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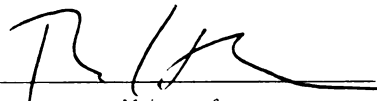
**SENSORIMOTOR INTELLIGENCE, LANGUAGE
DEVELOPMENT, AND PARENT-CHILD INTERACTIONS
IN 14, 18 AND 22 MONTH OLDS**

presented by

CHARLES TALOR

has been accepted towards fulfillment
of the requirements for

M.A. degree in Psychology


Major professor
Thomas H. Carr

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SENSORIMOTOR INTELLIGENCE, LANGUAGE DEVELOPMENT,
AND PARENT-CHILD INTERACTIONS IN 14, 18 AND 22
MONTH OLDS

by
Charles Talor

A THESIS

Submitted to
Michigan State University
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for the degree of

MASTER OF ARTS

Department of Psychology

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ABSTRACT

SENSORIMOTOR INTELLIGENCE, LANGUAGE DEVELOPMENT,
AND PARENT-CHILD INTERACTIONS IN 14, 18 AND 22
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by

Charles Talor

Thirty male and female infants 14, 18 and 22 months of age were assessed for sensorimotor intelligence, language development, and mother speech interactions in videotaped situations. Object permanence development related only to certain object word vocabulary categories in comprehension that reflect knowledge of objects. Means-end relations development related to verb and marginally related to causality statements in infant speech, in a manner consistent with Bates (1976) observations. Situations affected mother-infant speech relations and infant utterances, though not infant MLU. Many forms of mother speech related to child speech. The general pattern is that inherently complex mother speech negatively related to child speech; fine tuned speech positively related to child speech. Some mother speech related to child relational comprehension.

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INTRODUCTION

Recently research in language development has focused on the first appearance of language comprehension and production (Benedict, 1979; Nelson, 1973). Language development has also been compared to cognitive development (Rodgon, 1976), and social interactions (Bruner, 1978).

Nature of the Problem

Recent studies of initial language and concurrent cognitive development emphasize one form of sensorimotor (mental) structure (object permanence) and compare that structure to one aspect of language development (verbal utterances). These studies find increases in language complexity are related to the development of representative thought as marked by successful "invisible" search for objects (object permanence stage 6). Also, the typical study of social interaction and language relates grammar and syntax development in young children to mother speech and has not emphasized simultaneous relations of cognitive development and mother speech to child language development. Overall, the pattern of relations between language development, cognitive development, and social interaction has been extensively mapped out with measures of object permanence and verbal utterances, while receptive language, other forms of sensorimotor growth, and

mother speech have not yet been interrelated to the growing body of work examining object permanence and verbal language.

This paper focuses upon: (a) distinguishing receptive language abilities from productive language abilities, (b) examining sensorimotor growth in areas other than object permanence development, (c) reviewing findings which relate sensorimotor growth to language development, and (d) relating maternal language factors to infant language.

REVIEW OF THE LITERATURE

Language development

Language development research has emphasized language production (Bloom, 1973; Bowerman, 1973; Brown, 1973; Greenfield & Smith, 1976; Nelson, 1973), though recent findings indicate differences between receptive and productive language abilities (Benedict, 1979; Huttenlocher, 1974). Receptive language abilities begin on the average at 10 months of age (Benedict, 1979), 2 months before productive language begins (Nelson, 1973). Also, initial acquisition rates of words in comprehension are greater than production (22.03 versus 9.09 words per month, Benedict, 1979). This means receptive vocabularies are generally larger than productive vocabularies during the early stages of language development (Benedict, 1976).

Early productive and receptive language also differ in the way word meanings are related. The understanding that words can alter the meaning of other words develops late, occurring 6 to 10 months after receptive language begins. In contrast, words that may alter the meaning of other words have been described as appearing early in speech production (Greenfield & Smith, 1976), though the appearance of such words in production takes place after the comprehension of

these same words.

Words that can change the meaning of other words have been termed "relational" (Benedict, 1976). Relational words are often, though not always, modifiers. Modifiers make up only one type of word category that characterize early vocabularies. Frequency counts of words belonging to different word categories can distinguish receptive and productive language abilities. Receptive vocabularies tend to have a greater proportion of action-oriented words than productive vocabularies during the acquisition of the first 50 words (36% versus 19%, $p < .01$, Benedict, 1979).

The larger proportion of action-oriented words in receptive vocabularies may be due to a general action-oriented response strategy by the children (Shatz, 1978). Shatz (1978) found that when 19- to 34-month-olds gave meaningful responses to linguistic commands, the responses were predominantly action-oriented although many commands did not require overt physical responses. The frequency of action-oriented responses dropped as older infants were assessed, though action-oriented responses predominated at all ages. For example, when children were asked to identify the location of a toy, most children who responded overtly pointed or picked up the toy in question rather than verbally identifying the toy's location.

