

1979

The relationship between prelinguistic communication and sensorimotor development in severely and profoundly retarded individuals.

Debra J. Lobato-Barrera
University of Massachusetts Amherst

Follow this and additional works at: <https://scholarworks.umass.edu/theses>

Lobato-Barrera, Debra J., "The relationship between prelinguistic communication and sensorimotor development in severely and profoundly retarded individuals." (1979). *Masters Theses 1911 - February 2014*. 1728.
Retrieved from <https://scholarworks.umass.edu/theses/1728>

This thesis is brought to you for free and open access by ScholarWorks@UMass Amherst. It has been accepted for inclusion in Masters Theses 1911 - February 2014 by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.

UMASS/AMHERST



312066013597770

THE RELATIONSHIP BETWEEN PRELINGUISTIC COMMUNICATION AND SENSORIMOTOR
DEVELOPMENT IN SEVERELY AND PROFOUNDLY RETARDED INDIVIDUALS

A Thesis Presented

By

DEBRA LOBATO-BARRERA

Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE

September 1979

Department of Psychology

THE RELATIONSHIP BETWEEN PRE-LINGUISTIC COMMUNICATION AND SENSORIMOTOR
DEVELOPMENT IN SEVERELY AND PROFOUNDLY RETARDED INDIVIDUALS

A Thesis Presented

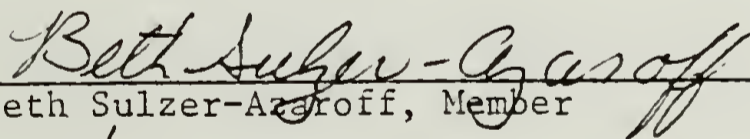
By

DEBRA LOBATO-BARRERA

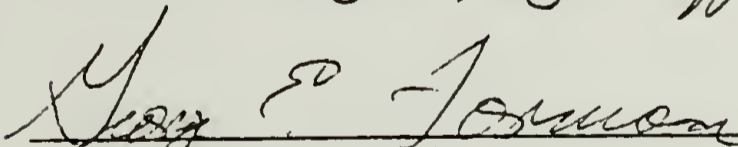
Approved as to style and content by:



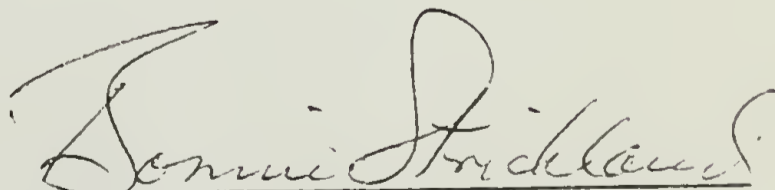
Robert S. Feldman, Chairperson of Committee



Beth Sulzer-Azaroff, Member



George Forman, Member



Bonnie Strickland, Department Head
Department of Psychology

ACKNOWLEDGEMENTS

Various individuals and service organizations were instrumental in helping to pave the way for the successful completion of this project. It is here that I acknowledge their contributions and express my gratitude.

The Bureau of Education for the Handicapped, Department of Health, Education, and Welfare, Grant No. 451AH60923, has funded my graduate education and training at the University of Massachusetts, and thereby has supported this research project.

Dave Scanlin, Jane Keyes, and Linda L'Abbee of Community Homes, Inc.; Timothy Molaghan of Northampton Nursing Home; Elizabeth Noonan of Belchertown State School; and Steve Reisman of Monson State Hospital aided in the identification of subjects and in the arrangement of appropriate testing sites.

I would also like to thank the forty students who participated as subjects, and their parents and guardians who provided their consent.

My undergraduate assistants, Marjorie Blass, Joanne Miller, and Julie Wolfe accompanied me to each of the testing sites. Their astute observations, precise recordings, reliable codings, and sensitive interactions with the subjects were appreciated throughout the course of the data collection and analysis.

Dr. Robert S. Feldman, my advisor and committee chairperson, gave generously of his time and knowledge in order to guide my translation of foggy questions into a realistic experimental design and analysis. Not only have I learned much from him professionally, but, more importantly, his open support and encouragement have enabled me to learn from myself.

Dr. Beth Sulzer-Azaroff provided me with valuable, positive, feedback on the execution and presentation of this project, as well as with suggestions for future research applications of its results.

Dr. George Forman provided me with a more critical understanding of Piagetian theory through his questions, conversations, and review of the thesis.

Dr. Greg Olley provided me with important community contacts , thereby enabling my access to handicapped populations.

My greatest appreciation, though, is to my parents, who have always surrounded me selflessly with more love and support than I could ever express or return, and to my husband, Richard, who has been the gatekeeper of my sanity and my emotion, and without whose love my present and future would mean nothing.

ABSTRACT

The primary goal of this research was to examine the prelinguistic nonverbal communicative behaviors used by severely and profoundly retarded individuals functioning at various stages of Piaget's sensorimotor period. Subjects were 40 institutionalized severely and profoundly retarded children and adolescents (mean age 13:2 years). Five scales of the Uzgiris and Hunt (1975) sensorimotor assessment were used to determine each subject's level of sensorimotor functioning. A standard set of communication elicitation tasks (Snyder, 1975) were used to examine the gestures used by each subject to communicate in both imperative and declarative contexts. A mixed design analysis of variance indicated that an increase in sensorimotor performance was associated with an increase in the frequency of more sophisticated and symbolic forms of gestural communication, and that subjects generally used more sophisticated gestures to communicate in the imperative tasks than in the declarative tasks, $F(15, 180) = 2.37, p < .004$. In addition, a step-wise multiple regression analysis indicated that declarative performance was best predicted by performance on the sensorimotor scales of Operational Causality and Gestural Imitation. Imperative performance was best predicted by performance on the scales of Vocal Imitation and Object Permanence. A moderate to high degree of intercorrelation ($r = .41-.83$) was found between the highest stage attained on each of the five

sensorimotor scales, suggesting that the cognitive skills used in solving the tasks of one sensorimotor domain were not independent of the skills involved in the solution of developmental tasks of the other domains. However, a low to moderate percentage of agreement (12.5% - 60%) between the highest stage attainments in each of the five areas assessed, indicated that, though the various sensorimotor skills of retarded subjects were intercorrelated, their skills across the domains were not developmentally equivalent. Tasks involving object permanence skills consistently elicited the subjects' highest levels of performance, while subjects demonstrated their lowest levels of performance in the area of vocal imitation. Results of Green's modification of the Guttman scalogram analysis (Green, 1956) revealed that all but the Operational Causality series of the Uzgiris and Hunt met the statistical criterion for an ordinal scale. This suggests that these subjects were acquiring sensorimotor skills in a sequence similar to the sequence of normally developing infants. The results of this research are discussed in terms of their applicability to the design of future intervention programs for the retarded, and of their implication for general theory concerning the relationships between language and cognition and between normal and atypical development.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
ABSTRACT	iv
Chapter	
I. INTRODUCTION.....	1
Language Delay and Disorders in Mental Retardation ..	1
Cognitive Development	5
Normal development	6
Retarded development	16
Acquisition of Preverbal Communicative Skills	22
Normal infant populations	22
Retarded populations	29
II. METHOD.....	33
Subjects	33
Assessment Scales	35
Materials	36
Experimenters	37
Procedure	37
Scoring and Coding	41
Communicative tasks	41
Sensorimotor tasks	45
Analyses	48
Relation between communication and sensorimotor stage	48
Relations among variables	48
Ordinality	49
III. RESULTS	50
Relation between communication and sensorimotor stage.....	50
Relations among Variables	66
Ordinality	68
IV. DISCUSSION	71
Communicative Behavior and Sensorimotor Stage	72
Stage III.....	72
Stage IV.....	75
Stage V.....	80
Stage VI.....	85

The Effect of Function on Communicative Behavior	89
Relations among Variables	92
Ordinality	98
Conclusions	101
REFERENCES	104
APPENDICES	111

LIST OF TABLES

1.	Diagnostic Classification of Subjects	34
2.	Sensorimotor and Communicative Behaviors	42
3.	Inter-Observer Reliabilities	46
4.	Stage Attainments and Sensorimotor Domains	47
5.	Mean Frequency of Communicative Behaviors: Sensorimotor Stage x Communicative Category x Communication Task Interaction	53
6.	Mean Frequency of Communicative Behaviors: Two-Way Interactions	58
7.	Number of Subjects at Each Sensorimotor Stage with Mean Declarative and Mean Imperative Levels of Communication.	64
8.	Multiple Regression Analysis of Variance	67
9.	Percentages of Agreement (%) and Intercorrelations (r) of Sensorimotor Stage Attainments and Mean Levels of Declarative and Imperative Communication	69

LIST OF FIGURES

1. Sensorimotor Stages and Declarative Communication Categories .. 51
2. Sensorimotor Stages and Imperative Communication Categories ... 52
3. Sensorimotor Stages and Declarative Communication Levels 60
4. Sensorimotor Stages and Imperative Communication Levels 61

C H A P T E R I

INTRODUCTION

Language Delay and Disorder in Mental Retardation

Mental retardation has been defined by the American Association on Mental Deficiency (Grossman, 1977) as "significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior, manifested during the developmental period." Given our fairly universal tendency to judge a person's intellectual abilities on the basis of their written or oral communicative skills, along with a heavy loading of linguistic items on traditional standardized intellectual assessments, it is not surprising to encounter an explicit relationship between mental retardation and language impairment. However, the exact relationship between the degree of impairment in either intellectual or communicative functioning needs to be clearly described.

In 1961, Bangs discussed the utility of a derived mental age in predicting articulatory proficiency in retarded persons. Copeland (1963) reported quite the opposite relation to intellectual functioning when describing language in terms of quantity of utterances. Obviously, the greater the discrepancy between authors in their measures of language, the greater is the difficulty in reconciling contradictory findings.

Despite these variations in definition, however, few investigators deny the existence of some form of language delay in retarded

individuals (Bloom & Lahey, 1978; Jordan, 1967; Ryan, 1975). Most of the research aimed at identifying the characteristics that lead to a diagnosis of "language delayed" has compared the performances of retarded to nonretarded children on tasks which either directly or indirectly assess their verbal skills. Typically, the two groups of children have been matched on the basis of chronological age, mental age, or more recently, mean length of utterance (MLU). The MLU measure indicates the average length of a child's utterances, and was derived as a measure of language complexity, free from contamination by chronological age (Brown, 1973). The validity of comparing the performance of subnormal to normal children on tests which have been standardized for and on the latter has been questioned by Ryan (1975). However, given the apparent paucity of descriptive analyses of the language development associated with mental retardation as a process in and of itself, independent of a comparative standard, the above research currently represents the most comprehensive source of data on the nature of the relation between language and retardation.

Not all aspects of the language of retarded children have been defined as deviant. In fact, the purpose of one author's detailed investigation of the grammar of five severely to moderately retarded children was to achieve a "slow motion perspective" of normal language development (Lackner, 1968). Lackner found similarities between children of the same mental age in terms of sentence length, sequential appearance of increasingly complex sentence types, and the inability to repeat sentences not already comprehended. However, by

the ages of four to six years, all normal children had surpassed the most advanced mentally retarded child in both sentence length and complexity of sentence type. Lenneberg, Nichols, and Rosenberger (1964) reported that children with Down's Syndrome passed through the various language milestones according to the normal developmental sequence and displayed typical error patterns on sentence repetition tasks. The finding of Bartel (1970), Dever and Gardner (1970), and Newfield and Schlanger (1968) also corroborated the existence of a sequential order of acquisition of morphological rules by subnormal and normal children. Likewise, Ryan (1975) reported no differences between these two diagnostic groups (matched on MLU) on the following measures: proportion of complete sentences, frequency of cliches, range and variety of verb transformations, errors of omission, errors of substitution, errors of overgeneralization, and errors of inversion of word order.

Such a discussion of only the similarities between the two groups could easily lead to the perspective adopted by Lackner, that retardation yields not a different form of language behavior, but a simple slowing of the normal sequence along with a termination of development at a ceiling stage below that of normal children. However, such a conclusion seems erroneous, for there is evidence that differences between the spoken languages of these children do exist on dimensions other than the sequence of acquisition.

The most frequently documented speech disorders associated with mental retardation occur in the quality of the voice and in articulatory proficiency (Jordan, 1967; Lyle, 1961; Spradlin, 1963).

In reviewing this literature, Jordan (1967) concluded that the language of the mentally retarded child is characterized by fewer abstractions, more frequent grammatical errors, and (based on the work of Soviet psychologist, Luria), an impaired ability to mediate behavior. In comparing subnormal and normal children matched on nonverbal mental age, Lyle (1961) found that the differences between the two groups of children became greater with increasing difficulty of the tasks. More interestingly, though, Lyle also found that the retarded, unlike the nonretarded child, often supplemented sentences with gestures. In addition, their speech was more likely to be of a very stereotypic nature, embedded with jargon and rote, echolalic phrases.

Ryan (1975) reported that subnormal children exhibited a proportionally larger noun vocabulary but less complex syntactic repertoire than their MLU matched normal counterparts. And though Newfield and Schlanger (1968) reported a similar sequence in acquisition of morphological rules, the retarded children demonstrated difficulty generalizing these correct inflections from familiar words to unfamiliar nonsense words requiring those same inflections.

All of the above studies have been concerned with those children whose linguistic abilities have been sufficiently intact so as to permit their participation in language tasks designed to draw conclusions about quality, morphology, and syntax. However, some retarded children never acquire any language at all, and therefore their language or communication systems are not analyzed. These individuals

are likely to reside within the confines of large institutions and their I.Q. scores generally cluster towards the bottom of the scale (Sheehan, Martyn, & Kilburn, 1968). Surveys conducted solely within the institutionalized population of Down's Syndrome children have estimated that up to 80 percent of the children are functionally mute - unable to vocalize except by crying, laughing, or grunting (Buddenhagen, 1971).

It is not surprising that the communicative skills of these children have not been systematically examined; our notions of language have until recently (Bates, Camaioni, & Volterra, 1975; Dore, 1975) been defined in the research as the exchange of spoken words. Therefore, the analysis of the relationship between language development and mental retardation has not yet extended to the prelinguistic levels at which the profoundly retarded child typically functions. It is with these more seriously delayed individuals that the present study is concerned.

Cognitive Development

The intellectual development of severely and profoundly retarded children has been defined by the profile of their functional abilities (Grossman, 1977) and by their subnormal performance on norm-referenced tests such as the Stanford-Binet and the Bayley Scales. The use of these assessments with both normal and developmentally delayed children has been lucidly criticized by many, but most notably by Piaget and Inhelder (1947). The grounds for their critique were that these examinations provide merely a sum of successes of

items passed, that the items themselves are often unrelated so that failure on one item does not predict failure on subsequent items, and finally, that the focus of these scales has been on the specific content rather than on the integrated process underlying development. To develop a case for alternative methods of assessing intellectual development, we will look first at normal, then at retarded, cognitive development.

Normal development. The theoretical framework of cognitive development adopted here is similar to the "developmental-interactive" approach described by Bricker and her colleagues (Bricker, Seibert, & Casuso, 1978). The developmental-interactive theory is based on three basic tenets: "1) behavior changes from the simple to the more complex, 2) disequilibrium produced by changing environmental demands is necessary for eliciting new adaptive responses, and 3) behavior develops sequentially following certain general but consistent guidelines" (Bricker, et al. 1978, p. 11).

Reflecting a Piagetian orientation to cognitive development, Uzgiris and Hunt (1975) set out to devise a systematic set of tasks which would assess the cognitive functioning of normally developing infants from birth to approximately two years of age. The tasks comprising this instrument were derived from Piaget's indepth descriptions of his own three infants (1952, 1954, 1962). The scales represent the most comprehensive and frequently used tool for assessing infant development systematically from this perspective. Because of its widespread use by investigators of early cognitive develop-

ment to be discussed throughout this study, a brief description of the Uzgiris and Hunt Ordinal scales of psychological development will be provided.

Uzgiris and Hunt classified infants' behaviors into six branches of development represented in Piaget's writing - 1) visual pursuit and permanence of objects, 2) means for obtaining environmental events, 3) imitation - gestural and vocal, 4) construction of operational causality, 5) construction of object relations in space, and 6) schemes for relating to objects. During the course of their research, Uzgiris and Hunt were made aware of more than just the six successive behavioral landmarks described by Piaget. Each branch of the instrument was therefore broken down into those smaller developmental steps which were displayed by a large sample of infants and recorded reliably by observers in both longitudinal and cross-sectional validation studies. The result is the instrument which appears in Appendix I. It is obvious from this description that the authors were concerned primarily with cognitive, as opposed to locomotor or emotional development. Nevertheless, these six scales have proved useful for systematically assessing certain aspects of sensorimotor development.

Piaget divided the first two years of life, the sensorimotor period, into six substages. Starting with early reflexive behavior, the infant becomes increasingly capable of more complex and sophisticated interactions with the environment. The culmination of this period is in the child's use of mental symbolic representation in both problem-solving and sociolinguistic situations. Symbolic representa-

tion is the thread of utmost importance during the sensorimotor period. It is that which sets it apart from and prepares the child for all subsequent cognitive stages. The infant whose behavior is reflex bound progresses to a child whose social, communicative, and cognitive behavior is steeped in and mediated by representational thought.

Various authors have amplified Piaget's descriptions of sensorimotor development, and in the process emphasized the aspects of development best suited to their particular needs. Ginsburg and Opper (1969) offered a general summary; Bates et al. (1975, 1977) emphasized symbolic abilities and intentionality; Fraiberg and her colleagues focused on the relation between object permanence and goal directedness in blind and sighted infants (Fraiberg, 1968, 1975; Fraiberg, Siegel, & Gibson, 1966). Robinson (1977) argued for the importance of means-ends and causal relations in the development of communicative competence in young severely and profoundly retarded children. The following summary of sensorimotor development borrows from all of these approaches, but focuses primarily on skills related to object permanence, imitation, causality, and means-ends relations.

In stage I ("reflexive", birth to one month) the infant's behavioral repertoire is viewed as one of uncoordinated, spontaneous action, heavily dependent on reflexes such as sucking, grasping, kicking, and crying. Because behavior consists mainly of exercising these reflexes, there is no real differentiation between skills associated with the various cognitive domains (e.g., imitation, object permanence).

During the second stage ("primary circular reactions", one to four months), the reflexes undergo adaptation to environmental consequences. Basic coordination is witnessed across the reflexive responses and the infant begins looking at and sucking grasped objects, or turns to visually localize sounds which are heard. The infant's earliest imitative abilities surface in their most primitive form. The infant will prolong its own sounds if an adult repeats them immediately back to the child. Evidence of the existence of the object concept is limited to the child's reaction to the disappearance of a slowly moving object. The child maintains its gaze at the point where the object disappeared. No search is initiated. No differentiation is yet possible between the development of means-ends and causality. However, basic skills emerging during this period - visually directed grasping, repetition of movements producing environmental effects, and visual examination of the hand - are seen as prerequisites for both.

In stage III ("secondary circular reactions", four to ten months) the infant's horizon is expanded through increased physical mobility, namely, crawling. Schemes of manipulation and exploration are repeated systematically in order to reproduce some spectacle in the environment which had been discovered accidentally. Behavior is conservative or repetitive in nature, insofar as the infant does not experiment with novel means to obtain the environmental event but simply repeats those that were previously successful. In terms of object permanence, the child moves to look after a fallen object

and will search for an object as long as a small portion remains in sight. The infant's imitative skills, likewise, become more adaptive and exact, yet they are still limited to behaviors which the infant has already previously displayed. The infant exercises its new locomotive ability to obtain objects out of reach and demonstrates additional means-ends skills by pulling a support to obtain an object attached to the support (for example, the child will pull one end of a blanket in order to get an object sitting on the other end.). Furthermore, the child exhibits some notion of external causality - the child responds to the cessation of a spectacle (e.g., a wind up toy stops moving) by touching the adult or the toy.

