainment for the class inclusion task. The sighted children showed a greater understanding of the multiple classification concept than their blind peers. These results further support the contention that the congenitally blind youngsters involved in this study were functioning at a preoperational level of cognitive development, indicating some cognitive delay among the older subjects.

Verbal Attribution

As could be expected, the blind children made significantly less reference to Color of the various objects than the sighted children. Most of the responses that were made by the blind group were references to the fact that the object has color rather than to specific colors. However, when specific colors were attributed to objects by the blind, appropriate color words were used.

Aside from the attribution of color, there were but a few statistically significant differences between vision groups in the number of responses falling within the various attribute categories. The blind group did use significantly more egocentric attributes (Person-Place-Thing, Comparisons) in their description of the MT objects than the sighted children. The blind group also used more attributes of a functional nature (Function, Action), but fewer perceptual attributes (Color, Shape, Major Parts, Numerosity, Dimension, and Physical Characteristics) than the sighted children. Although the difference was not statistically significant, the blind group assigned a greater number of attributes to the MT objects than the sighted group.

For the LT objects, the blind group ascribed fewer attributes to the objects. Moreover, the blind children used fewer egocentric, functional, and perceptual attributes in their discussion of the LT objects than the sighted children used.

Based on a comparison of the total number of attributes assigned to the objects by the congenitally blind children, it was found that they were better able to discuss the MT objects than the LT objects. A greater number of egocentric and functional attributes were used in their discussion of the MT objects, as well as attributes in the categories Shape, Dimension, and Physical Characteristics. When discussing the LT objects, however, more mention was made of Color, Major Parts, and Numerosity attributes than was the case for the MT objects. Also, a larger number of incorrect responses were made by the blind in regard to the LT objects than were made for the MT objects.

Differences over age in the number of attributes the blind used in several categories were found. For both the MT and LT objects, a greater total number of attributes were conferred by the older blind, the difference between age groups achieving statistical significance in the discussion of the LT objects. The older blind children also attributed significantly more Composition and Dimension attributes to the MT objects than the younger blind children. The general trend was for the older children to impart a greater variety of attributes to the objects. The same was found to be true when the younger and older sighted children were compared. If the attribute categories are equated with semantic features, this data may be considered as support for the semantic features hypothesis (E. Clark 1972, 1973, 1974, 1977a, 1977b) according to which word meaning is "built" by successively adding semantic features to the child's concept of the word/object.

More egocentric, functional, and perceptual attributes were used by the older blind children for both the MT and the LT objects. The difference in the number of perceptual attributes ascribed to the MT objects was statistically significant, as was the difference in the number of egocentric attributes for the LT objects. On the other hand, no significant differences in these combined attribute groups were found between the younger and older sighted children, although the total number of attributes used by the older sighted children was higher than that of the younger sighted children.

In contrast to the blind, it was the younger sighted children who had a higher number of responses in the egocentric group. This would appear to be the result of added experience for the older sighted children (enabling them to deal with the objects in a less egocentric manner), but may also relate to the fact that the blind children were functioning at a preoperational level which is characterized by egocentric thought. Support for this conclusion is found in the comparison of the number of responses made by conservers and nonconservers. Although these differences did not attain statistical significance, conservers used a higher number of functional and perceptual attributes, and a lesser number of egocentric attributes in discussing the MT and LT objects than the nonconservers used. The conservers group, it will be remembered, contained only one blind child.

The younger blind children assigned more egocentric and functional attributes to the MT objects than the younger sighted children. On the other hand, the younger sighted children assigned more egocentric, functional, and perceptual attributes to the LT objects. This suggests that the younger sighted children have had more, or more meaningful, experiences with the LT objects, resulting in a more developed object concept for these items. Comparison of the older blind and older sighted children showed that the older blind mentioned more egocentric attributes for both MT and LT objects than the older sighted children, suggesting (a) that the blind children had benefited from the additional experience that accompanies age, and (b) that the blind children held a more "personalized" meaning for the objects based on their experiences and association with the objects. There was little difference between the older blind and sighted in the number of functional and perceptual attributes assigned to the MT and LT objects, which is considered to be further evidence of increased experience with objects over age.

Regarding the quality of responses, this study showed many similarities between the blind and the sighted children suggestive of common experiences with the objects. Duplication of responses between vision groups was noted in the attribute categories Function, Action, and Major Parts. Evidence of egocentric attributions were found in the blind children's responses in the Label and Person-Place-Thing categories where siblings, friends, personal toys and experiences were mentioned. This was not found to the same degree in the responses of the sighted children.

The blind children's reliance on tactually rather than visually acquired information was apparent in their responses describing the Physical Characteristics of objects. Such attributions were largely restricted to textural information, in contrast to the sighted children's responses which included visually oriented characteristics. The blind group also made more Comparisons to other objects than the sighted. comparisons based upon the shape and/or function of the objects. These facts, plus the relative lack of visually oriented attributions, suggest that the blind children's conceptualization of the objects is based on their unique experience.

Less imaginative use of the MT objects by the blind was suggested by the absence of references to "pretend" play such as were given by some of the sighted children. This corresponds to the findings of previous studies carried out by Singer (1966), Singer and Streiner (1966), and Tait (1972).

Tactual Attribution

Similar results were obtained on the tactual attribution tasks as on the verbal attribution tasks. The blind made significantly less

Color attributions than the sighted, and those that were made were basically references to the fact that the object has color. The total number of attributions was higher for the sighted than for the blind, and in each combined attribute group (egocentric, functional, and perceptual) fewer responses were made by the blind children than by the sighted children. On the other hand, the blind children made more incorrect attributions and more negative responses to the objects.

Differences over age were apparent among the blind group. The younger blind children suggested a greater number of egocentric and functional attributes than the older blind; the older children, in turn, suggested more perceptual attributes. Significantly more attributes in the Shape, Composition, and Physical Characteristics categories were made by the older blind children. The total number of attributes assigned to the objects was also higher for the older blind subjects.