Comprehension and production vocabularies also differ in other word category frequencies. Comparisons of the first 50 words in comprehension and production vocabularies show

fewer general nominals in comprehension compared to production (39% versus 50%, $p < .01$), fewer personal-social words (5% versus 10%, $p < .01$), and more specific nominals (17% versus 11%, $p < .01$).

Overall, substantial differences between comprehension and production of early language have been found in studies of vocabulary acquisition (Benedict, 1979; Nelson, 1973), and the comprehension of multiword utterances by young children may be relational or non-relational. Measures of both receptive language and productive language can enhance our picture of early language competence compared to using each measure separately.

Cognitive Development

Piaget (1952, 1954, 1967) describes early cognitive development in terms of action schemes and cognitive influences on action schemes. Action schemes are the actual set of behaviors possessed by a young child to perceive and manipulate objects, such as eye scanning patterns in looking. Object manipulation characterizes for Piaget a child's understanding of objects and their properties. The proposal that cognition influences action schemes emerges from Piaget's philosophical position that the child actively seeks knowledge about the environment. These cognitive influences can be considered as procedures or strategies which determine action scheme usage in particular situations.

Early in development a child tends to use a limited set of behavioral acts on objects. A child acquires a larger set of acts with age and experience. The early use of action

schemes is often haphazard. The child must apply several different behaviors until an appropriate one is found for a particular situation. Development occurs in the adjustment and adaptation of old behaviors to meet the demands of new situations. The result is an expanding and increasingly differentiated set of situation-appropriate behaviors. Adjustments begin initially after old behaviors fail in new situations. However, long term development is more than the acquisition of larger and larger sets of situationally-appropriate behaviors applied in a trial-and-error fashion.

In addition to acquiring larger sets of behaviors, a child eventually "reasons out" appropriate sets of actions without carrying out any "preliminary" acts. A "planfulness" develops as correct behaviors are devised systematically and directly without feedback from the failures of unadjusted behaviors. This planfulness is a major development for Piaget, indicating the first use of internal, mental representation by the child. For example, Bates (1976) notes a young child carrying flowers and wishing to enter her house. The child places her flowers on the porch and began to open the door when she looked down at the flowers and stopped. She then moved the flowers outside the path of the door, correctly anticipating the effect of its movement on her delicate flowers.

Piaget calls the period in early cognitive development during which a child first acquires a set of behaviors to act intentionally on objects as sensorimotor stage 4. When a

child adjusts established behaviors to meet changes in new situations, the child is said to be operating in sensorimotor stage 5. When the child "plans" appropriate behaviors in situations before acting the child is seen as operating in sensorimotor stage 6. Thus the last three stages of the sensorimotor period, beginning at about 8 months of age and carrying on through age 18 to 24 months on the average, mark the development of strategically planned, goal-directed action.

Piaget describes a hierarchical sequence of stages. However, he notes that complex situations which exceed a child's capacity for understanding tend to cause that child to revert to less advanced strategies to cope with the situation. Similarly, a stage 6 child may be unable to "plan" an appropriate course of action without attempting some "trial" behaviors in difficult situations.

The apparent interaction between situational complexity and the child's level of cognitive reasoning is explained by Piaget as horizontal decalage. In a horizontal decalage, children operate at an advanced stage of cognition in simple situations, but at a lower stage in complex situations. Piaget organizes the decalages around four major situational interactions. These interactions involve cognitions associated with objects, space, causality, and time. The cognitions for each interaction are thought to be interdependent. Knowledge of objects is necessary for the understanding of space and causality. Causality knowledge is critical for the understanding of time.

Uzgiris (1973) confirms Piaget's general findings of stages and horizontal decalages. Uzgiris (1973) found that new knowledge of causality and space developed after critical developments in object knowledge. This is understandable as space understandings require knowledge of objects in space, and causality requires a knowledge of how actions and objects can create movements and activities in other objects and people. However, Uzgiris (1973) found that stage 4 and stage 5 behaviors were difficult to distinguish from one another, and two distinct stages were found in the behaviors associated with stage 6 performance.

The implications of Uzgiris's findings are first, early behavior adjustments of stage 5 may be difficult to distinguish from non-adjusted behaviors of stage 4. Infants may simply try a variety of "trial and error" behaviors to solve a situational problem, rather than try one behavior which produces unsatisfactory results. Second, the "reasoning" that a child performs may be divided into "simple reasonings" of an early stage 6, and "harder reasonings" of a late stage 6. Uzgiris (1973) reports space and causality behaviors were not complex when children solved invisible hidings (early stage 6) in a test of object knowledge (object permanence). Space and causality behaviors increased in complexity only after the children solved multiple invisible displacements (late stage 6) in the same test of object knowledge. For example, space behaviors of young children in early stage 6 include retrieving out of reach objects with

small sticks, while in late stage 6, children recognize and do not stack onto a stick a ring with its hold filled which is mixed among several unfilled rings. Late stage 6 behaviors are more subtle than early stage 6 behaviors.