In stage IV ("coordination of secondary circular reactions", ten to twelve months) the infant combines skills in novel ways for intentional, rather than accidentally discovered, goals. The infant can find an object which has been completely hidden under one of two screens by searching directly under the correct screen. However, if the screen under which the object is hidden is alternated, then the infant will look first in that place where the object was last found. Not only is the infant able to imitate its own previously displayed behaviors, but it now also attempts to match behaviors with dissimilar topographies. At this stage the infant's responses inadequately match the standard; an exact replication is highly unlikely on the first trial, yet the child perceives the discrepancy and proceeds through a series of successive approximations to that standard, spontaneously. Furthermore, presented movements involving body parts invisible to the infant (e.g., eye

blinks) elicit general, though not precise movements of the infant's corresponding body region. That the infant is at least capable of mobilizing perceptually unavailable areas suggests the presence of a mental image directing that localization process. The child expands the pulling-as-means scheme to other tools such as strings horizontally and vertically attached to objects. This requires not only a precise grasp but also object permanence, as the vertically attached object is not in view.

Stage V ("tertiary circular reactions", 12 to 18 months) corresponds in time with walking. This increased mobility affords the opportunity for exploration, and with it emerges a curiosity and penchant for novelty for its own sake. Whereas the stage IV child combined novel skills for the purposes of a familiar end result, the stage V child utilizes familiar skills towards the attainment of novel effects. Characteristically, and to the dismay of parents, the child may take a spoon and repeatedly drop it (familiar means), varying the surface onto which it lands in order to produce novel sounds with each repetition. The child recognizes that objects have permanence and will activate a prolonged search consistently in that place where it was hidden, even if the object has been complexly shifted about by the adult.

The child's attempts at imitation become systematic and are more often correct on the first trial. In addition, the child's successive approximations may result in a successful rendition of a completely unfamiliar act or vocalization. The child's use of tools as means extends to the use of unattached tools, such as a rake,

to obtain an object. To illustrate the development of causality, the child attempts to activate a mechanical toy after demonstration by the adult.

During stage VI ("the beginning of thought", 18 to 24 months) the child is assumed to solve problems through mental representation before applying the solution to the situation. The child has thereby further established independence from the concrete environment. By this time the child's object concept is also fully developed and search strategies become highly sophisticated and systematic. In response to a presented verbal or gestural behavior, the spontaneous formation of an immediate match no longer requires overt approximation. It is as if the various facial, vocal, or postural adjustments could be made efficiently and precisely through mental activity. Through the process of deferred imitation, the child reproduces novel behaviors of a model even if that model is no longer present. (This requires observation over time.) The child uses "foresight" in the solution of means-ends and causality problems. For example, the child does not attempt to stack a solid ring onto a spindle and spontaneously attempts to activate a mechanical toy.

As with all stage theories, these substages are by no means discrete, absolute categories of behavior. They are ideal types abstracted from actual behavioral displays. They characterize the skills that occur and emerge concurrently at a given time as representing a more basic underlying cognitive structure governing the infant's manifest abilities. The skills at one level serve

as the necessary matrix of competence upon which other more highly integrated skills develop. The sequence of developments is posited as invariant. The rate at which these developments occur, however, is highly variable and individual, in part related to the richness of the infant's rearing environment (Paraskevopoulous & Hunt, 1971), its mental capacity (Rogers, 1977), and its sensory intactness (Furth, 1966). Developments across each of the cognitive domains (as examined most frequently by the Uzgiris and Hunt instrument) are to some degree interdependent since development is viewed as a process of branching and elaborating core reflexes into integrated skills.

Researchers have recently begun to investigate the issues of the existence of the invariant sequence of development and of the parallelism of stage attainments across the various sensorimotor domains. The statistical technique most often used to test the hypothesis of invariance is the modification of the Guttman scalogram analysis proposed by Green (1956). The existence of an invariant sequence has received support in both normal (e.g., Corman & Escalona, 1969; Kramer, Hill, & Cohen, 1975) and retarded populations (Kahn, 1976; Rogers, 1977; Woodward, 1959; Woodward & Stern, 1963). Variations in the order of acquisition of basic skills have been found (Miller, Cohen, & Hill, 1970) but they are far outweighed in quantity and extent by the above literature. Where any variations have been observed, they were in the order of acquisition of skills within the various substages.

Investigations aimed at unveiling the degree of parallelism across sensorimotor domains have yielded inconsistent results, although, as compared with the study of sequences, not as much research has been conducted. Uncovering corresponding sensorimotor stage attainments in each of these cognitive areas would attest to their interrelatedness. More significantly, however, this question challenges the notion of "stage" in describing the relation between cognitive abilities at any given age. Whereas methodological and statistical tools used by the various authors to analyze the hypothesis of invariance have been relatively comparable, such uniformity of method does not exist for the question of parallelism. The largest problem is that conclusions have been based on either stimulation-intervention or observational-correlational studies. This major discrepancy is further compounded by differences in the cognitive areas selected for comparison. The observational-correlational studies are presented first.

Using longitudinal data, Uzgiris (1973) compared the domains of object construction, spatiality, development of means for obtaining environmental events, and operational causality. When children were classified according to chronological age, and correlations were computed on their ranks across each of the branches, nothing impressive was revealed. However, Uzgiris made the argument that chronological age was an arbitrary classification that ignored different rates of development during different time periods for individual infants. She, therefore, proceeded to define the childrens' devel-

opmental status according to the sequential steps of the object construct scale. Advancement in this branch appeared to precede advancement in the other domains.

In a later report, using rank correlations, Uzgiris and Hunt (1975) documented a high degree of parallelism across the domains ($r = .80 - .93$) when using the construction of objects, rather than chronological age, as a point of reference.

Further evidence confirming the hypothesis of parallelism (and also of unitary holistic stages) was presented by Hunt (1976) in his description of the development of infants in various Greek orphanage settings. Intercorrelations among the scale scores for object construction, gestural imitation, and vocal imitation, ranged from .80 to .88. Contrary to the Uzgiris work though, object construction did not lead the development of imitation.

Evidence accumulating in the infant intervention literature indicates that these cognitive branches may function as independent entities - that stimulation may propel or hasten development in one area without affecting or by minimally affecting a different area. A program of enrichment of infant-environment interaction designed by Badger (Hunt, 1976) fostered development to the most sophisticated object search behavior without having any effect on vocal imitation. Furthermore, institution-reared infants exhibited eye-hand coordination at a median age of three months whereas their stage correspondent imitation skill (babbling) was absent even at the age of six months.

This discussion is certainly suggestive of the necessity of further systematic research. In general, the correlational-observational studies have yielded a moderate to high degree of intercorrelation across the various cognitive domains for normally developing and institution-reared infants. It would seem from these studies, that in the course of development, the sequential sensorimotor stages appear to reign as unitary wholes, with parallel developments across cognitive domains.

Retarded development. In 1959, Woodward reported that the behavior of 147 institutionalized "mentally defective" children of ages 7-9 and 14-16 years could be interpreted according to Piaget's descriptions of normal sensorimotor development. Woodward focused on the last three stages of the sensorimotor period and devised her own corresponding tasks and observational method. The postulated order of object concept and means-ends development was confirmed. Furthermore, the children's stereotypic hand movements and object manipulations resembled those characteristic of normal infants at various stages of development. There was correspondence of stage attainments in 43 percent of the cases as to means-ends problem solving abilities and the type of repetitive behaviors displayed with objects. Correspondence between means-ends and object permanence performance was found in 87 percent of the cases. Although Woodward's investigation was exploratory in nature, it is important as one of the earliest applications of developmental analysis to profoundly delayed children.

In a study of the longitudinal development of object permanence in 67 moderately to profoundly retarded children in a residential treatment setting, Wolheuter and Sindberg (1973) found that with few exception, the emergence of the various stage related abilities followed closely the sequence offered by Piaget. Only 20 of their children, aged 1:0 to 5:9 years, attained the highest level of performance on the object permanence tasks. Top level object permanence skills were demonstrated when a child retrieved an object hidden in a container which disappeared under three consecutive covers. This would be accomplished by going under the cover where the container disappeared last and then proceeding through the series of covers in an order that reversed that in which the container disappeared. Twenty nine children failed to attain this criterion performance. The remaining children in the sample were not available for the longitudinal follow-up. Of these 29 non-criterion subjects, 18 were functioning at the severely and profoundly retarded levels. Furthermore, within this group of non-criterion children three distinct patterns of development emerged. A "plateau" performance was characterized by behavior remaining at the same cognitive level for most of the twelve or more monthly observations. Of the children exhibiting such a pattern, nine were classified in the profound range. A "variable" pattern was characterized by month to month performance which was as likely to move in an upward as in a downward trend. In the third "upward" pattern, the overall trend of development was generally, though not consistently, towards higher

stage attainments. Furthermore, the criterion and the upward (non-criterion) subjects frequently skipped particular steps within the substages delineated by the developmental sequence. This trend may be accounted for by the time span between observations, during which these intermediary steps may have actually emerged, though unmeasured by the experimenter. As a result, the authors argued for more frequent contact with the children over prolonged periods of time in order to better investigate the issues of invariance and developmental patterning. Overall, this research corroborated the general sequential nature of the acquisition of the concept of a permanent object, but also suggested that there is great variability in the performance of delayed children over time.

In a similar study, Kahn (1976) investigated the issue of the parallelism of the stage attainments across the various branches of cognitive development in severely and profoundly retarded children. Parallelism was measured by rank ordering and by computing the percentage of agreement between the highest stage level performance of the particular domains. Using the complete Uzgiris and Hunt (1975) instrument, representing seven domains (treating vocal and gestural imitation separately), Kahn found that 19 of the 21 correlations fell in the moderate range of .43 to .68. Impressive correlations were obtained for the schemes and causality series and for the vocal and gestural imitation series: .93 and .91, respectively.

More recently, Rogers (1977) administered a sensorimotor assessment (a combination of the Uzgiris and Hunt and the Corman and Escalona scales) to 40 institutionalized profoundly retarded children. She hypothesized that 1) the retarded childrens' sequential pattern would replicate the invariant sequence characteristic of normal infants, 2) the stage attainments across the various domains would be parallel, and 3) the mental age, but not chronological age, would be positively correlated to higher achievements on the sensorimotor tasks. The four domains of sensorimotor intelligence of interest to Rogers were object permanence, spatiality, causality, and imitation. In general, the order of appearance of the sensorimotor skills within the four domains was consistent with her predictions. Mental age was positively correlated with higher sensorimotor stage performances. However, the percentage of agreements of the highest stage demonstrated across the four domains was lower than the author had anticipated (10% to 58%). The smallest degree of agreement was between spatiality and imitation. The greatest agreement was between spatiality and causality. Correlations between the stage attainments of each cognitive domain were moderate and significant ($r = .48 - .67$).

Together, these investigations attest to the applicability of Piaget's integrated theory of cognitive development to children with delayed development. Along with the language studies introducing this paper, they substantiate the similarities between normal and subnormal children in the sequence of acquisition of various

linguistic and cognitive skills, separately. Two additional investigations shall now be discussed in which the authors attempted to semi-systemmatically study and relate cognition and language within the sensorimotor period for severely and profoundly retarded children.

In 1963, Woodward and Stern addressed the issue of the relationship between certain symbolic abilities exhibited by 83 severely subnormal children, ages 11 months through 8:7 years. Once again, the cognitive stage attainments were found to be hierarchically and sequentially related, insofar as success on an item characteristic of sensorimotor stage VI predicted success on almost all previous stage III through stage V items. More interestingly, though, Woodward and Stern reported an increase in expressive language with higher stage VI attainments. Specifically, the most complex sound emitted by children functioning at stage III and stage IV was a four syllable, unintelligible babble. Children functioning at stage V emitted jargon, intermingled with single words. Two children at stage V produced echolalic two word combinations and short sentences occurred only in the speech of some children at stage VI. In terms of verbal comprehension, stage III and stage IV children responded to verbal instructions, and even then did so only with gestures. However, all stage VI children showed some verbal comprehension. It is apparent from this investigation that the children who did not exhibit evidence of symbolic representation in terms of object permanence also failed to demonstrate this symbolic function in linguistic interactions.

The latter conclusion has been further substantiated by Kahn (1975) in his investigation of the relation between language acquisition and sensorimotor stage VI in profoundly retarded children. Kahn compared the sensorimotor stages of eight retarded children exhibiting meaningful expressive language to that of eight retarded children not exhibiting such language. "Meaningful expressive language" was defined as a vocabulary exceeding ten words which the child used to request various objects. Four subtests of the Uzgiris and Hunt assessment scales were administered to each child: visual pursuit and permanence of objects, development of means for achieving desired environmental events, development of causality, and development of imitation (gestural and vocal). Seven of the eight children in the expressive language group demonstrated stage VI functioning on all of the subtests. The other child attained stage VI functioning on two of these subscales. Conversely, none of the children in the non-language group achieved stage VI functioning on all four subtests. Specifically, five children functioned below stage VI in all four domains, while the remaining three children demonstrated this stage in only two of the domains. Because only two children were found to be functioning below stage VI, the data were analyzed dichotomously, as at or below stage VI, and therefore no further analysis was made concerning the nature of the language associated with the earlier sensorimotor stages.

A tentative conclusion can be drawn from the studies of Woodward and Stern (1963) and of Kahn (1975). It seems that the cognitive

skills characteristic of sensorimotor stage VI are integrally related to the acquisition of meaningful spoken language and may actually represent necessary though not sufficient prerequisites to the development of that language.

Acquisition of Preverbal Communicative Skills

The notion of cognitive prerequisites and parallels to language acquisition is one that has recently engaged researchers interested in normal development (Bates, Camaioni, & Volterra, 1975; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977; Brown, 1973). Bates and her colleagues have provided ample evidence that not only do the cognitive capacities of normal infants go through a developmental process of reorganization and integration, but that this increasing sophistication and complexity is also characteristic of the infants' preverbal communicative behaviors, such as gestures, as well.

Due to the absence of such description of preverbal linguistic skills in the literature of mental retardation, recent research with normal infants and language delayed children of particular relevance shall now be presented.

Normal infant populations. During the late 1960's through the early 1970's the field of psycholinguistics was characterized by a preponderance of concern with syntax and with deriving some notion of childrens' grammar from their spontaneous speech (e.g., Chomsky,

1965; McNeill, 1970). As the search for the origins of syntactic knowledge became more intense the children to whom these investigators listened became younger and younger. Because the language initially spoken by very young children is of a holophrastic nature (one or two word utterances), the efficacy of applying formal adult-like grammars to these statements was called into question (Bloom, 1973). This led to a greater emphasis on the semantic, and later, the pragmatic, nature of a child's utterances within well defined contexts. Pragmatics, then involves the study of linguistic indices (words, vocalizations, gestures) used in a context to achieve some end. The reaching and whining of an infant for an object represent the communicative sensorimotor origins of the child's later abilities to deliver a verbal imperative, such as "Gimme".

In this context, Dore (1975) proposed the notion of a primitive "speech act" (called a "performative" by other authors) which expresses the child's intention and eventually develops into more conventional, propositional utterances. Dore declared that the development of sensorimotor stage IV abilities in which the child becomes able to intercoordinate object manipulation skills within a new context is the crucial indicator that the child knows what it wants and can express it gesturally or otherwise before its intention is encoded with a word.

The importance of object manipulation skills or of "schema development" has been delegated a lesser role in the development of communication by other authors (Bates et al., 1975, 1977; Snyder,

1975; Sugarman, 1973). Sugarman examined the cognitive functioning of seven infants from 4 to 14 months, and the role it played in sociocommunicative interactions. She created systematic tasks to elicit commands and requests for objects from the infants and administered the means-ends and developmental causality scales from the Uzgiris and Hunt instrument. Sugarman emphasized the notion of prerequisite cognitive and social schemes which gradually combine into complex communicative abilities, mostly as a function of stages of sensorimotor development. Five stages of response to the elicitation tasks were described as follows:

1) The child's schemas are at a level of simple, unintegrated activity. The child only looks at the adult in response to the task.

2) The child's schema progresses to the use of complex but unintegrated activity. The child looks and fusses at the adult.

3) The child's activity is integrated, but unadapted. The child points to or reaches for objects, then looks at the adult.

4) The child's activity becomes adapted. The child first seeks the adult's attention and then points at or reaches for the object.

5) The child uses linguistic communicative behavior to achieve this end.

Sugarman noted the parallel instrumental skills required in the ability to use objects as a means towards obtaining other objects and those involved in the ability to use adults as a means towards objects. The skills she found most crucial in this regard were those demonstrated in sensorimotor stage V. This stands in direct

contrast to Dore's contention that the ability to communicatively use adults as tools depends on the acquisition of the stage IV object schema.

In 1975 and 1977 Bates and her colleagues reported two corroborating investigations- the first, longitudinal and exploratory; the second, cross-sectional and systematic - in which the speech acts or performatives of preverbal normal infants were described in accordance with the infants' levels of sensorimotor functioning. They found, first of all, that the referential use of words emerged in close temporal relation with the demonstration of sensorimotor stage VI abilities. The communicative-cognitive relationship did not end there, however. More basic gestural patterns were associated with the other developmentally prior sensorimotor stages. These authors looked specifically at the emergence of declaratives, defined as the use of an object to obtain attention, and imperatives, defined as the use of an adult to obtain an object. These prelinguistic correlates of spoken declaratives and imperatives were termed "protodeclaratives" and "protoimperatives". The development from the protodeclarative to the declarative was described as follows:

- 1) Use of physical contact with the adult to obtain adult attention.

- 2) Use of "showing off" or exhibitional behavior to get attention.

- 3) First showing, then giving and pointing (mutual gazing) to an object in order to direct adult attention.

4) The use of signals such as pointing and vocalizing, combined, to direct attention.

5) The use of intelligible simple words to obtain attention. Similarly, the development from the protoimperative to the imperative sequenced as follows:

1) The use of direct manipulation of the child's own body for the object or simply looking at the adult, but never combined.

2) The use of general, undirected fussing, and/or reaching, grabbing, for the object.

3) The beginning use of the adult as a means - the child looks at or touches the adult's hand after reaching or pointing for the object.

4) The child uses some attention getting behavior before pointing to and/or reaching for the object.

5) The child uses intelligible, simple words to request the object.

Bates et al. contended, like Sugarman, that the acquisition of concepts and schemas of sensorimotor stage V were necessary for the elaboration and use of intentional communicative behavior. This notion of intentionality was used to distinguish between early and later communicative interchanges between the infant and the adult. Crying patterns of the newborn may actually communicate various messages of hunger or discomfort to the parent, although they are not used intentionally by the infant towards such discriminable ends. This Bates and her colleagues termed the "perlocutionary" phase of

communicative development, in which the child has an effect on the listener though the message was programmed to execute it. In the second "illocutionary" phase, the child intentionally uses nonverbal signals to communicate. Only in the next "locutionary" phase does the child make use of conventional words to deliver a message. These three phases for communicative development were presented as coinciding with the emergence of sensorimotor stages I through IV, V, and VI, respectively.