The total number of attributions by the conservers was significantly greater than that of the nonconservers. A significantly higher number of perceptual attributes were mentioned by the conservers; nonconservers described the objects more in terms of egocentric and functional attributes. In addition, the nonconservers made more incorrect attributions.

With respect to the quality of attributions, similarities were again apparent between the blind and the sighted children, particularly with reference to the Action and Major Parts responses. A subtle difference was suggested between the Action responses given by the blind and sighted groups, however. The blind children's responses seemed to be more concrete in nature, often suggesting an action which could be performed with or upon the object. In contrast, the sighted children's responses were often of a more abstract nature and frequently revealed the influence of visual input.

The reliance upon tactual experience was apparent in the attributions of the blind children in the categories Physical Characteristics and Comparisons. Such attributions were largely based on textural aspects and/or shape, as was the case on the verbal attribution task. Visually oriented terminology was at a minimum, restricted to the mention of Color and such Physical Characteristics as "clean" and "striped." On the basis of the verbal and tactual attribution tasks used in this study, support is found for the conclusions of Harley (1963) and Dokecki (1966) that visually oriented verbalisms are not a significant problem for congenitally blind children.

No statistically significant differences between vision groups were found concerning the ability of the children to identify, via tactual examination, the objects used in the testing. A single blind child was unable to identify the ROPE, although she had been able to discuss it on the verbal attribution task. Mislabeling of objects occurred three times among the blind group and once for the sighted, but the names that were suggested for the objects were within the same general class as the stimulus object. In each instance, the child who mislabeled an object was among the younger group of children. This parallels Harley's (1963) observation that with increased age, and consequently increased experience with common objects, comes a decrease in the number of verbalisms found in the language of blind children. It was concluded, therefore, that verbalism--the ability to describe but not identify an object--was not a significant problem for these children, at least in terms of the objects used in this study.

Verbal and Tactual Attribution

Because of the blind child's reliance upon tactually gained information about objects, differences in the number of attributes assigned on the basis of verbal recall and on the basis of tactual exploration would be expected. Indeed, statistically significant differences did occur when the performance on the two tasks was compared. Significantly more Function, Person-Place-Thing, and Comparison responses were given on the verbal attribution task by the blind children. On the other hand, the number of Action responses and the total number of attributes assigned was higher for the tactual portion of the interview (not to a statistically significant degree, however).

Egocentric and functional attributes were used more frequently during the verbal task, to a statistically significant degree. Greater attention was paid to the perceptual attribute categories during tactual examination, however. These same patterns were found in the responses of the sighted children, and are not in themselves indicative of deficiencies in the mental representation of the congenitally blind.

Manual Expression

The children were asked to demonstrate the use of the MT objects (through pretense of having the object in their possession) in order to gather additional data regarding their mental representation and conceptualization of the objects. It was found that the blind children tended to respond verbally rather than, or in addition to, gesturally to a significant degree. Conservers tended to respond with fewer verbal expressions and more gestural responses than nonconservers, although these differences were not statistically significant. The gestural responses the blind children did make were generally appropriate to the object specified. It is felt that the statistical differences between vision groups are suggestive of a lack of understanding by the blind children of the concept "show me" which can be attributed to the absence of vision. The younger blind children made significantly more verbal responses than the younger sighted children, though there was no statistical difference in the number of gestural responses. This lends further support to the interpretation that the concept of showing something to another either has little meaning for young blind children or is interpreted by them as implying verbalization. It is also possible that the prompt "pretend you have a ____ and show me how you use it" may be less meaningful for blind children because of their reported lack of creative and imaginative play (Singer 1966; Singer & Streiner 1966; Tait 1972).

Nominal Realism

Explanations given by the blind children for the origin or meaning of the names of the objects generally related to the specific Function of the object or to an Action involving the object. Major Parts were sometimes given as reasons for the name being what it is, as well as Physical Characteristics and Shape. The fact that the same attribute categories can be used to "classify" the children's responses to the origin of names question as were used in the verbal and tactual attribution tasks, substantiates Bloom's (1975) assertion that the manner in which a child perceives and mentally represents objects or events gives structure to the lexical meaning of words for the child.

The blind children were less ready to allow a name change than the sighted, frequently asserting that to change the name would result in the object's no longer serving its function or being the same object. Those who would permit the name to be altered without subsequently altering the object itself, tended to be those who showed concrete operational thought. Consequently, the blind children, functioning at a preoperational level, generally showed a belief in nominal realism. In addition, several of the blind children conferred the animistic attribute of feeling to many of the objects (cf. Wills 1965). Hearing and thinking, however, were denied to the objects with the exception of the DOLL. Nominal realism has been observed in sighted children of CA 6 to 7 years (Williams 1976, 1977). Its presence in the thinking of the older blind children involved in the present study provides further evidence that these children were functioning at a preoperational level of development and demonstrated cognitive delay (Piaget 1967).

Receptive Comprehension of Comparative Adjectives

No significant differences between the blind and sighted groups were found in terms of the number of correct responses to the receptive use of comparatives task. A few of the blind children were unable to identify the "thicker," "thinner," and "narrower" objects when requested to do so. The sighted children also erred on "thicker" and "narrower." Comparison of conservers and nonconservers indicated that little difficulty was had by the conservers on any of the comparative adjectives--

a single error was made on "narrower." Nonconservers, on the contrary, made significantly more errors on this task. Difficulty was greatest among nonconservers for the concepts of "width" and "thickness."

Expressive Use of Comparatives

The blind children, when asked to compare two objects that were identical except along one dimension, tended not to compare the objects by dimension spontaneously. More frequently, the blind would focus their attention on a single object and describe it in terms of its function, use, or physical characteristics. The sighted children more readily compared the objects as to dimension. When dimensional comparisons were made by the blind children, general references to size (big/small) were used to describe the dimensions height, width, length, and thickness. This tendency was also found among the sighted children.

Comparison of conservers and nonconservers revealed the same tendencies. The conservers group--primarily sighted children--made more spontaneous comparisons and specified the correct dimension significantly more often than the nonconservers.

When specific comparisons were elicited from the blind children, errors were made along each dimension, but primarily for height, thickness, and width. The latter two problem dimensions are those which were shown to be more weakly developed concepts on the receptive comprehension task.

Verbal Comparisons of Less Tangible Objects

No statistically significant differences occurred between vision groups in the number of correct responses to the verbal comparison questions involving less tangible objects. However, the blind children made a number of errors involving the comparatives "thicker," "thinner," and "shorter" (both height and length). The objects involved in these comparisons were BUSH, TREE, STREET, CAR, and HOUSE. The evidence suggests that the blind group was at a disadvantage when applying these dimensional terms to objects that were not fully accessible to tactual examination. In general, this portion of the interview, when considered in conjunction with the results of the children's receptive and expressive use of comparative adjectives, appears to agree with the order of acquisition of spatial-comparative adjectives predicted by Clark (1972): big/small before tall/short and long/short; long/short before thick/thin and wide/narrow.

Forced-Choice of Dimensional Adjectives

Statistically significant relationships were determined to exist for both vision groups among some of the polar adjectives of dimension. This analysis showed that the children tended to use general size adjectives (big/small) to refer to the various dimensions (height, width, thickness, and length). This is possible confirmation of the idea that semantic growth proceeds from the general to the specific (Carroll 1964). A tendency to select adjectives of the same polarity was shown for those dimensions in which a significant relationship existed (cf. Brewer & Stone 1975). The largest percentage of responses was in favor of the positive pole, unmarked adjectives. This finding seems related to H. Clark's (1970) contention that the nominal use of the adjective is semantically prior to the contrastive use, and to E. Clark's (1974) conclusion that children learn to use and understand the positive terms before the negative terms.

The blind children, more frequently than the sighted, refused to make a choice and apply one of the dimensional terms to an object, particularly with the adjectives referring to general size. This was true more for the older subjects (both vision groups) than for the younger, and may be explained as resulting from a more appropriate understanding of the relativity of size. Alternatively, the blind children's dependence on tactual examination may make the size of objects more conspicuous and foster the realization that objects come in different sizes, or that different parts of the same object may vary in size.

Conclusions

Based on the present study, the following conclusions can be drawn relative to the research questions posed at the outset of the project.

Does the Absence of Vision Affect the Child's Understanding of Common Words or Concepts?

Absolute identity between individuals or groups in the number and kind of attributions made to the objects was, of course, not expected. Differences in cognitive development and individuality of experience argue against completely identical meanings being brought to words, objects, or situations by different persons. More precisely, the concern expressed in the research question was with the degree to which the absence of vision affects the meaning assigned to common words or concepts, and whether such possible differences in meaning interfere with communication between congenitally blind and sighted individuals (Scholl 1973).

The idea has been forwarded that the world is perceived and organized in accordance with the cognitive and perceptual abilities of the individual (Bierwisch 1970), that the manner in which a child perceives and mentally represents an object gives structure to the lexical meaning of the words the child uses to refer to the object (Bloom, 1975). It has been further contended (Davidson 1976; Gottesman 1976) that totally blind children must rely on less sophisticated sensory mechanisms which bring information to the child in a non-integrated, fragmentary manner. There is, therefore, an aspect of this study in which tactually and visually based information processing is compared.

The present research has highlighted some differences between the blind and sighted children's understanding of the key words and concepts studied which can be attributed to the lack of vision. However, the fact that the sighted group did not significantly outnumber the blind group in the total number of attributions for either the "more tangible" or the "less tangible" objects shows that those differences may not be severe. In fact, the blind children ascribed a slightly higher number of attributes to the "more tangible" objects than the sighted children.

Based on the number of attributes, or features, used by the blind children to describe the stimulus words (objects), the data suggests that information gained through tactual means does not significantly differ from information gained through vision. This study, therefore, has not shown the meaning of common words, and the underlying object concept as revealed through the children's attributions, to be substantially altered by the absence of vision.

The only consistently significant difference which is directly attributable to the lack of vision among the blind, is the sighted children's mention of color in describing the objects more often than the blind. Since color cannot be readily perceived via tactual exploration, the infrequency of its mention by the blind is not surprising.

The blind children interviewed in the present study tended to invest the words/objects with more private, personal meaning than the sighted children drawing upon their experience. The sighted children, on the other hand, tended to focus more on functional and perceptual characteristics. Differences between vision groups in the number of attributes in these categories were not statistically significant, however, and many of the responses bore much similarity.

Defining meaning in terms of the number and kind of attributes assigned to the objects leads to the conclusion that the "more tangible" objects held more meaning for the blind children than the "less tangible" objects. This seemed especially true for the younger blind children (those under CA 7 years) who were found to ascribe considerably (but not statistically) fewer egocentric and perceptual attributes to the LT objects than the younger sighted children. This seems indicative of less experience with the objects/concepts involved on the part of the younger blind children. These differences were not as pronounced between the older blind and older sighted children, suggesting continued and more meaningful experience with the LT objects over time. Consequently, it may be stated that the younger blind children have an accurate, but more shallow concept of the LT objects than of the MT objects. Although the present data does not support the conclusion that communication between blind and sighted children is severely hampered by the absence of vision, or that the blind child's thinking in regard to these words/concepts is "loose" (Cutsforth 1932, 1951), it may be that for more abstract concepts the absence of vision might lead to significant differences in meaning.

What is the Nature of the Blind Child's Representational Thought?