Despite the importance of the Bates et al. work in terms of elaborating the relationship between language and cognition, certain inadequacies existed in method and analysis. First, analyses were for the most part limited to sensorimotor stages V through VI. In addition, no mention was made as to how each child was assigned to a particular cognitive level. Owing to the possibility of nonparallel stage attainments across the various sensorimotor domains (as discussed above) it becomes necessary to explain the rationale behind assigning an individual to one general cognitive level. In addition, Bates never discussed how frequently a behavior had to be used by her normal infant subjects to be considered indicative of the child's overall level of communicative performance. Her only criterion appeared to be a dichotomous present-absent judgment as to whether the behavior had emerged. It is conceivable that the child who used pointing only on rare occasions differed communicatively from the child who used solely pointing to maintain almost all of his or her interactions.

Language delayed populations. More relevant to the present research, Snyder (1975) avoided Bates' procedural problems in a study that compared the sensorimotor and communicative developments of 15 language delayed children to those of 15 language normal infants matched on MLU, socioeconomic class, and general level of mental development, as measured by the Bayley scales. Snyder administered the full Uzgiris and Hunt instrument and thereafter described the childrens' communicative skills according to their responses to 20 systematic communication elicitation tasks.

Ten of these tasks were designed to elicit declaratives and ten were designed to elicit imperatives. The sequence of communication development was virtually identical to those reported by Bates et al. Snyder made greater use of quantitative analyses with her data, separating the roles played by each of the sensorimotor domains represented on the Uzgiris and Hunt instrument. A multiple regression analysis demonstrated that the weighting of the means-ends scale accounted for most of the variance among the subjects' scores. The weighting of the remaining scales indicated that they did not significantly enter into the prediction of communicative performance.

The sequentiality of communicative skills, as well as the importance of the child's nonlinguistic ability to find and use means towards a desired goal, were substantiated in both the normal and the language delayed groups. All children performed significantly better on imperative than on declarative tasks. In general,

the language delayed children made more frequent use of gestural performatives than did the matched developmentally normal children. And, in specific, the gestures they used were at a consistently lower developmental level than those of the normals, whereby the language delayed children focused mainly on the object rather than on the communicative interaction which could aid them in obtaining it.

Retarded populations. To this experimenter's knowledge, the present investigation is the only one to date which has applied a performative analysis to the communicative behaviors mentally retarded individuals. Its undertaking, therefore, appeared warranted by a number of critical factors, discussed briefly below.

That developmentally delayed children make greater use of gestures in communicating has been fairly well documented in the literature (Buddenhagen, 1971; Grossman, 1977; Lyle, 1961). It seems reasonable intuitively that special educators and therapists experienced with these children have capitalized on the more primitive forms of communication throughout the history of their interactions. However, as evidenced by the above literature review, there is a need to systematically describe the early communicative behaviors of severely and profoundly retarded children, especially because these may be the only means of communication at the childrens' disposal.

In order to make a strong argument for the existence of a prerequisite or parallel relationship between cognitive and comm-

unicative development, one must look beyond the phenomena of normal development to populations in which one and/or the other process is arrested. If in the course of such a study, one replicated the parallel developments described by Bates, Snyder, and Sugarman, then one would have additional evidence that language is part of the general symbolic ability developing during the sensorimotor period. The processes which propelled language acquisition would likely be related to those which allowed the child to imitate absent events, find objects after successive invisible displacements, and to use tools spontaneously and effectively rather than by trial and error to obtain other objects in the environment. However, if when examining non-normal populations, one failed to replicate the isomorphism of attainments in cognitive and communicative development, then one would have to conclude that the development of the various cognitive and communicative abilities was more independent than has currently been believed. Thus, in order to fully understand the relationship between cognition and communication, these processes must be examined in the context of both normal and atypical development.

In addition, many language training programs have been undertaken in the past with little regard for the subjects' developmental levels of cognitive and communicative skills prior to training (see Scheifelbusch & Lloyd, 1975, for a discussion of this issue). If it should be that there is a relation between cognitive and communicative competence even at the preverbal sensorimotor stages, then

this would be useful knowledge for making decisions about language intervention. Children whose pre-intervention skills represented those which were known to immediately precede spontaneous language acquisition could be discriminated from other children whose development was as yet deficient in certain critical areas. Cognitive and communicative training for the latter group, thus, could be adapted more appropriately to their individual levels of functioning. However, first the case would need to be made that such a relationship did, indeed, exist.

The major goal of the current research, then, was to identify the nature of the relationship between cognitive and communicative performance in severely and profoundly retarded individuals functioning at the sensorimotor stages of development. Through the administration of the Uzgiris and Hunt instrument and the set of 20 systematic tasks described by Snyder (1975), the following hypotheses were tested: 1) that the development of the cognitive abilities of retarded children would replicate the invariant sequence described for normal infants (Piaget, 1952, 1954, 1962; Uzgiris & Hunt, 1966, 1975) and other severely and profoundly retarded populations (Kahn, 1975, 1976; Rogers, 1977; Woodward, 1959; Woodward & Stern, 1963), 2) that the relationship between sensorimotor functioning and communicative development in retarded children would parallel that described for normal (Bates et al., 1975, 1977) and language delayed (Snyder, 1975) children. An increase in the use of symbolic representation and the coordination of means to solving

simple problems would be reflected in both cognitive and communicative development, 3) that the development of means-ends relations would better predict a child's level of performative development than any other single scale from the Uzgiris and Hunt instrument, as had been found for language delayed and developmentally normal children (Snyder, 1975), and 4) that the correlation of stage attainments across the various cognitive domains would be in the moderate range as was found by Kahn (1976) and Rogers (1975).

C H A P T E R I I

METHOD

Subjects

Forty children and adolescents functioning at the severe and profound levels of retardation participated as subjects in the project. They consisted of 19 males and 21 females, ages 6:3 years to 18:9 years (mean age, 13:2 years). Each subject was a resident of one of five different facilities in western Massachusetts. The average length of institutionalization was 8 years, ranging from approximately 2 to 16 years. Etiologies were categorized as per the handbook of the American Association on Mental Deficiency (Grossman, 1977) and are summarized in Table 1.

In addition, all subjects conformed to the following selection criteria:

- 1) Parent or guardian had signed a letter of informed consent.
- 2) The individual had limited verbal or conventionalized sign (e.g., American Sign Language) skill. Caretakers could identify no more than a ten word (spoken or signed) appropriately used vocabulary, or the presence of rote echolalic phrases and jargon as the individual's primary verbal skills.
- 3) There was no evidence of serious vision or hearing impairment.
- 4) The individual had full mobility in upper torso and limbs

Table 1

Diagnostic Classification of Subjects

<u>Classification</u>	<u>Male</u>	<u>Female</u>
Infection and intoxications	1	0
Trauma or physical agent	3	3
Metabolism or nutrition	0	1
Gross brain disease (postnatal)	0	1
Unknown prenatal influence	8	8
Chromosomal abnormality	4	5
Gestational disorder	2	2
Other: Unknown familial-hereditary	1	1

such that (s)he could easily grasp and manipulate objects.

5) Caretakers or record indicated that the individual had only limited ability in the self help areas of toileting, dressing, grooming, and eating.

6) When available, the subject's previous I.Q. test scores did not exceed 36, the minimum for the moderately retarded range.

Assessment Scales

A sensorimotor assessment consisting of five scales from the Uzgiris and Hunt Ordinal Scales of Psychological Development (1975) were administered to each subject. The scales used were: 1) visual pursuit and permanence of objects (VPP0), 2) development of operational causality (DOC), 3) development of means for obtaining environmental events (DME), 4) development of imitation - vocal (I-V), and 5) development of imitation - gestural (I-G). These particular scales were chosen for their relevance to evaluating mental representational abilities, instrumentality, and imitative abilities. They are also those scales most frequently cited in previous literature. Task descriptions and summary data charts are included in the appendix.

The communication assessment was administered via the 20 elicitation tasks described by Snyder (1975). The criteria for the selection of the tasks included and expanded upon those she offered, as follows:

1) They provided a context in which either the informative element (declarative) or the desired object (imperative) was readily identifiable by both the subject and the adult observer.

2) They provided a context which was intrinsically interesting to younger as well as older individuals.

3) They provided a context which was intrinsically interesting to individuals at lower as well as at higher cognitive levels.

4) They provided a context which did not pose any unnecessary stress or discomfort for the subjects.

5) The context created some type of activity which involved some interaction between the subject and the adult examiner.

Ten tasks were designed to elicit declaratives from the subject and ten to elicit imperatives. Declaratives were defined as any attempt by the subject to use an object to direct adult attention. These tasks involved having the subject or the adult repeat an action with a particular object. A different object was then introduced so as to evoke some "comment" from the subject about the novel object. Imperatives were defined as the use of an adult to obtain an object. During these interactions the adult retained possession of a presumably desirable object for the purposes of evaluating the means by which the child made requests and commands. Task descriptions and summary data charts appear in the appendix.

Materials

A variety of simple preschool toys were used throughout all sessions. Care was taken to use items similar to those described

by Uzgiris and Hunt (1975) and Snyder (1975) for sensorimotor and communicative tasks, respectively. A list of items used is included in the appendix. All toys and materials were provided by the experimenter and were transported to the testing sites.

Experimenters

The experimenter was the author, a female psychology doctoral student. The observers were one male psychology doctoral student, and three female undergraduate Honors students at the University of Massachusetts at Amherst. All had extensive applied experience with special needs populations. The three undergraduate women received three research credits for their participation. They were trained via two recording and observation workshops conducted by the two graduate student experimenters. The graduate assistant was familiar with the experimental hypotheses. The three undergraduate women were not.

Procedure

Each complete assessment required approximately 1.5 to 3.5 hours of observation and recording spread over two to four days. The amount of time varied according to each subject's attention span, motivational level, degree of cooperativeness, and availability. An initial rapport was established prior to testing by spending at least 30 minutes casually interacting with each individual in his or her most familiar environment.

All testing was conducted individually at the subject's residential setting, in a private room containing a minimum of potentially distracting objects. In most cases, the experimenter simultaneously administered the tasks and scored the subject's responses. An independent observer also recorded these responses and timed a fifteen second response latency period following the presentation of the stimulus materials. However, seven individuals became very distracted and difficult to manage when the experimenter took time to record their behaviors. In those instances, only the observer recorded the subject's responses.

The experimenter was seated directly across from the subject, either at a table or on the floor. The observer was seated as inconspicuously as possible but in a position from which all behaviors, including such behaviors as eye contact, could be judged. During the communicative tasks, all stimulus objects were placed at a 45 degree angle to the subject in order to distinguish behaviors directed towards the adult from those directed towards the objects. The stimulus objects for the sensorimotor tasks were placed directly in front of the subject. Favored edible and social reinforcers identified by the subject's caretakers were delivered contingent on an attempt by the individual to perform in the task situation. If the subject displayed any distress or discomfort during any part of the sessions, another appointment was scheduled with no more than one week between consecutive contacts.

The experimenter administered all of the communicative tasks in a standard fashion. In the declarative sequences she modelled a simple repetitive action with duplicates of an object, such as dropping three identical blocks into a pail. The subject was then encouraged to engage in the activity. Once the repetitive movement with the one type of object had been established by the subject, the experimenter changed the stimulus to be acted upon (e.g., from block to doll) in order to evoke some "comment" from the subject about the stimulus change. After presenting the new stimulus material, the experimenter further encouraged communication by asking "What is that?" and "What is the matter?". After a fifteen second time allowance for the initiation of a response, the experimenter and the observer recorded the subject's responses in narrative form. The task was then presented for a second trial in the same manner. Following this second trial, the subject was permitted to briefly play with the stimulus materials while his or her responses to the presentation were recorded.

The imperative tasks were more varied, yet all required some communication from the subject to obtain a desirable object. The different tasks were characterized as follows: the experimenter presented the subject with an object and held onto another object which he or she would need in order to make appropriate use of the first object. For example, the experimenter handed the subject a set of batons and conspicuously held onto a xylophone. In other imperative tasks the experimenter gave the subject a single, plain

object, such as a ball, but held onto a collection of more colorful and interesting objects, such as a handful of small finger puppets. In all cases the examiner encouraged communication for the second object(s) by asking, "What do you want?" and "What is the matter?". Once the subject initiated some behavior in reaction to the situation, and after the fifteen second response period, the experimenter and observer recorded the child's responses in narrative form. The task would then be re-presented to the subject in the same manner. Following the end of the second trial the examiner delivered the desired object(s) to the subject for a brief period of play. In all cases this was done in order to sustain the individual's interest and to avoid extinction of his or her efforts to communicate.

All of the tasks in the five scales of the Uzgiris and Hunt instrument were administered according to standard manual procedures. The data collection forms were organized in the checklist fashion suggested by its authors. The subjects were given fifteen seconds to initiate a response. Each task was presented twice. Recording the subjects' behaviors was accomplished by checking the appropriate response category on the form, or by entering a narrative recording of the response in the "other" category if the response observed had no obvious correspondence to any of those listed.

For all communication and sensorimotor tasks the subject received a score of "no response" if no behavior had been initiated within the fifteen second response latency period.

The order of presentation of the sensorimotor and communicative assessments was balanced across children. The declarative and imperative tasks were further balanced within the communicative assessment, such that Group A₁ was administered first the sensorimotor, followed by the declarative tasks, and then the imperative tasks. The order for Group A₂ was: cognitive, imperative, declarative. Group B₁ received first the declarative, then the imperative, and finally the sensorimotor tasks. Group B₂ received first the imperative, then the declarative, followed by the sensorimotor tasks.

Scoring and Coding

Communicative tasks. The developmental sequence of communication posited by Bates et al. (1975, 1977), Snyder (1975), and Sugarman (1973) was used by the experimenter and observers as a basis for coding their narrative recordings into communication categories. The research cited above has identified five categories of communicative behavior associated with the development of declarative and imperative functions during sensorimotor stage IV through VI. The present experimenter included an additional category of "no communicative response" in order to account for the possibility of a subject either sitting passively through the fifteen second response period or simply manipulating the stimulus materials without engaging the adult in their action.

Table 2 summarizes the levels of communication composed of the six behavioral categories for the declarative and the imperative

Table 2

Sensorimotor Stage and Communicative Behavior

Sensorimotor Stage	Communication Level	Category	Declarative Behavior	Imperative Behavior
III	A	1	No communicative response.	No communicative response.
IV	B	2	Physical manipulation of adult (e.g., tugging, holding) to direct attention.	Eye contact with either the adult or object, but not both.
		3	Repetition of previously reinforced or attention-getting behaviors.	Eye contact and fussing at the adult. OR Points or reaches to object without obtaining adult attention.
V	C	4	Shows or gives object to adult, or points to it without obtaining adult attention.	"Non-communicative point" Points to or reaches for object and then engages adult attention.
		5	"Communicative point" Obtains adult attention and then points, or performs both simultaneously.	"Communicative point" Obtains adult attention and then points, or performs both simultaneously.
VI	D	6	Uses simple, intelligible word or sign.	Uses simple, intelligible word or sign.

functions hypothesized to be associated with sensorimotor stages III through VI. This typology differs in three respects from that offered by the earlier research. One difference is the addition of category 1, "no communicative response", described previously. The second change occurred in the definition of the highest level communicative behavior - the use of linguistic communication, or the use of simple words. Many residential facilities for the retarded are currently emphasizing the conventional use of American Sign Language rather than speech in their language training programs. Because research samples of previous authors were of children acquiring spoken language, there was no need on their part to categorize the appropriate use of signs to communicate. Since American Sign Language represents the use of a conventionalized referential symbol system, the present experimenter assigned it to communication category 6, for the declarative and imperative functions. The third change involved an expansion of the definition of imperative categories 4 and 5. Bates et al. described the importance of eye contact as one attention getting behavior occurring either before (category 4) or after (category 5) the child points to an object. However, it seemed reasonable that eye contact is only one of many ways of obtaining adult attention. Therefore, other forms of attention getting behavior, such as vocalizations and physical contact, were included along with eye contact as critical components of effective communication through pointing.

Following each recording session with a subject, the experimenter and observer independently summarized their narrative recordings into one of the response codes described above for the declarative and imperative tasks. In the event that the subject had responded with more than one type of behavior in one task presentation, the highest level behavior (as determined by the developmental sequence) was used for summarizing the narrative into one of the response codes. The experimenter then placed each code into one of the six communication categories to which it belonged.

Inter-observer reliability was computed via the percentage of agreements to agreements plus disagreements for the codes assigned by each observer to each of the behavioral observations made. Inter-observer reliability for coding the subjects' responses to the declarative tasks ranged from 80% to 100%, with a mean of 93%. Reliability for the coding of responses to the imperative tasks ranged from 50% to 100%, with a mean of 86%.

For each subject, a cumulative communication score, a mean communication score, and a distribution of scores was obtained via the communication categories. The subjects' responses to each task were assigned a score from 1 to 6 (corresponding to the six categories). A cumulative score was obtained by summing responses over the ten tasks. Since there were two trials for each task, the higher trial cumulative score was used. The minimum obtainable cumulative score was thus 10 (for a score of 1 or "no communicative response" on all ten tasks) and the maximum score possible was

60 (for a score of 6 or "use of word or sign" on all ten tasks). The mean communication score was determined by dividing the cumulative score by the number of tasks (ten). In order to obtain the score distribution, the frequency of scores 1 through 6 on the subjects' best trial of ten tasks was computed. This distribution was later used in an analysis of variance described below to analyze the relation between communicative and sensorimotor performance. Therefore, the assumption was made, based on previous research, that the categorization of responses into the six communicative codes could be arranged into an interval scale.

Sensorimotor tasks. The checklists used to describe subjects' responses to the sensorimotor tasks were used to analyze each of the five scales administered - visual pursuit and permanence of objects, means-ends relations, operational causality, vocal imitation, and gestural imitation. Inter-observer reliability for the coding of behaviors recorded during observations ranged across scales from 33% to 100%, with a mean of 90%. The range and mean of inter-observer reliability for each scale are summarized in Table 3.

Behaviors described by Piaget (1952, 1954, 1962) as reflecting the attainments of each sensorimotor stage (see Table 4) were used to classify each of the subject's performances into stages III through VI on each of the five sensorimotor scales listed above. A domain score was assigned, indicating the highest stage attained on each scale. Inter-scorer reliability for stage assignment was 94% for object permanence, 93% for means-ends relations,

Table 3

Inter-Observer Reliabilities

<u>Task</u>	<u>Range of Agreement</u>	<u>Mean Agreement</u>
Object Permanence	78% - 100%	94%
Operational Causality	33% - 100%	88%
Means-Ends Relations	67% - 100%	94%
Vocal Imitation	33% - 100%	88%
Gestural Imitation	50% - 100%	88%

Table 4

Stage Attainments and Sensorimotor Domains

Stage	Object Permanence	Operational Causality	Means-Ends Relations	Imitation
III	Searches under screen for partially hidden object.	Physically prompts adult or reproduces part of action during familiar game.	Demonstrates a visually directed grasp. Repeats movements producing environmental events.	Attempts to imitate only those sounds or movements previously shown to be in own repertoire.
IV	Searches directly under correct screen following single visible displacement	Responds to cessation of mechanical toy by giving it to activate it manually.	Moves to regain object out of reach. Pulls support to obtain object. Does not pull support without object on it.	Attempts to imitate all sounds and movements, but does so imperfectly.
V	Searches under correct screen with successive visible displacements. Locates object following single invisible displacement.	Attempts to activate mechanical toy following demonstration.	Adopts successful strategy for placing beads in bottle following initial failure. Uses attached string to obtain object out of reach. Uses unattached tool to obtain object, with demonstrations.	Imitates novel sounds and movements through successive gradual approximations.
VI	Searches along path or directly under correct screen following successive invisible displacements.	Spontaneously attempts to activate mechanical toy, without demonstration.	Uses unattached tool to obtain object, without demonstration. Immediately succeeds in placing beads in bottle. Does not attempt to stack a solid ring onto a spindle.	Immediately imitates most invisible and visible sounds and movements which are novel.