(a) Does the language of congenitally blind children reflect their unique experience and means of mental representation?

(b) Does the language of congenitally blind children reflect their knowledge of the language of sighted children?

Santin and Simmons (1977) suggested that the early language of the congenitally blind mirrors their knowledge of the language of others more than it mirrors their knowledge of the world. Hence, the present study sought to explore the nature of blind children's representational thought--that which gives structure to the child's language (Bloom 1975; Sinclair-de-Zwart 1969). The uniqueness of the blind child's experience lies in his reliance upon nonvisual sensory input. Information about objects and events in the environment comes to the blind child primarily through tactual and auditory means (sometimes supplemented with olfactory and/or gustatory perceptions). It has been suggested that these sensory processes are less sophisticated than vision (Gottesman 1976), provide fragmented rather than integrated information (Davidson 1976), and "make the total experience of the blind child more restricted" (Warren 1977, p. 83). It was presumed that the mental representation of the objects and events in the blind child's experience are built from the information gained via these nonvisual means, and that the child's verbal description (attribution) of the objects will reveal his mental representation of the object. If the object concept and mental image significantly differs from that of the sighted children (because of the blind child's "less efficient" sensory information gathering processes), the characteristics which the child attributes to the objects should bear little similarity to those which the sighted child describes. Absence of numerous and significantly different attributions by blind children, on the other hand, would favor the conclusion that the object concept and mental image of the objects is essentially the same; that object concepts which are based on tactually obtained information closely resemble those which are derived from visually obtained information. Little or no difference in attribution, coupled with the presence of a great many visually oriented attributes would lead to the conclusion that the language of the blind reflects not their knowledge of the world of objects, but their knowledge of the language of others.

In fact, there were few significant differences in the number of attributions made to the objects by either vision group. Many of the terms used in describing the function of the objects, actions which can be performed with or upon the objects, their major parts, etc., bore much similarity between the blind and sighted children. Both vision groups made attributions based on functional and perceptual characteristics--usually a greater number by the sighted children, but not to a statistically significant degree. However, many of the actions attributed to the objects by the blind group were more concrete and simple, and the blind children tended to relate to the objects from a more personal perspective than their sighted peers.

The percentage of visually oriented terminology was considerably small (2 to 3%) in relation to the total number of attributions advanced by the blind children. Use of color words by the totally blind children reveals a copying of the language of the sighted, but such visual words were seldom used. Most of the references to specific color in the response of the blind were made by the child who had some color vision. If these responses are discounted, the number of visually oriented terms would be even less. There was no evidence of a problem of verbal unreality or verbalism in the present data.

The gestural responses made by the blind on the manual expression task (although significantly fewer than were given by the sighted children) were appropriate for the objects being considered. This is interpreted as indicating that the mental image for the blind children was based on the object concept rather than the language of the sighted.

Dimensional adjectives are, perhaps, more abstract than the objects used in the verbal attribution task. Nevertheless, significant differences in receptive comprehension of adjectives were not found between vision groups, and differences on the expressive use of comparatives task related only to the fact that the sighted children compared objects on the basis of dimension more readily than the blind. Error patterns between vision groups were similar, suggesting that the development of understanding of the concepts of dimension among the blind children parallels that of the sighted. Similarities found on the forced-choice task also support this conclusion. However, statistically significant differences between conservers and nonconservers suggests that the blind children, because of cognitive delay, will begin to "lag behind" the sighted children in the use of abstract dimensional terms as they become older.

The data from the present study suggests that the language used by the blind children to describe the various objects reflects the object concept and mental representation which they have gained through their intact sensory mechanisms. Furthermore, the data suggest that the object concept gained by these means does not significantly differ from that of the sighted child.

It is felt that if the lexical semantic tasks were carried out with older blind and sighted children (CA 7 to 12 years), greater differences might be found between vision groups. There is a delay in cognitive development among totally and congenitally blind children such that the blind children in the present study were all functioning at the preoperational level of cognitive development. Comparisons between conservers and nonconservers in this research--while not producing statistically significant differences between vision groups--suggested that conservers conceive of the objects more in terms of functional and perceptual attributes than nonconservers. Nonconservers, on the other hand, continued to assign more egocentric attributes to the objects. If the present research was to be replicated with older blind and sighted children, where the distinction between concrete operational and preoperational thought is more pronounced, the data might reveal greater (and statistically significant) differences leading to the conclusion that the object concept is significantly different (in a negative sense) from that which the sighted child derives.

What is Revealed in Their Understanding of Common Words/ Concepts Regarding the Congenitally Blind Child's Conceptualization of the World?

The present study demonstrated cognitive delay among the older blind children. All the congenitally blind children interviewed were functioning at a preoperational level of development. One of the primary characteristics of this level of reasoning is egocentrism, the inability to take the role of another, or to consider things from another's point of view, leading to the absence of reflection upon one's own thoughts (Wadsworth 1971). This tendency was evident in the responses to the Piagetian assessments as well as in many of the more personal responses to the attribution tasks. The extent to which nominal realism and the attribution of feeling to many of the objects was present among the congenitally blind confirms that the group was preoperational in their thinking.

Such tendencies are found among sighted children who function at a preoperational level also, as in this study and others (Williams 1976, 1977). Thus, though it cannot be concluded that the blind children interviewed have a different conceptualization of the world than the sighted, it can be said that the cognitive delays experienced by totally and congenitally blind children prolong such concepts of objects.

According to Piagetian theory, knowledge of objects (and hence, of the world) is derived from acting upon, or transforming, the objects. This manipulation of reality is initially carried out through sensorimotor actions performed directly upon or with the objects. Through vision, the sighted child is able to draw together and unify the information he receives during these manipulations of objects from all of his sensory mechanisms. The concern has been raised whether blind children, in the absence of unifying vision, tie together the sensory information which they receive in such a manner as to organize or mentally construct a concept of the world which is comparable to that of the sighted (Santin & Simmons 1977). There are those who suggest that auditorily and tactually gathered information is not sufficient to compensate for the visual deficit (e.g., Kephart, Kephart, & Schwarz 1974). However, the present research did not show this to be the case; large numbers of significant differences between the blind and the sighted in their verbal attributions were not found. Rather, many parallels were found in the number and kinds of responses given in the various attribute categories. There was a tendency for the blind children to use fewer perceptually based attributes in their verbal description of the objects and more egocentric and functional attributes, but not to a statistically significant degree.

Comparing the responses on the verbal and tactual attribution tasks leads to the conclusion that the mental image/object concept for both the sighted and the blind children interviewed draw more heavily on egocentric and functional characteristics of the objects. This was particularly true for the blind children who used a significantly greater number of such attributes in verbally describing the objects than they did upon tactual examination. When asked to tactually describe the objects, both groups named fewer egocentric and functional attributes and described in more detail the perceptual characteristics of the objects.

Differences in mental image or conceptualization of the objects were found only to the extent that many of the comparisons, physical characteristics, and shape attributes mentioned by the blind showed their dependence on tactual information. The sighted children, on the other hand, added to the tactually derived attributes a number of characteristics that could only be determined via vision. Nevertheless, the present data can be interpreted as indicating that the tactually derived conceptualization of the objects among the blind children does not significantly differ from the visually dominated object concept evident among the sighted children.

Recommendations and Unanswered Questions

For Further Research

Several areas for continued research are suggested by the present data.

1. The possibility that as the cognitive differences between congenitally blind and sighted children become more pronounced (i.e., concrete vs. preoperational), differences in object concept and representation and/or understanding of dimensional adjective concepts might increase, suggests the need to assess older children (e.g., CA 7 to 12 years) in similar fashion to the present research.

2. The objects used in the present study were more or less tangible and concrete. The same research questions could guide research into congenitally blind children's understanding of (a) non-tangible objects such as the sun, moon, stars, or air; (b) more abstract concepts such as clean, dirty, love, time, etc.; (c) prepositions and directional

terms necessary for orientation and mobility; and (d) novel objects or nonsense words.

3. Investigation of the meaning blind children bring to "visual" ideas (e.g., "show me" and "pretend") might be helpful in understanding the world of the blind child.

4. More direct study of the effectiveness of verbal communication among blind child and/or between blind and sighted children would yield important information in relation to the mainstreaming practices of the public schools. Examination of the functions or uses of language among blind children could be included in such research.

Unanswered Questions

The present study did not take into consideration the amount of experience the children had had with the various objects. The assumption was made that none of the objects considered would not have been encountered previously by the children. The question can be raised whether a greater number of experiences (interactions) with the objects is required by the blind children in order to form an object concept comparable to that of the sighted children in order for meaningful communication to ensue. Replication of the tactual attribution task using novel objects might help to answer this question.

The inability of the younger congenitally blind children to use tactual exploration in an efficient and systematic manner was observed during the Piagetian and tactual attribution tasks. Swallow (1973) stated that blind children need to be taught how to investigate objects actively. Since taction is a primary means of gathering information about the world and of forming mental representations of objects, why do blind children not use this sense more methodically and effectively?

Implications for Education

The most obvious implication of the present research for educational practice, particularly at the preschool level, can be drawn from the finding that the congenitally blind child's mental conception of objects is based on his personal experiences with the object and its use, and on the tactual information he gains in that experience. Educators must, therefore, take pains to assure that the blind child receives sufficient opportunity to experience first hand the objects and events. In conjunction with this, the need to assist the congenitally blind child to develop efficient means of tactually gathering information from an object in his environment must be underscored.

The use of concrete materials and "real" objects is an acknowledged principle of good teaching, but it must be stressed when working with the visually handicapped--especially in those settings where blind and sighted children are integrated. When introducing a new object into a discussion, for example, it is important that the blind child either be the first to work with and examine the object, or have one in his possession while the sighted children look at and work with another. Also, since the blind children in the present study tended to make more comparisons among objects, it might be helpful for the teacher to suggest ways in which new or novel objects being introduced into the classroom (or to the child) are similar to objects with which the blind child has had some previous experience.

A second point of educational significance is that there was no indication that verbal communication between blind and sighted children of this age group regarding the kind of objects used in this study would be seriously disrupted because of differing mental conceptions. When sufficient experiences and interactions with the objects are provided, similar concepts are developed. Any efforts at vocabularly development among preschool visually handicapped children, however, must center on actual experiences with the objects themselves, or make use of concrete (manipulative) materials in demonstrating concepts.

With regard to the preschool education of the visually handicapped (ages 3 to 6 years), this study suggests that actual experience with "less tangible" objects may be limited and/or less meaningful for the congenitally, totally blind child than for his sighted peer. This may be the case because of the lack of efficient tactual exploration skills among the blind population, or because sighted individuals in the child's life assume that the blind child possesses the same understanding of these common objects as they have gathered from their visually oriented experiences. Therefore, care must be taken by those who manage such preschool programs--particularly those in which blind and sighted children are integrated--not to presuppose great familiarity among the blind with this type of object. Appropriate programming for such children would include the provision of "hands-on" activities and experiences which will assist the blind child in gaining a fuller understanding of the objects.

A final implication drawn from this study--a reconfirmation of the work of others--relates to the cognitive development of congenitally blind youngsters. Some cognitive delay was evident and must be considered in curriculum design for visually handicapped children. Efforts to provide activities geared toward cognitive remediation (e.g., Stephens, Grube, & Fitzgerald 1977) should be incorporated into the educational program for the congenitally blind.

INTERVIEW PROTOCOL

PART I: VERBAL ATTRIBUTION AND DESCRIPTION

BLOCK What is a block? Tell me about a block.