87% for operational causality, and 100% for both vocal and gestural imitation. Each subject's general level of sensorimotor development was then obtained by computing the mean of the domain scores. This general sensorimotor level was then used along with the communication distribution score described above in an analysis of variance.

Analyses

Relation between communication and sensorimotor stage. The relation between communicative level and sensorimotor stage was examined in a 4 (sensorimotor stages III through VI) x 2 (declarative v. imperative task) x 6 (communicative category) mixed design analysis of variance. The between subject variable was sensorimotor stage and the within subject factors were communication task and communication category. Differences between means, following significant F 's, were tested using the Duncan new multiple-range test (Duncan, 1955).

In addition, a chi square analysis was used to provide another analysis of the relation between communicative and sensorimotor stages for the imperative and the declarative tasks separately.

Relations among variables. A step-wise multiple regression was used to determine which sensorimotor domain was the best predictor for level of communication in the declarative and imperative situations. In addition, the correlation between the mean communication level and the sensorimotor stage attained in each of the five sensorimotor domains was computed for the declarative and imperative task performances.

In order to examine the issue of parallelism of stage attainments across sensorimotor domains, intercorrelations and percentages of agreement were computed for the highest stage attained on each of the sensorimotor scales. In addition, the correlation and percentage of agreement of the mean level of communicative performance obtained during declarative and imperative tasks were computed.

Ordinality. The issue of the sequentiality of sensorimotor development was examined by applying Green's modification (1956) of Guttman's scalogram to each of the five sensorimotor scales administered.

CHAPTER III

RESULTS

Relations between Communication and Sensorimotor Stage

The 4 (sensorimotor stage) x 2 (declarative v. imperative task) x 6 (communicative category) mixed design analysis of variance yielded a number of significant interactions and main effects. Of greatest interest is the significant three-way interaction between sensorimotor stage, communicative function (declarative or imperative), and communicative category, $F(15,180) = 2.37, p < .004$. Figures 1 and 2 depict this interaction separately for the declarative and the imperative tasks and Table 5 presents the means involved. Reference back to Table 2 will provide the reader with a more detailed description of the behaviors associated with each communicative category. In the section to follow, cell mean differences which are discussed are significant at the .05 level, using Duncan's test (1955).

During the ten declarative tasks the highest frequency of "no communicative response" occurred with the ten subjects functioning at sensorimotor stage III and below ($\bar{x} = 7.10$). During the declarative tasks these subjects occasionally used communicative behaviors such as establishing physical contact (category 2, $\bar{x} = 1.1$) and repeating attention getting behaviors (category 3, $\bar{x} = 1.7$). However, the frequency of responding with either of the

FIGURE 1

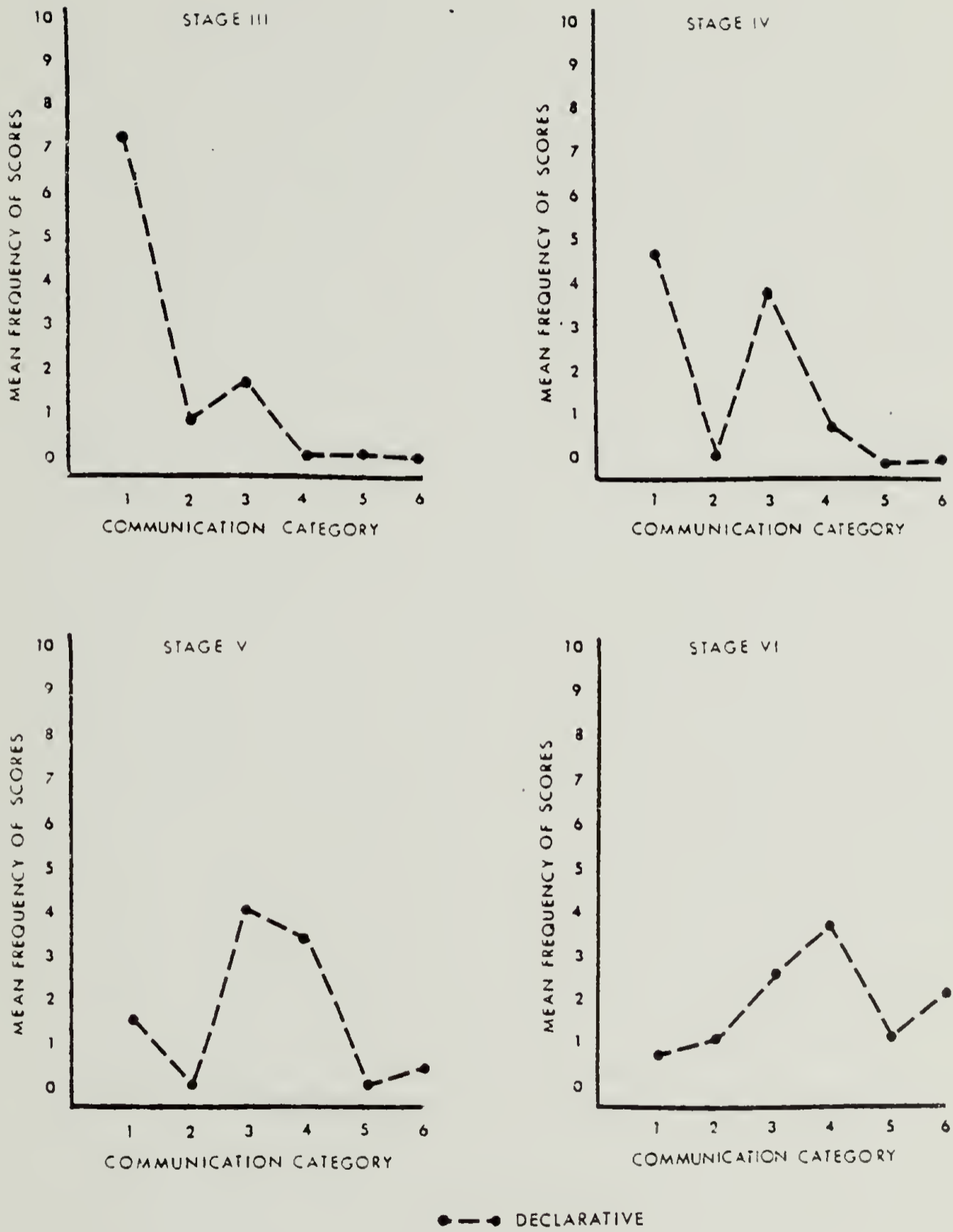
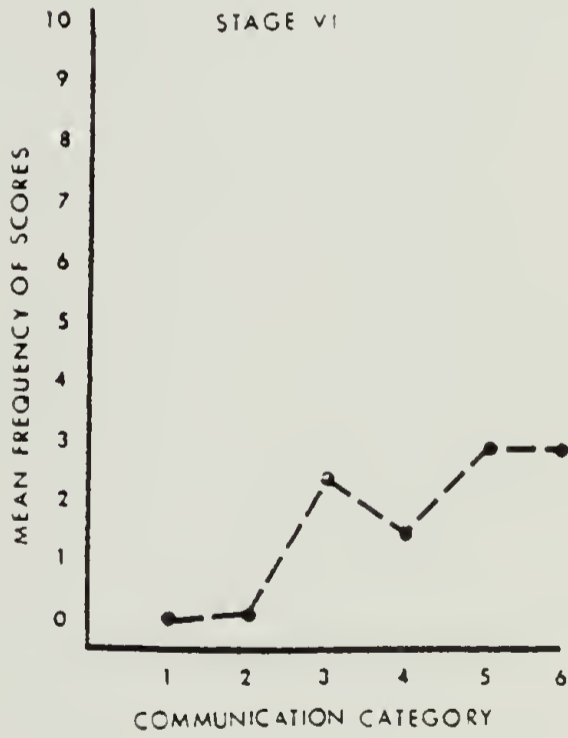
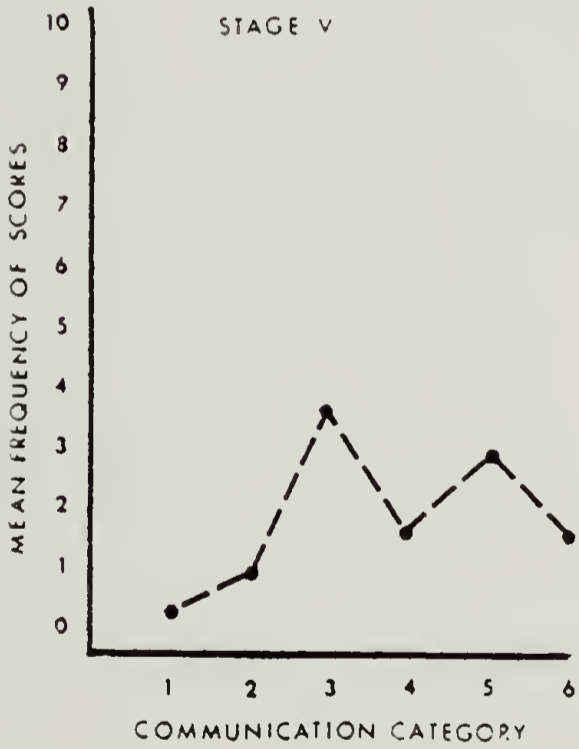
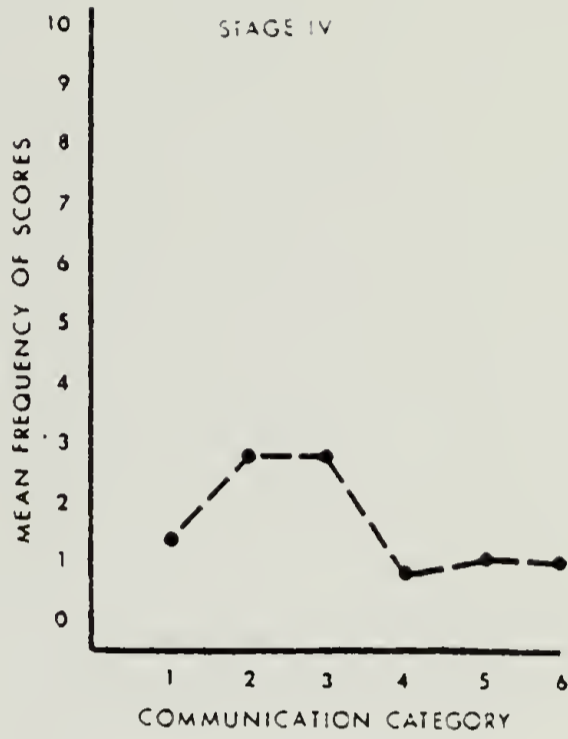
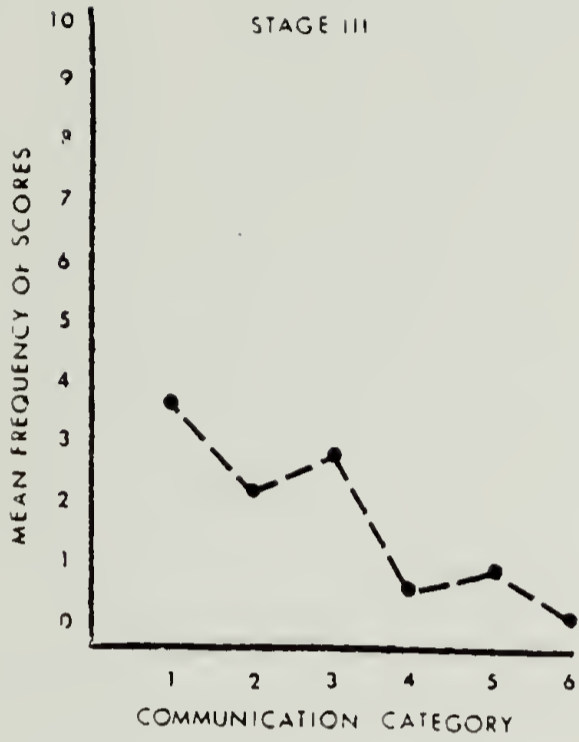


FIGURE 2



● — ● IMPERATIVE

Table 5

Mean Frequency of Communicative Behaviors:Sensorimotor Stage x Communicative Category x Communicative Task Interaction

Sensorimotor Stage	Number of Subjects	Communicative Category (1-6) Declarative (D) and Imperative (I) Tasks						<u>Total</u>						
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>							
III	10	7.10	3.70	1.10	2.10	1.70	2.90	.10	.50	.00	.70	.00	.10	20.00
IV	13	4.77	1.54	.15	2.69	3.85	2.85	.92	.77	.08	1.08	.23	1.00	19.93
V	9	1.67	.33	.22	.89	4.00	3.44	3.33	1.44	.33	2.55	.44	1.33	19.97
VI	8	.88	.38	1.00	.25	2.50	2.50	3.38	1.50	.88	2.63	1.88	2.63	20.41
Total	40	14.42	5.95	2.47	5.93	12.05	11.69	7.73	4.21	1.29	6.96	2.55	5.06	

latter types of behavior was significantly lower than the frequency of the "no communicative responses". The two most sophisticated forms of communication, "communicative pointing" and the referential use of simple words or signs were never exhibited by stage III subjects during these declarative situations.

Though subjects performing at sensorimotor stage III exhibited a higher number of "no communicative responses" ($\bar{x} = 3.70$) to the imperative tasks than subjects at any other stage, the frequency was significantly lower during the imperative than during the declarative tasks. In general, their overall level of communicative performance was higher during the imperative than the declarative situations. Their most frequent mode of active communication for a desired object was to look only at the object and to reach or grab for it (category 3, $\bar{x} = 2.90$). The second most frequent communicative strategy was to simply look at either the adult or the object, but not both (category 2, $\bar{x} = 2.10$). There was an occasional use of non-communicative pointing (category 4, $\bar{x} = .70$), but there was no use of conventional words or signs to refer to the desired object. Only the differences in the frequency of category 3 and category 4 behaviors were statistically significant.

Subjects functioning at sensorimotor stage IV most frequently exhibited "no communicative response" ($\bar{x} = 4.77$) to the declarative situations. These 13 subjects demonstrated an increase over stage III subjects in the use of the communicative behaviors of category 2 ($\bar{x} = .15$) and category 3 ($\bar{x} = 3.85$), most frequently in the form of repeating behaviors which had been previously successful in

obtaining adult attention and reinforcement. The pointing behaviors of category 4 ($\bar{x} = .92$) and category 5 ($\bar{x} = .08$) and the category 6 use of words or signs ($\bar{x} = .23$) were infrequent, but more popular than they were for sensorimotor stage III subjects. The cell mean differences between declarative categories 1 and 2 were statistically significant, as were the differences between cell means for categories 2 and 3.

The performance of stage IV individuals during the imperative situations was generally higher than their performance during the declarative tasks. Compared to their declarative performance, there was a significant increase in the use of eye contact (category 2, $\bar{x} = 2.70$) and reaching and grabbing (category 3, $\bar{x} = 2.85$), with a significant decrease in the frequency of the "no communicative responses" ($\bar{x} = 1.54$). Within the imperative situations the difference between the frequency of behaviors of category 3 and category 4 was the only one to reach statistical significance.

A total of nine subjects were functioning in sensorimotor stage V. These subjects were more active in their responding; the frequency of "no communicative response" ($\bar{x} = 1.67$) was lower than for subjects at either prior sensorimotor stage. Their most frequent modes of communication during the declarative tasks were repeating previously reinforced, attention getting behaviors (category 3, $\bar{x} = 4.00$) and showing or giving the object to the adult (category 4, $\bar{x} = 3.33$). The frequency of showing and giving was

significantly higher than the frequency of communicative pointing (category 5, $\bar{x} = .33$). The frequency of the use of words or signs (category 6, $\bar{x} = .44$) was slightly higher than the use of communicative pointing, though this difference was not statistically significant.

During the imperative tasks, subjects functioning at sensorimotor stage V had a low incidence of "no communicative response" ($\bar{x} = .33$). Behaviors of category 2 ($\bar{x} = .89$) and category 3 ($\bar{x} = 3.33$) were slightly, but not significantly, more frequent than behaviors associated with category 4 ($\bar{x} = 1.44$) and category 5 ($\bar{x} = 2.56$), combined. Category 5 and category 6 ($\bar{x} = 1.33$) communication, however, was much more frequent for this group of subjects than for subjects in either sensorimotor stages III or IV. Furthermore, the use of communicative pointing and words or signs was significantly more frequent during the imperative than during the declarative tasks.

The eight subjects performing at sensorimotor stage VI showed the fewest number of "no communicative responses" ($\bar{x} = .875$). The most frequent categories of communication exhibited by this group of subjects were the showing behaviors of category 4 ($\bar{x} = 3.375$) and the pointing behaviors of category 5 ($\bar{x} = .875$) during the declaratives. However, showing and giving (category 4) were significantly more frequent than the more sophisticated communicative pointing. As predicted, the frequency of occurrence of communicative pointing and words or signs ($\bar{x} = 1.875$) was higher for this

group than for any other group of subjects.

In the imperative situations as in the declarative situations, subjects performing at sensorimotor stage VI made greater use of communicative pointing (category 5, $\bar{x} = 2.625$) and words or signs (category 6, $\bar{x} = 2.625$) to request objects than any other group of individuals. The frequency of communicative pointing in the imperative situations was significantly higher than in the declarative situations, while the frequency of non-communicative pointing was significantly lower during the imperative than the declarative tasks. In addition, the frequency of "no communicative responses" in the imperative tasks was very low ($\bar{x} = .375$).