What does (is) a block do (for)? What can you do with a block?

What does a block look like?

Is a block BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a block.

PENCIL What is a pencil? Tell me about a pencil.

What does (is) a pencil do (for)? What can you do with a pencil?

What does a pencil look like?

Is a pencil BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a pencil.

BALL What is a ball? Tell me about a ball.

What does (is) a ball do (for)? What can you do with a ball?

What does a ball look like?

Is a ball BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a ball.

**Why is it called a ball? Why do we call it a ball?

**Can we call it anything else? Can we call it a ____?

**Can a ball feel? hear? think?

ROPE What is a rope? Tell me about a rope.

What does (is) a rope do (for)? What can you do with a rope?

What does a rope look like?

Is a rope BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you can do with a rope.

WALL What is a wall? Tell me about a wall.

What does (is) a wall do (for)? What can you do with (on/to) a wall

What does a wall look like?

Is a wall BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Why is it called a wall? Why do we call it a wall?

**Can we call it anything else? Can we call it a _____?

**Can a wall feel? hear? think?

BUILDING What is a building? Tell me about a building.

What does (is) a building do (for)? What can you do with (in) a building?

What does a building look like?

Is a building BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

BUSH What is a bush? Tell me about a bush.

What does (is) a bush do (for)? What can you do with (to) a bush?

What does a bush look like?

Is a bush BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Why is it called a bush? Why do we call it a bush?

**Can we call it anything else? Can we call it a _____?

**Can a bush feel? hear? think?

STREET What is a street? Tell me about a street.

What does (is) a street do (for)? What can you do with (in/on) a street?

What does a street look like?

Is a street BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

HOUSE What is a house? Tell me about a house.

What does (is) a house do (for)? What can you do with (in) a house?

What does a house look like?

Is a house BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Why is it called a house? Why do we call it a house?

**Can we call it anything else? Can we call it a _____?

**Can a house feel? hear? think?

CAR What is a car? Tell me about a car.

What does (is) a car do (for)? What can you do with (in) a car?

What does a car look like?

Is a car BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Why is it called a car? Why do we call it a car?

**Can we call it anything else? Can we call it a _____?

**Can a car feel? hear? think?

YARD What is a yard? Tell me about a yard.

What does (is) a yard do (for)? What can you do with (in) a yard?

What does a yard look like?

Is a yard BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

DOOR What is a door? Tell me about a door.

What does (is) a door do (for)? What can you do with (on/to) a door?

What does a door look like?

Is a door BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

BUS What is a bus? Tell me about a bus.

What does (is) a bus do (for)? What can you do with (in) a bus?

What does a bus look like?

Is a bus BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

BRUSH What is a brush? Tell me about a brush.

What does (is) a brush do (for)? What can you do with a brush?

What does a brush look like?

Is a brush BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a brush.

CUP What is a cup? Tell me about a cup.

What does (is) a cup do (for)? What can you do with a cup?

What does a cup look like?

Is a cup BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a cup.

**Why is it called a cup? Why do we call it a cup?

**Can we call it anything else? Can we call it a _____?

**Can a cup feel? hear? think?

COMB What is a comb? Tell me about a comb.

What does (is) a comb do (for)? What can you do with a comb?

What does a comb look like?

Is a comb BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a comb.

TREE What is a tree? Tell me about a tree.

What does (is) a tree do (for)? What can you do with (in) a tree?

What does a tree look like?

Is a tree BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Why is it called a tree? Why do we call it a tree?

**Can we call it anything else? Can we call it a _____?

**Can a tree feel? hear? think?

SPOON What is a spoon? Tell me about a spoon.

What does (is) a spoon do (for)? What can you do with a spoon?

What does a spoon look like?

Is a spoon BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a spoon.

**Why is it called a spoon? Why do we call it a spoon?

**Can we call it anything else? Can we call it a _____?

**Can a spoon feel? hear? think?

DOLL What is a doll? Tell me about a doll.

What does (is) a doll do (for)? What can you do with a doll?

What does a doll look like?

Is a doll BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a doll.

**Why is it called a doll? Why do we call it a doll?

**Can we call it anything else? Can we call it a _____?

**Can a doll feel? hear? think?

KEY What is a key? Tell me about a key.

What does (is) a key do (for)? What can you do with a key?

What does a key look like?

Is a key BIG or SMALL? TALL or SHORT? WIDE or NARROW? SHORT or LONG? THIN or THICK?

**Show me what you do with a key.

**Why is it called a key? Why do we call it a key?

**Can we call it anything else? Can we call it a _____?

**Can a key feel? hear? think?

PART II: TACTUAL OBJECT IDENTIFICATION AND ATTRIBUTION/DESCRIPTION

(Goal: to solicit name and further description of objects)

(Hand child object and say: "TELL ME ABOUT THIS.")

BLOCK:

SPOON:

PENCIL:

KEY:

DOLL:

CUP:

BALL:

COMB:

BRUSH:

ROPE:

PART III: RECEPTIVE AND EXPRESSIVE USE OF COMPARATIVES

A. EXPRESSIVE USE

(Present objects in pairs and ask questions in sequence as necessary to elicit the desired relational term or until it is clear that the term will not be used. Desired relational terms are indicated in parentheses.)

Questions: 1. TELL ME ABOUT THESE TWO.....
WHAT CAN YOU TELL ME ABOUT THESE.....?
2. THIS ONE IS (X); THIS ONE IS _____?

SPOONS (long/short)

ROPES (thick/thin)

KEYS (big/small)

DOLLS (tall/short)

CUPS (wide/narrow)

B. RECEPTIVE COMPREHENSION

(present object pairs and ask WHICH ONE IS_____? GIVE ME THE_____ ONE. Key words are in parentheses.)