There were also two significant two-way interactions found in the analysis of variance, sensorimotor stage x communicative category, $F(15, 180) = 10.06$, $p < .0001$, and communicative category x type of communicative task, $F(15, 180) = 11.57$, $p < .0001$. In addition, there was a main effect for communicative category, $F(5, 180) = 19.56$, $p < .0001$. However, these two interactions and main effect must be interpreted with caution given the significant higher order three-way interaction previously discussed. With an increase in sensorimotor stage there was a concomitant increase in the use of higher levels of communication, as depicted in Table 6. Furthermore, performance during the imperative situations was significantly better than performance during the declarative situations, also shown in Table 6. In addition, the significant main effect for communicative category indicated that there was

Table 6

Mean Frequency of Communicative Behaviors:Two-Way Interactions

Sensorimotor Stage	Communicative Category					
	1	2	3	4	5	6
III	10.80	3.20	4.60	.60	.70	.10
IV	6.31	2.84	6.70	1.69	1.16	1.23
V	2.00	1.11	7.44	4.77	2.88	1.77
VI	1.25	1.25	5.00	4.88	3.50	4.50

Communicative Task	Communicative Category					
	1	2	3	4	5	6
Declarative	14.42	2.47	12.05	7.73	1.29	2.55
Imperative	5.95	5.93	11.69	4.21	6.95	5.06

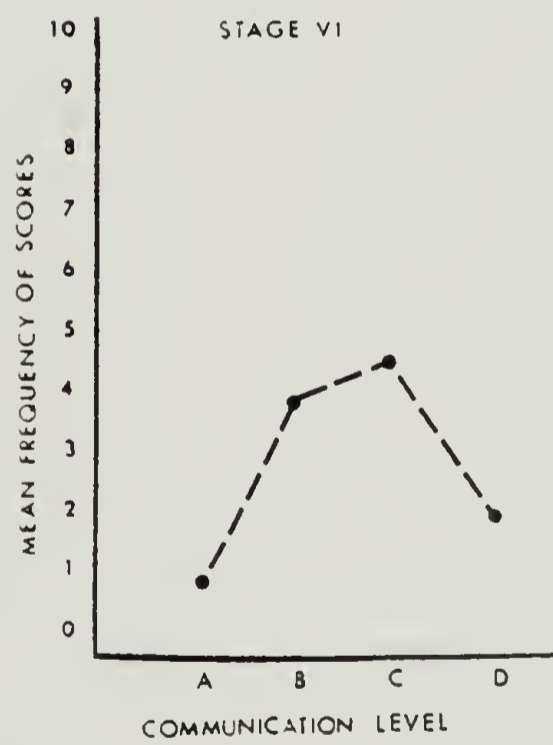
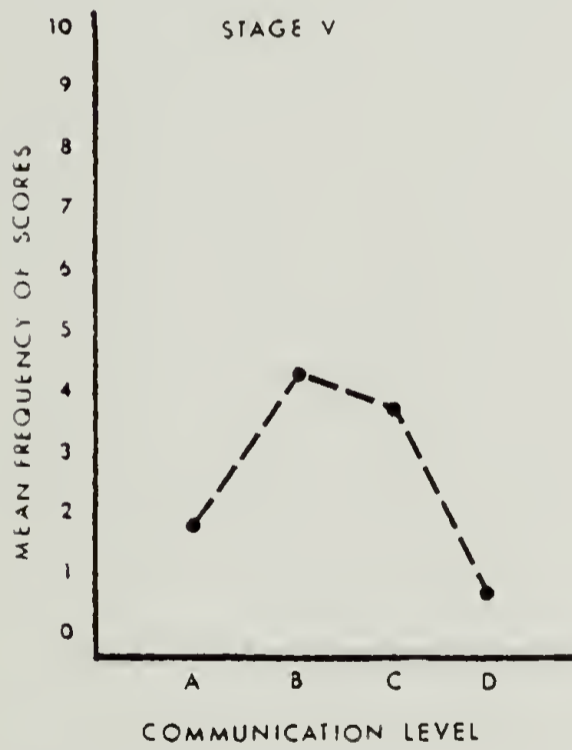
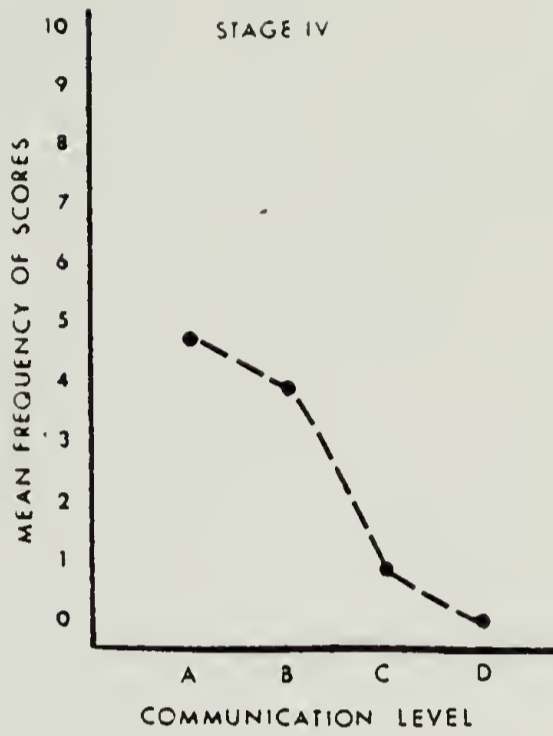
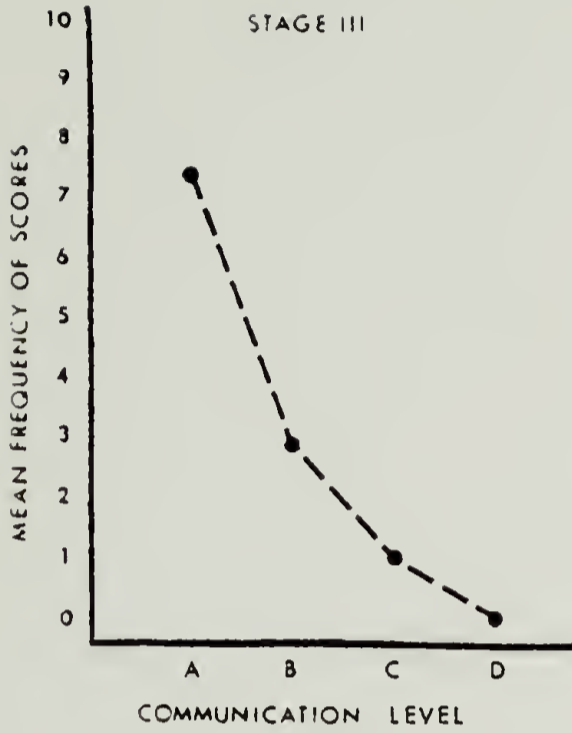
a significant difference in the frequency of different types of communicative behavior.

When behavioral categories are summarized graphically into the four communicative levels, rather than the separate six categories described by Bates et al. (1975, 1977), Snyder (1975), and Sugarman (1973), the trend of the interaction becomes more evident. Figures 3 and 4 depict this interaction by communicative level rather than by communicative category. Refer to Table 2 for the relationship of the six communicative categories to the four communicative levels.

The most frequent level of responding for subjects performing at sensorimotor stage III and below was level A (no communicative response) in the declarative tasks and level B in the imperative tasks. There was no use of word or sign to communicate by this group. Subjects at stage IV demonstrated a disproportionate number of "no communicative responses" in the declarative tasks but functioned at a higher level B when the communicative interaction had an imperative function. Subjects at stage V demonstrated communicative behaviors which were associated in the normal infant population (Bates et al., 1975, 1977) with sensorimotor stage IV, during the declarative situations. However, their performance in imperative situations paralleled that of normal and language delayed children (Snyder, 1975) functioning at stage V.

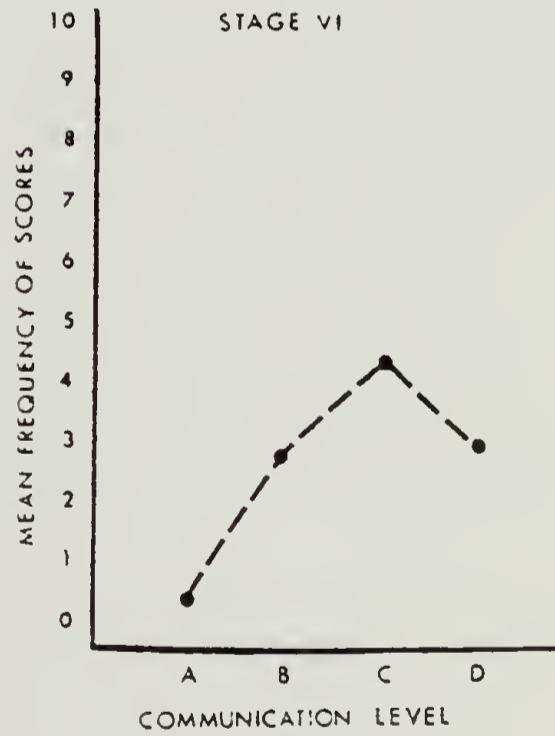
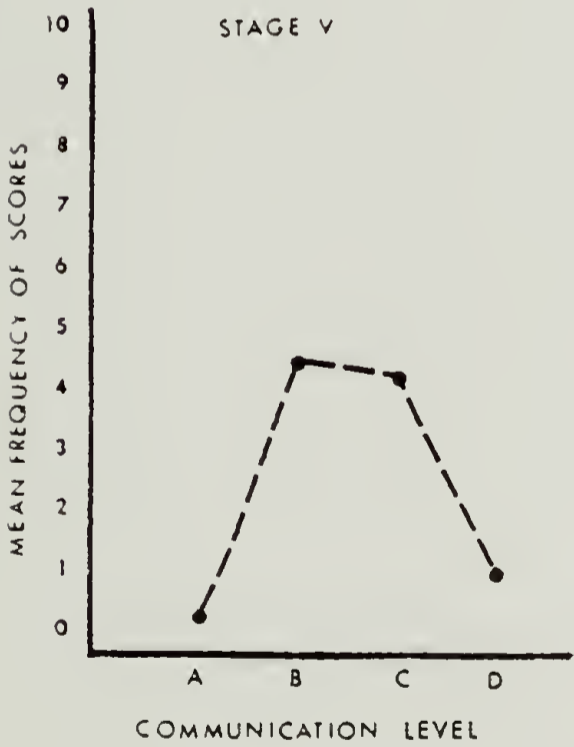
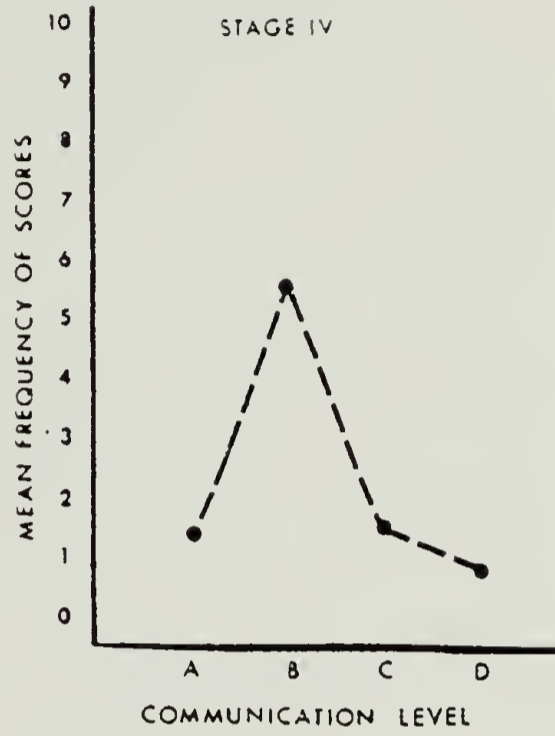
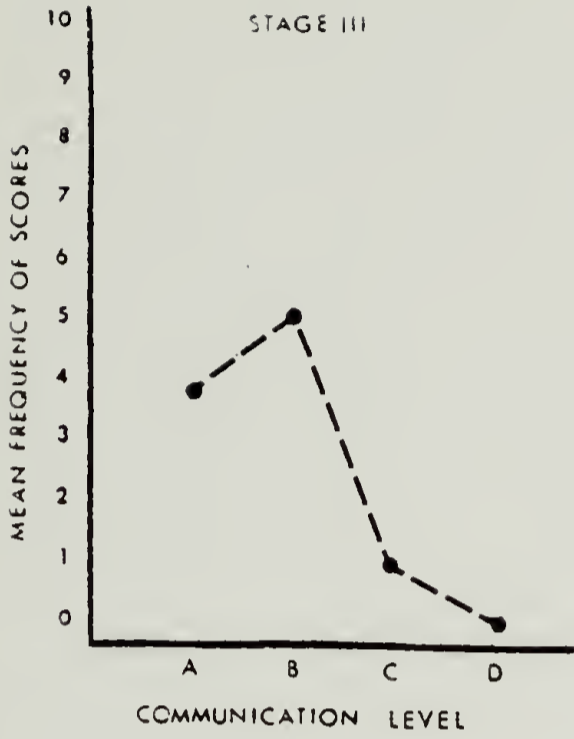
As predicted, subjects at sensorimotor stage Vi made greater use of level D communication (words and signs) than any other subject

FIGURE 3



● — ● DECLARATIVE

FIGURE 4



● — — ● IMPERATIVE

group. However, their most frequent mode of responding was with non-communicative pointing, an early level B behavior, for declarative functions. In contrast, coordinated, communicative pointing and the use of words or signs (levels C and D, respectively) occurred at the same relatively high frequency when there was an imperative context to that communication.

Despite the proposition that behaviors of certain communication categories are indicative of a particular stage of sensorimotor development, there were cases in which subjects at each sensorimotor stage made significantly greater use of a behavior of one communicative category than of the other communicative category associated with that stage. Within communicative level B, comprised of category 2 and 3 behaviors, there was a significantly greater use of category 3 behaviors during the declarative tasks for subjects functioning in sensorimotor stage IV and V. During the imperative tasks, subjects at sensorimotor stages V and VI also demonstrated a greater use of category 3 behaviors than of category 2 behaviors. Furthermore, during the declarative tasks there was a significantly different frequency in the use of the two pointing behaviors (categories 4 and 5) of communicative level C for subjects functioning at sensorimotor stages V and VI. Subjects at stage V demonstrated a higher frequency of the non-communicative pointing response, while subjects at stage VI relied more heavily on the use of the more sophisticated communicative pointing response. Given Bates' et al. (1975, 1977) contention

that the latter type of pointing represents a transitional behavior of infants functioning between sensorimotor stages V and VI, it is not surprising to find that it was most frequent with the stage VI subjects in this investigation, and was as frequent as their use of conventionalized words or signs.

In summary, the relationship of sensorimotor stages and communication level paralleled that identified for normal and language delayed infants when the function of the communication was to obtain a desired object, as measured by the imperative task performance. However, the parallel was less clear when the communication had a declarative function. Subjects in these situations performed as often at communication levels associated (in normal infant populations) with their demonstrated sensorimotor stage as they did with communication levels associated with the previous stage of development. The discrepancy between performance in the declarative and imperative mode was such that subjects generally used more sophisticated means of communication when the result of that communication was to obtain a desired object.

A chi square analysis was used to supplement the results of the analysis of variance in order to further examine the relation between level of communicative and sensorimotor functioning. The two tables of Table 7 relate the number of subjects at each sensorimotor stage with their mean declarative and mean imperative levels of communication. A significant relation was found between sensorimotor stage and level of declarative communication, $\chi^2 (9) =$

Table 7

Number of Subjects at Each Sensorimotor Stage with
Mean Declarative and Mean Imperative Levels of Communication

<u>Sensorimotor Stage</u>	<u>Declarative Levels</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
III	7	3	0	0
IV	2	11	0	0
V	0	3	6	0
VI	0	3	5	0

<u>Sensorimotor Stage</u>	<u>Imperative Levels</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
III	2	7	0	0
IV	0	8	5	0
V	0	2	7	0
VI	0	0	7	1

33.71, $p < .001$, as well as imperative communication, $\chi^2 (9) = 23.96$, $p < .005$. Using the developmental sequence of Bates et al., 24 of the 40 subjects (60%) demonstrated the relation between sensorimotor stage and communication level in the declarative situation cited for the normal infant population. Of the remaining 16 subjects with discrepant sensorimotor and declarative levels, 14 (88%) were using levels of communication demonstrated by Bates and Snyder as being characteristic of the previous sensorimotor stage. In the imperative task situations the correspondence between sensorimotor and communication level was similar; 23 subjects (57%) performed according to the normal infant patterns. Of the 17 subjects remaining with discrepant sensorimotor and imperative levels, 7 subjects (41% of the 17) had communicative scores indicative of higher sensorimotor stages, while 10 subjects (59% of the 17 discrepant cases) used communication behaviors associated in normal infants with a lower sensorimotor stage.

The results of the chi square complemented the findings from the analysis of variance and showed that the general relationship of communication level and sensorimotor stage found to exist in normal infants and language delayed children existed for children and adolescents functioning at the severe and profound levels of retardation. Of the subjects whose patterns did not fit that of the other research populations, their mean communication score on declarative tasks was one level lower than would be predicted by their sensorimotor stage. However, subjects with discrepant

patterns for imperative situations, used communicative behaviors associated with both higher and lower sensorimotor stages.

Relations among Variables

A step-wise multiple regression analysis was employed to determine which of the five sensorimotor domains was the best predictor of mean level of communication in the declarative and imperative tasks. The results are presented in Table 8. Performances on the vocal imitation series was found to be the best predictor on the imperative tasks; it accounted for the greatest proportion of the variability in communicative performance, $F(1, 38) = 51.12, p < .001$. Object permanence was second-most important in predicting level of imperative communication because it accounted for the greatest proportion of the remaining variability after adjustment for the variability due to vocal imitation, $F(2, 37) = 49.72, p < .001$. No other cognitive domains accounted for a significant proportion of the remaining variability.

Two sensorimotor scales entered the regression equation for prediction of performance on the declarative tasks. The development of operational causality was the best predictor, $F(1, 38) = 43.34, p < .001$, and gestural imitation was second, $F(2, 37) = 27.79, p < .001$.

The correlations and percentages of agreement between the highest stage attainments in each of the five sensorimotor areas

Table 8

Multiple Regression Analysis of Variance

Predictor Variables	Multiple R	Multiple R-Square	Sum of Squares	df	Mean Square	F Ratio
<u>Declarative Performance</u>						
Operational Causality	.73	.53	28.12	1	28.12	43.34
Gestural Imitation	.77	.60	31.68	2	15.84	27.79
<u>Imperative Performance</u>						
Vocal Imitation	.76	.57	28.34	1	28.34	51.19
Object Permanence	.85	.73	35.99	2	17.99	49.72

and the mean communicative levels of the two types of communicative tasks are presented in Table 9. All of the correlations between the five sensorimotor domains were moderate to high, ranging from $\underline{r}(38) = .41, p < .01$ between means-ends relations and vocal imitation, to $\underline{r}(38) = .83, p < .001$ between object permanence and causality. The percentages of agreement ranged from 13% between object permanence and vocal imitation to 60% between object permanence and means-ends relations.

The mean level of communication in the declarative tasks correlated most with performance in the operational causality series, $\underline{r}(38) = .73, p < .001$, and least with vocal imitation, $\underline{r}(38) = .60, p < .001$. The correlation between mean level of imperative communication and highest sensorimotor stage attainments was highest with vocal imitation, $\underline{r}(38) = .79, p < .001$, and lowest with means-ends relations, $\underline{r}(38) = .58, p < .01$.

The percentage of agreement between mean declarative and mean imperative levels was 22.50%. There were 31 disagreements between communicative levels in these two task situations. Of these 31 disagreements, 29 of the scores (94%) were higher in the imperative than in the declarative situations.

Ordinality

Green's modification (1956) of Guttman's scalogram analysis was used to determine the scaliability of each of the five sensorimotor scales administered. Using Green's criterion, whereby an

index of consistency (I) greater than .50 is used as evidence of a reproducible scale, four of the five sensorimotor tests were scalable. Only the series of the development of operational causality failed to form a reproducible scale ($I = .27$). The index of consistency for each of the four reproducible scales was .675, .92, .95, and .87 for the means-ends, object permanence, gestural imitation, and vocal imitation scales, respectively. This analysis, thus, indicated that the theoretical hierarchy of stage-related behaviors was ordinal in nature (in all but the causality series), such that subjects who were successful in sensorimotor stage VI tasks were likely to be successful in the developmental tasks preceding stage VI.