COMBS	(longer)	PENCILS	(thicker)
SPOONS	(shorter)	ROPES	(thinner)
BALLS	(bigger)	CUPS	(taller)
BRUSHES	(wider)	BRUSHES	(narrower)
KEYS	(smaller)	BLOCKS	(shorter)

PART IV: VERBAL COMPARISONS--LESS TANGIBLE OBJECTS

1. Which is LONGER, a car or a bus?
2. Which is WIDER, a door or a wall?
3. Which is SMALLER, a house or a bush?
4. Which is THICKER, a tree or a bush?
5. Which is TALLER, a building or a car?
6. Which is SHORTER, a car or a street?
7. Which is BIGGER, a wall or a house?
8. Which is NARROWER, a street or a car?
9. Which is SHORTER, a bush or a tree?
10. Which is THINNER, a tree or a house?

<u>PRELIMINARY EXPERIMENT</u> - Knowledge of "same," "more," "different," and "less."

Materials: 6 pencils of the same length and thickness
2 pencils, same length but different thickness
2 pencils, same thickness but different lengths

Procedure:

A. E gives two sets of three pencils (same length) to S, and asks--

"WHAT CAN YOU TELL ME ABOUT THESE TWO GROUPS OF PENCILS? WHY?"

(If S does not use relational terms, ask:) "ARE THESE SETS OF PENCILS THE SAME OR ARE THEY DIFFERENT? WHY?"

"ARE THERE MORE HERE, LESS HERE, OR ARE THEY THE SAME? WHY?"

B. E takes one pencil for himself from one of the groups so that the S has three in one hand and two in the other, and asks--

"WHAT CAN YOU TELL ME ABOUT THESE TWO GROUPS OF PENCILS? WHY?"

(If S does not use relational terms, ask:) "ARE THESE SETS OF PENCILS THE SAME OR ARE THEY DIFFERENT? WHY?"

"ARE THERE MORE HERE, LESS HERE, OR ARE THEY THE SAME? WHY?"

C. E removes the pencils. E gives two pencils to the S, one short and one long (same thickness), and asks--

"ARE THESE PENCILS THE SAME? WHICH ONE IS LONGER? WHY?"

D. E removes the pencils. E gives two pencils to the S, one fat and one thin (same length), and asks--

"ARE THESE PENCILS THE SAME OR ARE THEY DIFFERENT? WHY? WHICH ONE IS FATTER?"

CONSERVATION OF SUBSTANCE - MODELING CLAY

Materials: Two balls of different color clay (play-doh)

Preliminary: Before beginning the experiment, S must agree that the two balls are of equal size (amount). All transformations are to be made by the S.

Part I: Hot Dog

(Instruct S to roll one ball of clay into a hog dog shape and ask:) "NOW IS THERE THE SAME AMOUNT OF CLAY IN THE BALL AND IN THE HOT DOG, OR IS THERE MORE IN THE BALL OR MORE IN THE HOT DOG? WHY?"

(Instruct S to roll hot dog into ball shape and insure equality.)

Part II: Pancake

(Instruct S to transform one ball of clay into a pancake and ask:) "NOW IS THERE THE SAME AMOUNT OF CLAY IN THE BALL AND IN THE PANCAKE, OR IS THERE MORE IN THE BALL OR MORE IN THE PANCAKE? WHY?"

(Instruct S to roll pancake into ball shape and insure equality.)

Part III: Tiny Pieces

(Instruct S to break one ball of clay into several tiny pieces. Proceed as before, but be sure S is comparing the entire group of tiny pieces with the intact ball of clay. Ask:) "NOW IS THERE THE SAME AMOUNT OF CLAY IN THE BALL AS IN THE TINY PIECES, OR IS THERE MORE IN THE BALL OR MORE IN THE TINY PIECES? WHY?"

TERM TO TERM CORRESPONDENCE

Materials: 6 plastic poker chips; 9 wooden blocks (one inch cubes)

Presentation: Arrange 6 plastic poker chips in a row leaving a space of about one inch between each chip. E manipulates S hand in making transformations and to assist in tactual examination of materials for each part of experiment.

Preliminary:

"TAKE ENOUGH BLOCKS FOR THE PLASTIC CHIPS. PUT A BLOCK IN FRONT OF EACH CHIP. THERE SHOULD BE NO MORE OR NO LESS."

(When S has placed the blocks in front of the chips, ask:)
"ARE THERE AS MANY BLOCKS AS THERE ARE CHIPS? WHY?"

Part I:
(E manipulates S hands to move blocks close enough so that they touch each other. Chips remain in original position. E asks:) "ARE THERE AS MANY BLOCKS AS THERE ARE PLASTIC CHIPS, OR ARE THERE MORE BLOCKS OR MORE CHIPS? WHY? HOW DO YOU KNOW?"

"IF WE PUT THEM BACK THE WAY THEY WERE BEFORE WILL THERE BE A BLOCK FOR EACH CHIP? WHY?" (After S has responded, E manipulates S hands to return blocks to original position.)

Part II:

(E manipulates S hands to move chips close together so that they are touching. Blocks remain in original position, about one inch apart. E asks:) "ARE THERE AS MANY BLOCKS AS THERE ARE PLASTIC CHIPS, OR ARE THERE MORE BLOCKS OR MORE CHIPS? WHY? HOW DO YOU KNOW?"

"IF WE PUT THEM BACK THE WAY THEY WERE BEFORE WILL THERE BE A CHIP FOR EACH BLOCK? WHY?"

CONSERVATION OF LENGTH - DISPLACED RODS

Materials: 2 rods, 8" in length and 1" in diameter
1 rod, 10" in length and 1" in diameter
1 rod, 6" in length and 1" in diameter
(all rods slightly flattened to prevent rolling)

Preliminary: S should tactually explore rods in order to choose the two that are of equal length. E asks: "WHY DIDN'T YOU CHOOSE THIS ONE (10 in.) OR THIS ONE (6 in.)?"

"WHY DIDN'T YOU CHOOSE THESE TWO (10 in. and 8 in.)?"

"WHY DIDN'T YOU CHOOSE THESE TWO (6 in. and 8 in.)?"

Part I: The two equal length rods are placed horizontally on the table, parallel to each other and about 3 inches apart. S should tactually determine that the rods are equal in length. E can assist in moving S hands along rods to answer questions.

(With S hands on rods, E moves one rod about 4 inches to the right and asks:) "ARE THE TWO RODS THE SAME LENGTH (EQUAL) OR IS ONE LONGER THAN THE OTHER? WHY? HOW DO YOU KNOW?"

Part II: E assists S in replacing the rods to original position and again determining equivalency.

(With S hands on the rods, E moves the rod not moved in Part I about 4 inches to the left and asks:) "ARE THE TWO RODS THE SAME LENGTH (EQUAL) OR IS THIS ONE LONGER OR THIS ONE? WHY? HOW DO YOU KNOW?"

Part III: E assists S in replacing the rods to the original position and again determining equivalency.

(With S hands on the rods, E moves both rods simultaneously, one to the right and one to the left, about 4 inches. E then asks:) "NOW ARE THE RODS THE SAME LENGTH (EQUAL) OR IS THIS ONE LONGER OR THIS ONE? WHY? HOW DO YOU KNOW?"

CONSERVATION OR LENGTH - ROPES

Materials: 2 rope sections, 24" in length and 1" in diameter

Preliminary: Place the rope sections on the table horizontally so that they are parallel and about 4" apart. Allow S to tactually examine the ropes to determine that they are of equal length. E should assist S in examining the ropes in response to each question.

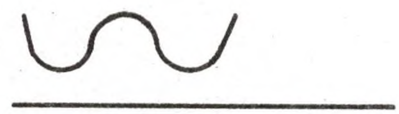
Part I: E places the ropes as in the diagram and allows (assists) S to tactually examine before asking question.

A:
B:

"ARE THE ROPES THE SAME LENGTH OR IS A LONGER OR IS B LONGER? WHY? HOW DO YOU KNOW?"

Part II: E places the ropes as in the diagram and allows (assists) S to tactually examine before asking question.

A:
B.



"ARE THE ROPES THE SAME LENGTH OR IS A LONGER OR IS B LONGER? WHY? HOW DO YOU KNOW?"

Part III: E places the ropes as in the diagram and allows (assists) S to tactually examine before asking question.

A:
B:

"ARE THE ROPES THE SAME LENGTH OR IS A LONGER OR IS B LONGER? WHY? HOW DO YOU KNOW?"

(Alternative questions for Parts I, II, and III: "IS THERE THE SAME AMOUNT OF ROPE IN A AS THERE IS IN B ? IS IT AS FAR FROM HERE TO HERE AS IT IS FROM HERE TO HERE?")

ROTATION OF ORDER - BEADS

Materials: 3 wooden beads of different shapes strung on a stiff wire.
1 cardboard tube, about 8" long

Preliminary: Allow child to tactually examine beads-on-the-wire and assign names to the beads (according to their shape). During all transformations, assist the S to place beads into the tube and hold child's hands while making the rotations.

Part I: Direct Order

(Beads are inserted into tube from left side. Before taking beads out from right side of tube, E asks:) "IF WE PULL THE BEADS OUT FROM THIS SIDE WHICH BEAD WILL COME OUT FIRST? WHY?"

(After S responds, demonstrate what happens.)

Part II: Rotation of 180 Degrees

A. (Beads are inserted into tube from left side. E assists S to rotate tube 180 degrees in a clockwise direction. Before removing beads from right side of tube, E asks:) "IF WE PULL THE BEADS OUT FROM THIS SIDE WHICH BEAD WILL COME OUT FIRST? WHY?"

(After S responds, demonstrate what happens.)

B. (Beads are inserted into tube from left side. E assists S to rotate tube 180 degrees in a counter-clockwise direction. Before removing beads from right side of tube, E asks:) "IF WE PULL THE BEADS OUT FROM THIS SIDE WHICH BEAD WILL COME OUT FIRST? WHY?"

(After S responds, demonstrate what happens.)

Part III: Rotation of 360 Degrees

A. (E repeats Part II-A but rotates tube 360 degrees and asks the question.)

B. (E repeats Part II-B but rotates tube 360 degrees and asks the question.)

CLASS INCLUSION

Materials: 8 wooden discs about 3½" in diameter; 3 smooth, 5 rough
3 wooden squares about 3½" square; all rough

Preliminary: Allow S to tactually explore all materials as presented. Be sure S can distinguish between shapes and textures.

Part I: E places 5 round/rough and 3 square/round shapes on table and assists S to examine tactually, and asks:

"ARE THERE MORE ROUND OR MORE ROUGH·SHAPES? WHY?"

"IF I TAKE AWAY ALL THE ROUND SHAPES, WHAT WILL BE LEFT?"

"IF I PUT BACK THE ROUND SHAPES AND TAKE AWAY ALL THE ROUGH SHAPES, WHAT WILL BE LEFT?"

"ARE THERE MORE ROUGH SHAPES OR MORE ROUND SHAPES? WHY?"

Part II: After removing all shapes, E places 5 round/rough and 3 round/smooth shapes on the table. Assist S to tactually examine the objects and ask:

"ARE THERE MORE ROUGH OR MORE ROUND SHAPES? WHY?

"IF I TAKE AWAY ALL THE ROUGH SHAPES, WHAT WILL BE LEFT?"

"IF I PUT BACK THE ROUGH SHAPES AND TAKE AWAY ALL THE ROUND SHAPES, WHAT WILL BE LEFT?"

"ARE THERE MORE ROUND SHAPES OR MORE ROUGH SHAPES? WHY?"

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