C H A P T E R I V

DISCUSSION

The major goal of this research was to identify the nature of the relation between cognitive and communicative performance in severely and profoundly retarded individuals functioning at the sensorimotor stage of development. The results showed that an increase in sensorimotor performance was associated with an increase in the frequency of more sophisticated forms of communication. Superior performance in both the sensorimotor and the communicative mode was characterized by an increase in the use of symbolic representation in the solution of a variety of simple tasks involving the manipulation of social and non-social objects in the immediate environment. The communicative act was conceptualized as comprised of at least two basic skills. The first of these skills, which constituted "the message" of the communication, was the ability to refer to an object or event. The second skill was that of engaging the attention of another person to whom the message would need to be delivered in order for it to be effective. With more advanced sensorimotor performance there was a simultaneous increase in the individuals' representational functions and in their abilities to coordinate the above communicative components into a unified, efficient, and meaningful act.

These developmental trends can be highlighted through an

examination of specific samples of the communicative behaviors of representative individuals functioning at each of the four stages of sensorimotor development. In the discussion to follow, samples of subjects' behaviors will be presented which best illustrate the most frequent responses to particular declarative and imperative tasks, separately.

Communicative Behavior and Sensorimotor Stage

Stage III. The greatest proportion of these subjects quietly sat manipulating the stimulus materials without any apparent interest in the social context in which they were presented. This was especially true of their performance during the declarative tasks, which elicited the fewest forms of communicative behavior, and, hence, the greatest number of "no communicative response". In many cases these subjects simply sat passively in their chairs and did nothing. There was very little eye contact established with the examiner, however, there was a higher frequency of eye contact with or mouthing of the stimulus objects. It will be recalled that during the declarative tasks the subject was reinforced for performing a simple repetitive motion with one object, such as a block, after which the examiner presented a different object, such as a doll. One stage III subject whose performance was characterized by a high frequency of the "no communicative response" category, responded as follows: She took the doll and stared at it for ten seconds. She looked up towards but not at the examiner and then let the doll fall to her lap. Another individual threw two of the blocks onto

the floor then took the doll, put its head in his mouth, and then stared out the window to his right.

Subjects functioning at or below stage III exhibited the greatest frequency of "no communicative responses" to the imperative tasks. These tasks involved the examiner temporarily withholding a presumably desirable object from the individual. Indeed, their performance was better than during the declaratives, but it was less sophisticated than that of any other subject group. An example is the typical response to the imperative task in which the examiner hands the subject a car while simultaneously waving a handful of finger-dolls in front of him or her. One young man simply stared at the car throughout the 15 second response period, while another boy played with its wheels.

What occurred in all of these behaviors presented was an exploration of the properties of the stimulus materials through a combination of visual, oral, and tactile examination. However, in none of the cases was there any evidence that the children were attempting to share their experiences of the object with the adult as would need be the case in the declarative tasks. Nor was there any evidence during the responses to the imperative task that the child was attempting to use the adult socially as a means to obtaining a more desirable object.

Though the responding of stage III subjects was characteristically at this lowest level, there were also certain situations in which they exhibited more sophisticated forms of communication.

During the declarative situations there were some occasions during which the subjects repeated behaviors with the newly presented object which the examiner had reinforced and attended to immediately before. These were interpreted as evidence that the children were using skills with the objects that they knew would result in the attention and, thereby, some interaction with the adult. In one declarative situation the examiner modelled the response of playing a xylophone with a set of batons. The subject was prompted to imitate and when (s)he finally acquired the response the examiner would take the batons and hand the subject a set of spoons instead. One stage III subject looked at the spoons for five seconds, looked up at the examiner, and then used the spoons as she had the batons. She then stopped playing the xylophone and looked up again to the examiner with a smile. This is the same girl who in the previous example simply looked at the doll and let it fall to her lap. In this second instance, however, she demonstrated, via eye contact, a simple form of coordinating her response to the novel stimulus with the attention of the adult from whom it had been received.

This higher form of responding in the declarative tasks was not very frequent for the subjects in this group. However, it was more frequent during the imperative tasks, especially during those tasks in which food items were the withheld objects of desire. The second-most frequent modes of responding for stage III subjects during the imperative tasks were with behaviors in which the child focused either on the adult or the desired object, but not both.

For one particular task, the examiner gave the subject an empty plate and then held another bag of cookies out of the subject's grasp. One stage III subject made eye contact with the bag of cookies. Her eyes drifted to the ceiling and then back to the cookies. Another child looked directly at the adult and laughed for the entirety of the 15 second response period without ever making reference to the cookies. He willingly ate one, though, at the end of the trial.

Sensorimotor stage III is defined as the stage of "secondary circular reactions" or "schemes for maintaining interesting events". Normal infants during this stage repeat simple behaviors, such as hitting or banging, presumably to maintain interesting environmental spectacles. Their abilities are at a level of simple, unintegrated activity. The retarded individuals in stage III in the present investigation frequently showed no communicative response to the task situations. When they did it was generally in the form of repeating previously successful attention getting behaviors (in the declaratives) or focusing, in an unintegrated fashion, on either the adult or the object (in the imperatives).

Stage IV. The retarded subjects functioning at stage IV showed a greater variety of communicative behaviors, but there were also definite trends. During the declarative tasks the most frequent form of response was what was termed the "no communicative response". However, the frequency of this response was not significantly higher

than that of the response in which the individual repeated previously attention getting behaviors.

Behaviors constituting the "no communicative response" category did not differ qualitatively from these same responses when exhibited by the stage III individuals. It was the quantity of these responses which differed. They were less frequent with the more advanced group, but were still characterized by the subject exploring the properties of the stimulus materials. In response to the task in which the child was handed a set of spoons in place of a set of batons with which to play the xylophone, one boy simply held the set of spoons without using them. Throughout the 15 second interval, he stared at the examiner's hair with his mouth open and was moving his tongue across his teeth. In another task the examiner rolled a set of three balls back and forth with the child and then substituted a rolling plastic bottle as the new stimulus. One 14 year old boy functioning at stage IV picked up the bottle instead of rolling it, and shook it repeatedly in front of his eyes while making very guttural, gurgling vocal sounds. He incorporated the object into what was for him a very stereotypic form of self stimulatory behavior. It is obvious that neither of these samples of behavior involved any attempt by the children to involve the adult into their actions with the materials of this task. However, the communicative repertoires of both young men were better typified by the more advanced form of responding of stage IV in which they apparently repeated behaviors for the sake of obtaining adult

attention and reinforcement. So, for example, in response to the task with the xylophone, the second 14 year old took the spoon, put it to his mouth and smacked his lips. He looked at the examiner briefly, played on the xylophone with them, put them down, and then reached for a raisin. This last behavior in the sequence made it obvious that he was using his own behavior with the objects as a way to get the adult to attend. The other young man also showed evidence of a beginning ability to coordinate his actions with objects with attention from the adult. In response to the declarative task in which the examiner handed the child a doll after he had thrown many blocks into a pail, this boy looked at the doll for about four seconds before throwing it into the pail with the blocks. He then looked at the examiner, touched her arm, and smiled. What is characteristic of both of these typical samples of behaviors during sensorimotor stage IV is that these two subjects both had certain simple modes of interacting with the immediate environment. They made eye contact with the objects and could perform simple acts with them such as throwing or banging. With the adult, they could also make eye contact. What is characteristic of this stage, though, is that none of the behaviors with objects occurred simultaneously with behaviors associated with the adult. They banged with the spoons, then made eye contact or smiled. They did not make eye contact or physical contact with the adult while they acted upon the objects.

During the imperative tasks there was a very low frequency of

"no communicative responses" for the stage IV subjects. They were much more active in their exploration of the social and non-social stimuli. However, it was still at the level of simple, unintegrated activity. Two imperative tasks shall be described, one involving toys, the other involving foods. The subjects are the same as those presented in discussion of the declaratives.

In the first imperative task the examiner handed the child a baton and held an xylophone out of reach. Though the response given on only one trial was used to score each subject's behavior, the two responses of the first subject described above to each presentation clarify the distinction made about this stage of development, namely, that behavior is focused on either the adult or the object. On the first trial this subject responded by looking at the examiner and vocalizing "i-ya, i-ya". He made no eye contact or gesture to the xylophone. On the second trial, however, he looked at the xylophone throughout and then extended the baton to it. He directed none of his activity to the adult. In both trials of this task, the second subject dropped his baton, looked at the xylophone and extended his arm to it. He did not look at the examiner.

Their response to the imperative tasks involving the withholding of the bag of cookies was similar. The first individual looked at the bag and reached for it. The second individual exhibited a behavior more typical of subjects at the next highest sensorimotor stage. He looked at the cookies, reached for them, and then looked back at the examiner.

Except for this last example of behavior, the separation is clear between what has been described as the two components of communication - the message or referent and its delivery to another person. The last example of behavior was atypical for subjects at this stage. The subject referred to the object, food, by reaching, and then looked back to the examiner, almost as if to insure that she had attended to the message. This represents the beginning of the coordination of the two communicative components, but it has not yet been integrated into what would be the most efficient sequence - obtaining first the adult's attention and then delivering the message. This latter form of behavior was more frequent with subjects functioning at the two higher sensorimotor stages.

Stage IV is defined as the "the coordination of secondary circular reactions". During this stage the normal infant combines old skills together to obtain new goals. Their schema progresses to the use of more complex but still unintegrated activity. According to Sugarman (1973), the infant can sustain a given social or non-social event by combining various skills acquired during previous stages. However, the child is unable to coordinate these different social and non-social abilities into unified communicative acts. Retarded individuals performing in stage IV also generally exhibited this lack of integration in their communicative interactions. In the declarative tasks, the non-social scheme involved repeating, with a new stimulus, the behavior taught during task

presentation. Only after the non-social behavior was concluded was there any acknowledgment made of the presence of the adult, and this was done typically through eye contact following, but not occurring simultaneously with, the actions performed on the objects. The imperative behaviors characteristic of stage IV also involved schemes in which the retarded subjects focused their compound, but simple, behaviors at either the adult - by looking and fussing at her - or at the object - by looking and reaching towards it. Not until the next stage, stage V, was it common for subjects to begin to coordinate the looking at the adult with the reaching towards the object.

Stage V. It is with the stage V individuals that there was the introduction of qualitatively new forms of communicative behaviors which differed from those exhibited in the repertoires of subjects functioning at either stage III and below or at stage IV. It was in this group that there was an expansion of the communicative repertoire from the simple use of eye contact, physical contact, and reaching to the use of more novel forms of behavior such as pointing, showing and giving an object to an adult as the basis of a communicative interaction.

During the declarative tasks, stage V subjects still responded with a relatively high frequency of repetitions of previously reinforced behavior. However, there was an almost equal frequency of behaviors indicative of the next highest category of communication, namely, the use of showing or giving an object to the adult in

order to direct the adult's attention to the interaction with the novel stimulus.

One of the older subjects, an 18 year woman, was a very active person who accompanied many of her movements with repetitive sounds and facial expressions. Her responses to the declaratives best fit the category of showing and giving objects as a means of communication with the adult. In response to the task in which the examiner handed the subject a doll after having handed her many blocks, this young woman responded as follows: She looked at the doll, then at the observer and laughed. She looked back at the examiner and shook her head with a smile. She extended the doll to the examiner and shook it vigorously in front of her. Then she took the examiner's hand, put the doll in it, and pushed the examiner's hand to the pail. This all occurred within the 15 second response period. Instead of simply throwing the doll into the pail as she had done with the blocks, this woman showed it and then gave it to the examiner. Another Down's syndrome child responded similarly to this task, though not with such rapid movements. She took the doll, looked at it and laughed. She looked at the examiner, and then threw it into the pail. She took it out again and then handed it back to her (the examiner). Both of these responses involved at least two steps in their chain. First, both subjects appeared to recognize the doll as different from the blocks, and then to communicate this difference (the message) by reaching to and handing the object back to the examiner. Both

individuals effectively coordinated their response to the non-social object with their abilities to interact socially with the adult, the social object.

The most frequent response of the stage V individuals to the imperative tasks was with one of three different types of pointing. The first, least sophisticated, form of pointing is characterized by the individual focusing solely on the object, without obtaining eye contact or attention from the adult. In the second case the individual points and then obtains adult attention. In its third form, the child engages the adult's attention before pointing to the desired object. Werner and Kaplan (1963) discussed a similar sequence in the development of the pointing gesture. They suggested that pointing develops first in a non-communicative context - one in which the child points to an object in order to objectify or "distance" it from the self. It is not used initially as a means to directing adult attention nor requesting objects. Thus, the first pointing gesture described above is reminiscent of Werner and Kaplan's description. In time, however, the child, now familiar with the pointing behavior, begins to intentionally incorporate it into his or communicative interactions. Hence, we see the development of the second and third more integrated forms of the gesture.

Interestingly enough, subjects functioning at stage V made greatest use of the third, most advanced and coordinated form. The second type of pointing was also evident, but at a lower frequency. In addition, there was also some infrequent use of signs by a few

of the stage V individuals. The first form of pointing was demonstrated by the first subject in response to the imperative task in which the examiner handed the subject a car but withheld a set of attractive finger-dolls. The first woman described above looked from the car to the dolls and back again to the car. She looked again to the dolls, reached and waved her fingers at them. She did not look at the examiner. Similarly, the second child looked at the dolls, smiled, and then reached for them, groaning, but at no point established eye contact or directed any other behavior towards the examiner.

In contrast, for the imperative task in which the bag of cookies was withheld, the first subject responded with the highest form of the pointing response, and the second subject also used a sign in conjunction with the pointing. The first subject first made eye contact with the examiner and put her fingers in her mouth. She then pointed to the cookies, always with her eyes on the examiner, and vocalized "ga-ga" with a rising, question-like intonation. The second girl, also functioning at stage V, used the two highest forms of communication investigated - the communicative point and a sign. She looked at the cookies, smiled, and made the sign for "eat". She then clapped her hands, knocked her right hand on the table, looked at the examiner, reached, and then pointed to the cookies. In their pointing responses, both subjects used some attention getting strategy (eye contact, clapping hands, knocking table) before delivering the message - pointing to the

cookies. The second girl had obviously received training in the use of simple sign, and used the word "eat" appropriately to communicate her intention. In no other task, however, did this particular girl use any conventional linguistic symbol. Her most frequent mode of responding was to point and then obtain the adult's attention.

Sensorimotor stage V is termed "the invention of new means to familiar ends" or "tertiary circular reactions". During this period normal infants begin to show and give objects and then to point to them. The pointing behaviors in declarative and imperative situations are initially rudimentary. They are of the second form described above. By the end of this stage, though, their pointing begins to take the form of the third, better sequenced, type. Sugarman (1973) noted that during this stage V, normal infants began to coordinate their actions with objects from the social and non-social environment. The retarded subjects' performance during the declaratives did give evidence of the "invention of new means to familiar ends". Whereas the highest level response of subjects in the previous sensorimotor stages was to repeat previous behaviors or to not respond communicatively, stage V individuals introduced a new form of interaction between themselves, the adult, and the object. They were the first group to demonstrate the use of showing and giving in the declarative exchange. During the imperative tasks, they demonstrated a high frequency of the various forms of pointing, also not seen to any great extent with previous groups.

Especially with the two more advanced forms of pointing, subjects began to coordinate their actions upon objects with their interaction abilities with the adult in such a fashion that the two components were unified into one communicative act - pointing to the object while looking at the adult.

Stage VI. It was with retarded subjects functioning at this last stage of sensorimotor development that the greatest frequency of conventional forms of symbolic communication was seen. This was true of both the declarative and the imperative task performances. However, in the declarative tasks this use of words or signs was not as frequent as the use of showing and giving, the most popular responses. There were also a greater number of repetitions of previously reinforced behaviors. Because examples of the latter have been presented earlier the following discussion will focus on examples of the use of showing and giving, the use of communicative pointing, and the use of words or signs. It is important to note here that communicative pointing, the use of simultaneous pointing and vocalizing with eye contact, was only rarely seen during the declarative tasks, even though the comparable behavior was elicited quite frequently during the imperative tasks.

In response to the declarative task in which the examiner replaced batons with spoons, one young woman (aged 17 years) played the xylophone briefly with the spoons then looked up at the examiner, held out one spoon, then resumed playing. This was one subject who did use communicative pointing in some of the declarative situations.

One such declarative task involved the examiner rolling three balls and then a plastic bottle to the subject. This woman looked at the bottle and vocalized, "aahba". She made eye contact with the examiner and handed her the bottle, after which she pointed to it and vocalized "aahba" again. In the first example this subject repeated the previously reinforced behavior, playing the xylophone, but then interrupted that activity with the objects in order to show one of them to the adult. She, thereby, used the object as a means to sharing adult attention. The object being shown was extended to the examiner. Thus, it was an integral part of the communicative act. However, in the case of the communicative pointing, the girl handed the examiner the bottle before pointing to it and vocalizing. The object to which she was referring was no longer part of the communicative act except as a referent. The act of communication had become "distanced" from the referent, and hence, involved a greater representational demand than the case of giving or showing in which the referent was an active part of the actual communicative exchange. Through the use of this type of pointing the communicator would be able to clearly refer to objects that were out of reach, though this would clearly not be the case for the communicator relying on physical contact or showing or giving.

The third type of behavior demonstrated during the declarative tasks by stage VI subjects more than any other subject group illustrated the greatest reliance on representational abilities. It was

the use of signs or simple words to refer to the objects. Here the message becomes even further independent of its referent, given that the communicator is using arbitrary vocal and gestural configurations and would be able to communicate about objects which were no longer perceptually present. Words and signs were used more frequently during the imperative tasks, but they were also elicited occasionally during the declaratives. In one such declarative the examiner modelled the action of pushing a toy car. She pushed three cars to the subject which the subject was encouraged to roll. After the third car had been pushed, the examiner pushed a toy dog on wheels instead. One young boy, aged twelve, pushed the second car back to the examiner, looked at her and smiled. When she did not respond, he pushed another car and said "cah" (car). This particular child responded at the ceiling on almost all of the sensorimotor tasks and was clearly one of the highest functioning individuals in the sample. It was interesting to note that during the initial adaptation period, before any tasks were administered, this boy showed the most appropriate play skills of all the subjects. He independently structured simple interactions with the various toys and with the examiner, such as a tea party. There was additional evidence, therefore, of his developing representational abilities.

As stated previously, the imperative tasks elicited the greatest number of the two highest level communicative behaviors - communicative pointing and the use of words or signs. In fact,

these were the two most frequent forms of communication for those subjects functioning at sensorimotor stage VI, and they occurred at equal frequency during these situations.

The young boy described above used both forms of these behaviors with both food and non-food related tasks. For the task in which the examiner withheld the bag of cookies, he looked at the examiner, pointed to the cookies, and then vocalized. In a similar situation the examiner handed the child an empty cup and then held up a container of juice. This boy maintained eye contact with the examiner throughout the interval. He vocalized "wah" ("want"?), and shook his head "yes". He simultaneously put out his cup and shook it in front of the examiner. When he was handed a baton, but the xylophone was held out of reach, he looked at the batons, then looked at the examiner, then pointed to the xylophone and vocalized "wah" again.

The 17 year old subject described above in the declaratives performed consistently with pointing and signs throughout the sequence of the imperative tasks, whether food-related or not. When given the empty cup, she looked at the examiner and signed "drink". When given the empty plate, she pointed to the plate, signed "eat" and then vocalized "ka-ka" (cookie?). In another task, the examiner handed the woman one toy car but held onto a box of many toy cars. She said, "me", and pointed to the table in front of her, shaking her head "yes". In a similar situation involving blocks, she looked at the examiner, and again pointed to the table and vocalized,

though it was a very guttural, unintelligible sound.

Sensorimotor stage VI marks the beginning of mental representation. During this stage the child is assumed to solve problems mentally, through "foresight", before applying that solution successfully to the situation. The child has thereby further established independence from the concrete environment. This same developmental landmark was true of the communication skills of those retarded individuals functioning at this stage of development. The imperative tasks were most successful in uncovering their skill. The use of pointing which was first coordinated with the attention of the adult was the first form of effective, coordinated communication in which the message was delivered independent of direct contact with either the object or the adult. The use of words and signs characteristic of all symbols, was to an even greater extent, independent of the presence of the object or contact with the adult.

The Effect of Function on Communicative Behavior

The type and level of the communicative behaviors used by the retarded individuals in the current investigation varied not only in accord with their stage of sensorimotor development, but also with the social function which the communication was to serve - i.e., declarative or imperative. In the declarative tasks, a communicative behavior would be used to share attention to objects with the adult; the objects would be used as a means to obtaining adult

attention. The function of communicative behavior during the imperative tasks was to use the adult as a means to obtaining a desired object. Only 9 out of the total sample of 40 individuals used behaviors of the same communicative level for both declarative and imperative functions. Ninety-four percent of the remaining 31 subjects used more sophisticated communication skills to obtain objects such as foods and toys than they did to simply make some "comment" about those objects to the adult. Snyder (1975) also reported that both language delayed and the normal infants also performed significantly better during imperative than during declarative tasks.

There are many ways in which to explain this apparent discrepancy in performance. One explanation is simply that declaratives are more difficult to elicit in contrived situations than are imperatives. A second explanation would be that there were no food items involved in the declarative tasks. However, if they had been included, it would have been very difficult to distinguish behaviors directed towards the food which had an imperative function ("give me cookie") from those behaviors which had a declarative function ("this is cookie"). It is very likely that the mere presence of food elicits imperatives, especially with institutionalized populations whose access to food is totally controlled by others.

A third explanation would be that the consequence of any given imperative act - receipt of the desired object - was much more

obvious by the nature of the task than the consequence of a declarative act - sharing of adult attention to an object. Failure to indicate desire for the object in the imperative task may have been perceived by the subjects as a potential loss of the opportunity to obtain the item involved, whereas, failure of obtaining adult attention during the declaratives led to no apparent loss for the child. All of these explanations assume that, given more representative and equally demanding tasks, the discrepancy between the subjects' declarative and imperative performance would disappear.

However, there are at least two other explanations which make the alternative assumption - that there is a true difference in the communicative ability of institutionalized retarded persons as a function of the context or meaning of the communication, both of which implicate the role played by the institutional environment.

Most of the institutional settings involved in this project were severely lacking in toys and materials with which the children could interact. Though the amount of contact with adults was also limited, when compared with contact with peers, any individual within the setting probably had a greater amount of exposure to people than to toys. Therefore, the novelty of the test materials may have elicited a higher level of performance in order to obtain them (as in the imperatives) than did adult attention (as in the declaratives), which the subject received noncontingently throughout the session.

Consideration of the social ecology of the institution also yields an interesting alternative explanation for the discrepancy between declarative and imperative performance. Throughout all of the institutions involved in this project, there was a premium placed on caretaking and custodial interactions between the clients and the staff. Thus, the person's most frequent interaction with adults was inherently designed to fulfill the child's basic wants and needs. Given the typically high client-to-staff ratio, and the limited amount of time a primary staff member could spend with any one client, it is probable that caretakers were more likely to respond to a communicative behavior involving tending to the person's basic needs rather than attending solely for attention's sake. Therefore, greater skill in using adults as tools to attain desired objects during the specific imperative tasks of this investigation may have reflected this more global differential reinforcement history of the two functional types of communicative behaviors within the institutional setting. Future research comparing institution-reared to home-reared retarded children, who would be expected to receive greater exposure to toys and a greater variety of social interactions, would provide some insight on the relationship between the development of early communicative functions and different socialization experiences.

Relations among Variables

The step-wise multiple regression was used to determine which

of the five sensorimotor scales was the best predictor of mean level of communication in the declarative and in the imperative tasks. The results indicated that vocal imitation and object permanence were the best predictors of imperative performance. Operational causality and gestural imitation were the best predictors of declarative performance. Given the caution which must be taken in using a multiple regression with moderately to highly correlated independent variables, these results still pose an interesting contrast to those obtained by Snyder (1975) and by Bates et al. (1975, 1977). Both of these authors emphasized the importance of means-ends relations in the child's ability to use adults as tools to obtaining objects and the ability to use objects as tools to directing adult attention. In fact, Bates et al. clearly stated that object permanence was "not a particularly strong predictor, either within or between sessions, of communication (1977, p. 299)". Furthermore, in their study, imitation did not begin to correlate significantly with communication until the last session of their data collection (it was a longitudinal study). Bates et al. made a tentative case, based on their own and on Snyder's data, that the "dynamic, relational" aspect of understanding represented on the means-ends scale was similar to the understanding required by active communication, whereas the notions of "permanence and stability of objects" represented on the object permanence scale, was not.

The importance of imitation abilities in predicting the communicative performance of the retarded individuals and relative lack of importance in prediction with the normal infant population is of some significance. Traditionally, developmental psycholinguists have underplayed the role of imitation in the sequence of the language acquisition in normal children (Bloom & Lahey, 1978; Brown, 1973). However, gestural and vocal imitation have been considered critical prerequisites for successful operantly based language intervention programs with language deficient retarded populations (Schiefelbusch & Lloyd, 1975). It is likely that most of the present subjects at some point had been involved in a strict imitation-reinforcement language learning program. This would be especially true for those individuals who had learned to communicate through sign language. Given the probable significance of imitation in their language learning histories, it is not surprising to find that it also played a part in their level of spontaneous communication throughout this study.

The moderate to high, significant intercorrelations between the highest stage attained in each of the five sensorimotor domains were consistent with those reported in previous research with severely and profoundly retarded populations (Kahn, 1976; Rogers, 1977). This suggests that the sensorimotor skills used to accomplish the tasks of one sensorimotor domain are not independent of the skills involved in the solution of developmental tasks of the other domains. This finding has particularly strong implications

for the strength of the conclusions which were drawn from the results of the multiple regression analysis discussed above. The procedure of the step-wise multiple regression analysis was used in such a way that the independent variable which accounted for the greatest proportion of the variability in the dependent variable was selected for entrance into the regression equation. Then the independent variable which accounted for the greatest proportion of the remaining variability in the dependent variable was selected out. Therefore, given the moderate to high degree of intercorrelations between each of the predictor, independent variables, variability in the dependent variable (communicative performance) attributable to a second predictor variable may have never entered the regression equation because of its high degree of correlation with the first predictor variable. The results of the multiple regression analysis, therefore, must be interpreted with great caution.

The percentages of agreement between the highest stage attainments on each sensorimotor scale were in the low to moderate range (12.5% - 60 %) and were consistent with the percentages of agreement reported in previous research with severely and profoundly retarded children (Rogers, 1977). Only three of the forty subjects attained the same stage of development on each of the five scales. One attained stage IV and the other two attained stage VI. The high intercorrelations cited above indicate that skills in the

various domains are related. However, these low to moderate percentages of agreement indicate that their performance across each of the sensorimotor domains was not necessarily developmentally equivalent. Such a result produces question as to the adequacy of the notion of unified "stages" when describing a retarded individual's general level of functioning.

The visual pursuit and permanence of objects scale consistently elicited the subjects' highest levels of performance. Performances on the scale for development of means-ends relations was second, and operational causality was third. Performances were poorest on the imitation scales, with vocal imitation being the worst. In fact, of the 37 subjects whose highest stage attainments were not exact on each scale, 32 of these subjects received their lowest stage assignment on the vocal imitation scale.

The fact that performance was often best on the object permanence scale was not surprising. Uzgiris and Hunt (1975) have presented evidence that this is their most reliable and most scalable set of tasks. It is also the scale with the greatest number of eliciting situations, seventeen. So, on purely psychometric grounds, one might predict that the object permanence tasks would elicit the subjects' best behaviors. However, the fact that performance was worst on the imitation scales, especially on vocal imitation, cannot be accounted for with such ease. The result may indicate a clinically significant finding that mute retarded individuals are particularly lacking in their imitative abilities. However,

Curcio (1978) recently made a similar conclusion concerning the sensorimotor functioning of 12 autistic children. Using the Uzgiris and Hunt instrument, he found that the autistic childrens' performance on the vocal imitation scale was lower than on any other scale. Similarly, their performance was highest on the object permanence scale.

Again, vocal imitation was, indeed, the lowest area of performance for the retarded individuals in this study, as well. It is the present author's contention that this trend for poor vocal imitation reflects not a trait of low functioning children, but the construction of these scales and the actual administration of the tasks. Of all of the scales in the Uzgiris and Hunt instrument, the imitation scales contain the fewest number of eliciting situations - four for gestural imitation and six for vocal imitation. They also are the only scales in the instrument in which the subject is not observed in interaction with objects, but is observed in interaction with the examiner, who is usually a relatively unfamiliar adult. In all of the other scales, the examiner prearranges the set of materials in such a way that the subjects would be highly motivated to manipulate the objects and solve simple problems, most of which the subjects are probably unaware are actually problems. The nature of the subjects' manipulation of the objects in the presumably intrinsically motivating situation is scored by the

examiner. In the case of the vocal and gestural imitation scales, however, the examiner simply models a particular familiar or unfamiliar sound or gesture to the subject. Because the examiner has been talking and gesturing to the subject throughout the assessment without requesting imitations, there is nothing inherent in the delivery of these particular sounds and gestures which should suggest to the subject that he or she should imitate them. The requirements and demands of the tasks of the imitation scales, then, are completely different from those of the other scales involving objects. It is likely, therefore, that the low imitation scores, reflect more the subjects' confusion over the task requirements than some particularly specific and strong developmental lag. However, this is only one tentative explanation, and it certainly warrants specific investigation.

Ordinality

Though the issue of ordinality has received great attention in the normal infant literature, it was only of minor concern in the present investigation. The existence of an invariant sequence of acquisition of sensorimotor skills has received support for both normal (Corman & Escalona, 1969; Kramer, Hill, & Cohen, 1975; Uzgiris & Hunt, 1975) and retarded populations (Kahn, 1976; Rogers, 1977; Woodward, 1959). Variations in the order of acquisition of basic skills have been found with normal infants (Miller, Cohen, & Hill, 1970) and with retarded children (Wolheuter & Sindberg,

1973) but these deviations have not been documented in many cases.

Using Green's modification of the Guttman scalogram analysis (Green, 1956) all of the sensorimotor scales used in the current investigation, with the exception of the operational causality series, formed statistically significant scales. Perfect ordinality on a seven item scale would be demonstrated if the item with the greatest number of successes was item 1, the item with the second greatest number of successes was item 2, and so forth, until the item with the fewest successes was item 7. Although four of the five scales used in this study formed reproducible scales, this statement obscures the fact that, even within statistically significant scales, there were many cases in which a subject who passed items indicative of a late stage failed items appearing earlier in the developmental sequence. This was especially true of performance on the scale for the development of means-ends relations. Theoretically, when ranked according to popularity (the number of successes) item 1 should be the most popular and item 12, the last item, should be the least popular. This, in fact, was far from the case, even though the means-ends scale met the criterion for a statistically reproducible scale. The obtained order of popularity of the items was: 1,5,2,4,6,8,9,3,7,10,11,12. There were obviously many order inversions in the sequence. In contrast, there was only one inversion on the causality series, which again, failed to meet the criterion of scalability. The order of popularity of the seven items on this series was: 1,3,4,5,6,2,7.

Green's modification of the scalogram and his criterion for assigning scale status are widely used in the literature on the development of normal infants and retarded children. Success in meeting this statistical criterion is often the only one used in deciding whether the acquisition of developmental tasks is sequential, and, hence, ordinal, in nature (Kahn, 1976; Rogers, 1977). The results of the current investigation indicate the necessity to use more than just this statistical criterion. Furthermore, the present results warrant more careful examination of the actual ordering of the developmental skill acquisitions. Green's criterion appears to be particularly loose when used in conjunction with the Uzgiris and Hunt instrument. Its widespread use may have inflated the degree to which sensorimotor development has been conceptualized as occurring in an invariant sequence.

Conclusions

One of the most persistent concerns in the research in the area of mental retardation has been the identification of the similarities and differences between retarded and normal development. Similarly, one of the more recent topics in the research on normal infant development has been the identification of the relation between early cognitive and early sociocommunicative development. The present research project has addressed both of these issues. It offered an extension of the analysis of the relation between mental retardation and language to children without speech. And it has extended the analysis of the relation between sensorimotor development and preverbal communication to a mentally retarded population. It, therefore, should have important implications for our understanding of both the normal and the delayed developmental process.

Methodologically, the use of a large subject population has made possible a comprehensive quantitative and qualitative analysis of the trends and variations in cognitive and communicative functioning of many individuals. The systematic tasks used throughout the study have the potential as a clinical tool for systematically assessing communicative behavior for nonverbal children in a variety of situations. Furthermore, the results of the study identify those situations which are most likely to elicit high level behaviors which could be arranged for effective language intervention.

There were some limitations of the present research which could hopefully be improved with future research. One such limitation was in the heterogeneity of the subject population in terms of diagnosis, age, and length of institutionalization. Generalization of the results, of course, would be most appropriate to older, institutionalized severely and profoundly retarded individuals. There is a need in the research to look at younger non-institutionalized populations of children functioning at a variety of levels of sensorimotor development.

As a correlational study, it has identified a number of relationships that exist in early sensorimotor and communicative development. In order to better understand the strength and the causal direction of these relationships one would now need to design and implement a study whose goal would be to see how intervention in one mode (sensorimotor or communicative) would affect functioning in the other mode.

As a cross-sectional study, this project has looked at the different stages of development across a number of individuals. A longitudinal study which documented the emergence of the various sensorimotor and communicative skills of retarded children would offer information as to the degree of sequentiality of these developments.

Another question yielded by this project concerns the relation between imitation and other sensorimotor skills of retarded and non-retarded children. In addition, it poses the question of the effect

of the institutional environment on the development of different communication functions.

A number of important future research questions have been generated, not only by the discussion of the limitations of this project, but also by its positive results. Empirical follow-up of these questions in the future, should hopefully lead to better understanding of mental retardation and to the design of more effective intervention programs for the handicapped.

REFERENCES

- Bangs, R.E. Evaluating children with language delay. Journal of Speech and Hearing Disorders, 1961, 26, 6-18.
- Bartel, N.R. The development of morphology in retarded children. Education and Training of the Mentally Retarded, 1970, 5, 164-168.
- Bates, E., Camaioni, L., & Volterra, V. The acquisition of performatives prior to speech. Merrill Palmer Quarterly, 1975, 21, 205-226.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. From gesture to the first word: On cognitive and social prerequisites. In M. Lewis & L.A. Rosenblum (Eds.), Interaction, conversation, and the development of language. New York: John Wiley & Sons, 1977.
- Bloom, L. One word at a time. The Hague: Mouton, 1973.
- Bloom, L., & Lahey, M. Language development and language disorders. New York: John Wiley & Sons, 1978.
- Bricker, D., Seibert, J., & Casuso, V. Early intervention. In J. Hogg & P. Mittler (Eds.), Advances in mental handicap research. New York: John Wiley & Sons, 1979.
- Buddenhagen, R. Establishing vocal verbalizations in mute mongoloid children. Champaign, Illinois: Research Press Company, 1971.

- Brown, R. A first language: The early stages. Cambridge, Massachusetts: Harvard University Press, 1973.
- Chomsky, N. Aspects of the theory of syntax. Cambridge, Massachusetts: M.I.T. Press, 1965.
- Corman, H., & Escalona, S.K. Stages of sensorimotor development: A replication study. Merrill-Palmer Quarterly, 1969, 15, 351-361.
- Copeland, R.H. The effects of feedback modification. In R.L. Schiefelbusch (Ed.), Language studies of mentally retarded children. Journal of Speech and Hearing Disorders, 1963, Monograph supplement No. 10.
- Curcio, F. Sensorimotor functioning and communication in mute autistic children. Journal of Autism and Childhood Schizophrenia, 1978, 8, 281-292.
- Dever, R., & Gardner, W. Performance of normal and retarded boys in Berko's test of morphology. Language and Speech, 1970, 13, 162-181.
- Dore, J. Holophrases, speech acts, and language universals. Journal of Child Language, 1975, 2, 1-20.
- Duncan, D.B. Multiple range and multiple F-tests. Biometrics, 1955, 11, 1-42.
- Fraiberg, S. Parallel and divergent patterns in blind and sighted infants. Psychoanalytic Study of the Child, 1968, 23, 264-300.
- Fraiberg, S. Intervention in infancy: A program for blind infants.

- In B.Z. Friedlander, G.M. Sterritt, & G.E. Kirk (Eds.),
Exceptional infant: Assessment and intervention. New York:
Brunner-Mazel, 1975.
- Fraiberg, S., Siegel, B., & Gibson, R. The role of sound in the
search behavior of a blind infant. Psychoanalytic Study of
the Child, 1966, 21, 327-357.
- Furth, H. Thinking without language: Psychological implications
of deafness. New York: The Free Press, 1966.
- Ginsburg, H., & Opper, S. Piaget's theory of intellectual devel-
opment: An introduction. Englewood Cliffs, N.J.: Prentice-
Hall, Inc., 1969.
- Green, B.F. A method for scalogram analysis using summary statis-
tics. Psychometrika, 1956, 21, 79-88.
- Grossman, H. Manual on terminology and classification in mental
retardation. Washington, D.C.: American Association on
Mental Deficiency, 1977.
- Guttman, L. The basis of scalogram analysis. In S.A. Stouffer,
L. Guttman, E.A. Suchman, P.F. Lazarsfeld, S.A. Star, & J.A.
Clausen (Eds.), Measurement and prediction (Vol. 4), Princeton,
New Jersey: Princeton University Press, 1950.
- Hunt, J. McV. The utility of ordinal scales inspired by Piaget's
observations. Merrill-Palmer Quarterly, 1976, 22, 31-45.
- Jordan, T.E. Language and mental retardation: A review of the
literature. In R.L. Schiefelbusch, R.H. Copeland, & J.O.

- Smith (Eds.), Language and mental retardation: Empirical and conceptual considerations. New York: Holt, Rinehart, and Winston, Inc., 1967.
- Kahn, J. Relationship of Piaget's sensorimotor period to language acquisition of profoundly retarded children. American Journal on Mental Deficiency, 1975, 79, 640-643.
- Kahn, J. Utility of the Uzgiris and Hunt scales of sensorimotor development with severely and profoundly retarded children. American Journal on Mental Deficiency, 1976, 80, 663-665.
- Kramer, J., Hill, K., & Cohen, L. Infants' development of object permanence: A refined methodology and new evidence for Piaget's hypothesized ordinality. Child Development, 1975, 46, 149-155.
- Lackner, J.R. A developmental study of language behavior in retarded children. Neuropsychologia, 1968, 6, 301-320.
- Lenneberg, E.H., Nichols, I., & Rosenberger, E.F. Primitive stages of language development in mongolism. Research publications, Association for Research in Nervous and Mental Disease, 1960, 4, 1-13.
- Lyle, J.G. The effect of an institution environment upon the verbal development of imbecile children, II: Speech and language. Journal of Mental Deficiency Research, 1960, 4, 1-13.
- Lyle, J.G. A comparison of the language of normal and imbecile children. Journal of Mental Deficiency Research, 1961, 5, 40-51.

- McNeill, D. The development of language. In P.H. Mussen (Ed.), Carmichael's manual of child psychology, Vol. I. New York: John Wiley & Sons, 1970.
- Miller, D.J., Cohen, L.B., & Hill, K.T. A methodological investigation of Piaget's theory of object concept development in the sensorimotor period. Journal of Experimental Child Psychology, 1970, 9, 59-85.
- Newfield, M., & Schlanger, B.B. The acquisition of English morphology by normal and educably mentally retarded children. Journal of Speech and Hearing Research, 1968, 11, 693-706.
- Paraskevopoulou, J., & Hunt, J. McV. Object construction and imitation under differing conditions of rearing. Journal of Genetic Psychology, 1971, 119, 301-321.
- Piaget, J. The origins of intelligence in children. New York: International Universities Press, 1952.
- Piaget, J. The construction of reality in the child. New York: Basic Books, 1954.
- Piaget, J. Play, dreams, and imitation in childhood. New York: Norton, 1962.
- Piaget, J., & Inhelder, B. Diagnosis of mental operations and theory of the intelligence. American Journal on Mental Deficiency, 1947, 51, 401-406.
- Robinson, C.E. Application of Piagetian sensorimotor concepts to assessment and curriculum for severely handicapped children.

American Association for the Education of the Severely and Profoundly Handicapped Review, 1976, 1, 5-10.

Rogers, S. Characteristics of the cognitive development of profoundly retarded children. Child Development, 1977, 48, 837-843.

Ryan, J. Mental subnormality and language development. In E. Lenneberg & E.H. Lenneberg (Eds.), Foundations of language development: A multidisciplinary approach Vol. II. New York: Academic Press, 1975.

Schiefelbusch, R.L., & Lloyd, L.L. (Eds.). Language perspectives - Acquisition, retardation, and intervention. Baltimore: University Park Press, 1974.

Sheehan, J., Martyn, M., & Kilburn, K. Speech disorders in retardation. American Journal on Mental Deficiency, 1968, 73, 251-256.

Snyder, L. Pragmatics in language-deficient children: Prelinguistic and early verbal performatives and presuppositions. Unpublished Ph.D. dissertation, University of Colorado, 1975.

Spradlin, J.E. Language and communication of mental defectives. In N.R. Ellis (Ed.), Handbook of mental deficiency. New York: McGraw-Hill, 1963.

Sugarman, S.A. A description of communicative development in the pre-language child. Honor's Thesis, Hampshire College, 1973.

Uzgiris, I. Patterns of cognitive development in infancy. Merrill-Palmer Quarterly, 1973, 19, 181-204.

- Uzgiris, I., & Hunt, J. McV. Assessment in infancy: Ordinal scales of intellectual development. Urbana: University of Illinois Press, 1975.
- Werner, H., & Kaplan, B. Symbol formation: An organismis-developmental to language and the expression of thought. New York: John Wiley & Sons, 1963.
- Wolheuter, M., & Sindberg, R.H. Longitudinal development of object permanence in mentally retarded children: An exploratory study. American Journal on Mental Deficiency, 1973, 79, 513-518.
- Woodward, M. The behavior of idiots interpreted by Piaget's theory of sensorimotor development. British Journal of Educational Psychology, 1959, 29, 60-71.
- Woodward, M., & Stern, D. Developmental patterns of severely subnormal children. British Journal of Educational Psychology, 1963, 33, 10-21.

A P P E N D I X A

SENSORIMOTOR SCALES

Visual Pursuit and Permanence of Objects

1. Following a slowly moving object through a 180 degree arc
 - a. Does not follow object
 - b. Follows jerkily through part of arc
 - c. Follows smoothly through part of arc
 - d. Follows object smoothly through complete arc
 - e. Other:

2. Noticing the disappearance of a slowly moving object
 - a. Does not follow to point of disappearance
 - b. Loses interest as soon as object disappears
 - c. Lingers with glance on point of disappearance
 - d. Returns glance to starting point after several presentations
 - e. Searches around point of disappearance
 - f. Other:

3. Finding an object which is partially covered
 - a. Loses interest
 - b. Reacts to loss, but does not obtain object
 - c. Pulls screen, but not enough to obtain object
 - d. Pulls screen off and obtains object
 - e. Other:

4. Finding an object which is completely covered
 - a. Loses interest
 - b. Reacts to loss, but does not obtain object
 - c. Pulls screen, but not enough to obtain object
 - d. Pulls screen off and obtains object
 - e. Other:

5. Finding an object completely covered in two places
 - a. Loses interest
 - b. Searches for object where it was previously found
 - c. Searches for object where it is last hidden
 - d. Other:

6. Finding an object completely covered in two places alternately
 - a. Becomes perplexed and loses interest
 - b. Searches haphazardly under one or both screens
 - c. Searches correctly under each of the screens
 - d. Other:

7. Finding an object completely covered in three places
 - a. Loses interest
 - b. Searches haphazardly under some or all screens
 - c. Searches directly under correct screen
 - d. Other:
8. Finding an object after successive visible displacements
 - a. Does not follow successive hidings
 - b. Searches only under the first screen
 - c. Searches under screen where object was previously found
 - d. Searches haphazardly under all screens
 - e. Searches in order of hiding
 - f. Searches directly under the last screen in path
 - g. Other:
9. Finding an object under three superimposed screens
 - a. Loses interest
 - b. Lifts one or two screens, but fails to find object
 - c. Removes all screens and obtains object
 - d. Other:
10. Finding an object following one invisible displacement
 - a. Loses interest
 - b. Reacts to loss, does not search
 - c. Searches only in the box
 - d. Checks the box and searches under the screen
 - e. Searches under screen directly
 - f. Other:
11. Finding an object following one invisible displacement with two screens
 - a. Searches only in box
 - b. Searches under screen where object was previously found
 - c. Searches directly under correct screen
 - d. Other:
12. Finding an object following one invisible displacement with two screens alternated
 - a. Loses interest
 - b. Searches haphazardly under screens
 - c. Searches directly under correct screen
 - d. Other:
13. Finding an object following one invisible displacement with three screens
 - a. Loses interest
 - b. Searches haphazardly under all screens

- c. Searches directly under correct screen
 - d. Other:
14. Finding an object following a series of invisible displacements
- a. Searches only in examiner's hand
 - b. Searches only under first one or two screens in the path
 - c. Searches under all screens in the path in the order of hiding
 - d. Searches directly under the last screen in the path
 - e. Other:
15. Finding object following a series of invisible displacements by searching in reverse of the order of hiding
- a. Searches only under last screen
 - b. Searches haphazardly under all screens
 - c. Searches systematically from the last screen back to the first
 - d. Other:

The Development of Means for
Obtaining Desired Environment Events

1. Appearance of hand-watching behavior
 - a. Hand-watching is not observed
 - b. Hand-watching is observed
 - c. Comments

2. Achievement of visually directed grasping
 - a. Reaches for, but does not grasp object
 - b. Grasps object when both hand and object in view
 - c. Grasps object by bringing hand up to object
 - d. Grasps object by shaping hand in anticipation of contact with object
 - e. Other:

3. Repetition of actions producing an interesting spectacle
 - a. Shows interest
 - b. Intensifies arm movements and activates occasionally
 - c. Repeats arm movements systematically and keeps toy active consistently
 - d. Only tires to grasp object
 - e. Other:

4. Letting go of an object in order to reach for another
 - a. Reaches for third object while holding the others
 - b. Reaches for third object with filled hands and drops one in the process of reaching
 - c. Drops one of the objects prior to reaching for third
 - d. Other:

5. Use of locomotion as means
 - a. No attempt to retrieve object, continues play
 - b. Indicates desire for object, but does not try to retrieve it
 - c. Moves to regain the object and resumes play using it
 - d. Other:

6. Use of the relationship of support
 - a. Reaches for object on the support
 - b. Tries to get object by climbing
 - c. Appeals to another person to get the object
 - d. Pulls support after demonstration
 - e. Pulls support without demonstration
 - f. Other:

7. Understanding of the relationship of support
 - a. Pulls support expecting to obtain object
 - b. Pulls support, but reaches for object at same time
 - c. Does not pull the support without the object on it
 - d. Other:
8. Use of string horizontally
 - a. Reaches for the object, ignoring string
 - b. Manipulates the string, but does not pull it enough to get object
 - c. Pulls string and gets object after demonstration
 - d. Pulls string and gets object without demonstration
 - e. Other:
9. Use of string vertically
 - a. Indicates desire for object, ignoring the string
 - b. Drops string to floor and becomes unhappy
 - c. Plays with the string itself
 - d. Pulls the string, but not sufficiently to get the object
 - e. Pulls string and obtains object after demonstration
 - f. Pulls string and obtains object without demonstration
 - g. Other:
10. Use of stick as means
 - a. Plays only with stick
 - b. Reaches for object, disregarding stick
 - c. Plays with stick and object, does not get object closer
 - d. Uses stick to get object after demonstration
 - e. Uses stick to get object without demonstration
 - f. Other:
11. Foresight in the problem of the necklace and the container
 - a. Does not try to put necklace into container
 - b. Attempts to put necklace in, but fails repeatedly
 - c. Succeeds in putting necklace in after several unsuccessful attempts
 - d. Invents a method which is successful after a failure
 - e. Adopts a method which is successful from the first
 - f. Other:
12. Foresight in the problem of the solid ring
 - a. Does not stack rings
 - b. Uses force in trying to stack solid ring repeatedly
 - c. Attempts to stack solid ring once and avoids it subsequently
 - d. Sets aside the solid ring without attempting to stack it
 - e. Other:

The Development of Operational Causality

1. Appearance of hand-watching behavior
 - a.. Hand-watching is not observed
 - b. Hand-watching is observed
 - c. Comments
2. Repetition of actions producing an interesting spectacle
 - a. Shows interest in object
 - b. Intensifies arm movements and activates occasionally
 - c. Repeats arm movements systematically and keeps object active consistently
 - d. Only tries to grasp object
 - e. Other:
3. Use of specific action as "procedure"
 - a. Shows interest only during spectacle
 - b. Shows excitement, but no dominant act during pauses
 - c. Dominant act during pauses suggests a "procedure"
 - d. Reaches for object only
 - e. Other:
4. Behavior in a familiar game situation
 - a. Shows no interest
 - b. Remains passive during pauses
 - c. A dominant act during pauses suggests a "procedure"
 - d. Performs part of the act during pauses
 - e. Touches examiner and waits during pauses
 - f. Other:
5. Behavior to a spectacle created by an agent
 - a. Shows interest only during spectacle
 - b. Shows excitement, but no dominant act during pauses
 - c. A dominant act during pauses suggests a "procedure"
 - d. Touches examiner and waits during pauses
 - e. Attempts to imitate examiner
 - f. Other
6. Behavior to a spectacle created by an agent acting on an object
 - a. Shows interest only during spectacle
 - b. A dominant act during pauses suggests a "procedure"
 - c. Touches examiner or the object and waits
 - d. Gives object back to the examiner
 - e. Attempts to activate object
 - f. Other:

7. Behavior to a spectacle created by a mechanical agent
 - a. Plays with object only
 - b. Makes object perform its activity manually
 - c. Touches examiner or object and waits
 - d. Gives object back to examiner
 - e. Attempts to activate object mechanically after demonstration
 - f. Attempts to discover a way to activate object mechanically without demonstration
 - g. Other:

The Development of Vocal Imitation

1. Use of vocalization other than crying
 - a. Only vocalizes distress sounds
 - b. Vocalizes (coos) when not distressed
 - c. Comments:
2. Response to familiar vocalizations
 - a. Shows no interest
 - b. Listens, does not vocalize
 - c. Positive response to infantlike sounds
 - d. Vocalizes in response to examiner's infantlike sounds
 - e. Vocalizes similar sounds, but does not shift to match examiner
 - f. Vocalizes similar sounds and shifts to match examiner
 - g. Other:
3. Response to familiar sound patterns
 - a. Shows no interest
 - b. Listens, does not vocalize
 - c. Positive response to familiar sound patterns
 - d. Vocalizes in response
 - e. Vocalizes similar sounds in response, but does not shift to match examiner
 - f. Vocalizes similar sound patterns and shifts to match examiner
 - g. Other:
4. Imitation of familiar words
 - a. Listens, does not vocalize
 - b. Vocalizes, but sounds fail to match model's
 - c. Imitates familiar words
 - D. Other:
5. Imitation of unfamiliar sound patterns
 - a. Shows unhappiness or cries
 - b. Shows no interest
 - c. Listens, does not vocalize
 - d. Vocalizes, but not similar sounds
 - e. Vocalizes with sounds becoming gradually closer approximations of models'
 - f. Vocalizes with sounds similar to model's immediately
 - g. Other:
6. Imitation of new words
 - a. Listens, does not vocalize
 - b. Vocalizes, but not similar sounds

- c. Imitates by gradual approximation
- d. Imitates a few words immediately
- e. Imitates most simple words immediately
- f. Other:

The Development of Gestural Imitation

1. Systematic imitation of familiar simple schemes
 - a. Shows interest, but no attempt to imitate
 - b. Performs some action consistently, does not imitate
 - c. Imitates
 - d. Other:

2. Imitation of complex actions composed of familiar schemes
 - a. Attends, but makes no attempt to imitate
 - b. Performs some action consistently, does not imitate
 - c. Attempts to imitate, but does not approximate on successive attempts
 - d. Imitates by gradual approximation
 - e. Imitates model immediately
 - f. Other:

3. Imitation of unfamiliar gestures visible to the infant
 - a. Shows interest, but no attempt to imitate
 - b. Performs some action consistently, but does not imitate
 - c. Imitates by gradual approximation
 - d. Imitates immediately
 - e. Other:

4. Imitation of unfamiliar gestures invisible to the infant
 - a. Shows interest, but no attempt to imitate
 - b. Performs some action consistently, does not imitate
 - c. Imitates by gradual approximation
 - d. Imitates at least one invisible gesture immediately
 - e. Imitates most invisible gestures immediately
 - f. Other:

A P P E N D I X B

COMMUNICATION TASKS

Declarative Tasks

1. The examiner models the action of throwing blocks into a pail. The examiner hands child each block to throw into the pail, which the examiner still holds. After the child has thrown three blocks into the pail, examiner hands child a small doll figure instead.
2. The examiner models the action of rolling a ball. The examiner rolls each of three balls back and forth to the child. After the child has rolled the third ball, the examiner rolls a plastic bottle to the child instead.
3. The examiner models the action of striking an xylophone with a baton. After the child has used the baton and xylophone appropriately, then the examiner takes the baton and hands the child a spoon instead.
4. The examiner models the action of dropping doll figures into a pail, The examiner hands the child each doll figure that the child is to drop into the pail, which the examiner holds. After the child drops three doll figures into the pail, the examiner hands the child a block instead.
5. The examiner models the action of pushing a toy car. The examiner pushes three cars separately towards the child. After the third car has been pushed, the examiner pushes a toy dog on wheels towards the child instead.
6. The examiner models action of turning plastic cups upside down. The examiner gives the child three cups, prompting the child to turn each of them over. When the child turns over the three cups twice, then the examiner hands the child a set of plastic dishes instead.
7. The examiner models the action of placing toy animals in a box. After the child has placed three animals in the box, the examiner hands the child a toy car instead.
8. The examiner models the action of taking small doll figures out of a truck. The examiner then puts three dolls into the truck separately, and the child is encouraged to take them out. After the child has removed each of the three dolls, the examiner places a toy animal in the truck instead.

9. The examiner models the action of placing three small cars in a line. The examiner hands the child each of the three cars separately, prompting the child to line them up. When the child has set down the three cars, the examiner hands the child a small doll figure instead.
10. The examiner models the action of feeding a small stuffed rabbit with a spoon. After the child places three imaginary teaspoonfuls into the animal's mouth, the examiner then offers the child a feeding bottle.

Imperative Tasks

1. The examiner gives the child a small stuffed animal. The examiner holds a baby blanket, baby hat, and feeding bottle.
2. The examiner hands the child a block. The examiner holds a pail filled with blocks.
3. The examiner gives the child a toy bus. The examiner holds several small doll figures in front of the child.
4. The examiner gives the child an empty plastic plate. The examiner holds a plate filled with cookies.
5. The examiner gives the child an empty cup. The examiner holds a carton of juice or milk.
6. The examiner gives the child one car. The examiner holds an open box filled with other cars.
7. The examiner gives the child a baton. The examiner holds an xylophone.
8. The examiner gives the child a clear plastic jar of cookies which the child cannot open. The examiner is present and near the child.
9. The examiner places a favored toy near the child. It is the only toy present within the child's reach. The examiner places her hand on it.
10. The examiner gives the child a clear plastic box of toys which the child cannot open. The examiner is present and near the child.

A P P E N D I X C

MATERIALS

- Rattle - a small plastic baby rattle, with two round balls at each end and a slender, easy-to-grasp center.
- Musical clown - a roly-poly toy in the shape of a clown that makes a sound when shaken. It consists of a ball, about ten centimeters in diameter, topped by a smaller ball with the features of a face painted on it and bright hat. It is weighted to return to an upright position when pushed from side to side.
- Necklace - a long, single-stranded necklace, made of small, pale colored beads (yellow, pink, white, tan) with dark grey beads interspersed.
- Scarf - a large, square, non-transparent white, gold, and pink scarf.
- Cloths - two pieces of terry material of similar size to the scarf, one tan, and one dark green.
- Pillow - a square, forty by forty centimeters velour pillow, green.
- Cardboard screen - a rectangular piece of grey cardboard about 30 by 40 centimeters .
- String - ninety centimeters of tan wrapping string.
- Rake - a bright pink plastic beach rake, about 25 centimeters long.
- Stacking toy - a set of five plastic rings that fit over a stick, each a different bright color, sold commercially by Fisher-Price as Creative Blocks. One ring is made solid by taping over its hole with tape of the same color.
- Blocks - ten 2.5 centimeter square blocks with letters painted on them, sold by Playskool.
- Pail - a dark blue plastic beach pail with bright pink plastic handle, standing about 22 centimeters tall.
- Finger puppets - four dolls which can be palced on fingers as puppets. All were of plastic, and were pink, green, blue, and brown.
- Miniature cars - four small cars that can be operated by friction

Cup - one eight ounce, orange, plastic drinking cup with attached handle.

Plate - one 20 centimeter diameter paper plate.

Batons - two white stemmed batons, plastic, with pink balls at the end of the stem, 16 centimeters in length.

Xylophone - one metal toy xylophone with ten tone keys varying in colors, 33 x 11 centimeters.

Bottle - one clear plastic bottle with child-proof lid.

Wind-up toy - one water toy in the shape of a penguin that flaps its arms when wound by an unobtrusively located key.

Plastic box - one clear Tupperware box with lid which snaps on, 10 x 12.5 x 5 centimeters.

Flannel baby blanket - white background with light green circles, about 27.5 x 44 centimeters.

Feeding bottle - a miniature (11 cms. tall) feeding bottle made of clear plastic.

Dog on wheels - one six centimeter tall dog which can be operated by friction. It has metal wheels, a white body, and a face painted on it in red.

Plastic tea-cup set - three cups and three dishes, seven cms. in diameter. Colors: flourescent pink, yellow, and lime green.