Piaget's situational interactions and Uzgiris's findings are important for two reasons. First, many studies of sensorimotor development measure only one sensorimotor activity (usually object knowledge, i.e. Corrigan, 1978). Second, sensorimotor development may be distinguished into early and late stage 6 functioning. Since different sensorimotor activities mature at different times and rates under different conditions (Uzgiris, 1973), individual differences are implied in cognitive development. Individual differences in cognitive development may relate to individual differences in language development if a cognitive primacy view of language development such as that of Sinclair (1973), covered in the next section, is true.

Cognitive and Language Development

Recent research has applied the theory of sensorimotor development (Piaget, 1954) to explain early language development. Ingram (1978) and Sinclair (1973) believe that early language behaviors are manifestations of sensorimotor action schemes and reasoning abilities. Empirical support for the sensorimotor view of language development, however, has been inconsistent.

Rodgon (1977) examined relations between six measures of cognition and one measure of language in a longitudinal assessment of eight 16- to 21-month-olds. The cognition

measures were symbolic play, deferred imitation, role playing, object permanence, cup manipulation, and object manipulation. The language measure consisted of word production vocabularies. Infants were matched on verbal ability by being able to speak one, but not more than one word at a time. The cognitive measures were given once during the first few months of study while language productions were assessed continuously.

Rodgon found no overall pattern among the cognitive measures and the ability to speak one word utterances. However, all children showed symbolic functioning in at least one cognitive measure, suggesting several explanations. First, cognition and symbolism in language depend on one another for development. This effect may be uni-directional. Concepts assessed in cognition may aid acquisition of symbolism in language. Alternatively, language symbolism may aid symbolic performance in cognition measures. Two-directional effects may also occur. For example, object permanence knowledge may influence symbolism in acquiring object words, while symbolism in social words may influence the acquisition of symbolism in Rodgon's cognitive measure of role playing.

A second form of relationship between cognition and language considers the two as depending on a common underlying capacity for abstraction. For example, symbolism involving objects may facilitate object understanding as marked by object permanence and object labeling. A third form of



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relationship between cognition and language is independence, in which symbolism in both areas develop separately but on a similar course.

Unfortunately, Rodgon's findings on cognitive and language relations are restricted by the exploratory nature of her study. The study was longitudinal for language development, while each cognitive measure was given once. Relations may have emerged in longitudinal assessments of both language and cognition, or within a cross-sectional design of several different ages. For example, words coding movements of visible objects, such as "move," may occur only after the child shows an understanding of multiple invisible displacements in an object permanence task. Alternatively, a child may show knowledge of objects not in the immediate environment by speaking words such as "all gone" prior to success in locating objects hidden invisibly in an object permanence task. In a longitudinal study, these relations will be readily observed, if present. In a cross-sectional study, a pattern should emerge in which one behavior co-occurs only as a subset of the second behavior across subjects.

In the preceding examples of the acquisition of "move" and "allgone," the consistent observation of one behavior before the other indicates a relationship between language and cognition and also the direction of that relationship. Though a consistent relationship would support the first argument, the second argument can still be valid if both

behaviors are mediated by a common process but that one behavior is easier to produce and is observed earlier. Third factors, such as the linguistic environment of children may provide a new way to examine cognitive and language relations. Linguistic environment factors may alter the time span between achievement of behaviors in one area compared to the second area. For example, stage 5 object permanence may precede the appearance of object words in a child not living in a linguistic environment emphasizing object word acquisition. Both behaviors may be reversed or appear simultaneously in a linguistic environment stressing object word acquisition. Linguistic environment factors on child language development will be described in a later section.

Rodgon's (1977) exploratory study also attempted to equate language fluency by assessing children producing only one word utterances. However, children speaking one word utterances may understand multi-word utterances (Benedict, 1976), and the number of words in the children's receptive vocabularies were probably greater than the children's concurrent productive vocabularies (Benedict, 1979; Huttenlocher, 1974). These differences in receptive and productive language capabilities imply that assessments of the number of units of linguistic information that can be operated upon at one time, as well as the aggregate amount of linguistic information available to a child, is greater in receptive language skills and that these receptive language skills should be used with productive language skills to determine language

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The greater sensitivity of receptive language skills has two related empirical implications. First, critical stages of cognitive growth may be more primitive than previously believed, such as stage 4 or 5 in object permanence. Second, relationships between cognition and language should be stronger for comprehension rather than production.

Rodgon's finding of no overall pattern of relations between cognitive measures and language may be related to the use of exploratory cognition measures, especially symbolic play and deferred imitation which received few or no responses. Future examinations of language and cognition may be clarified by Rodgon's multi-measure approach, but based on a multi-faceted theory such as the four sensorimotor situational interactions using standardized measures (Uzgiris and Hunt, 1975).

Zachery (1978) examined decalage among different aspects of Piaget's sensorimotor stage 7 and language productions. Twenty-four infants between 12 and 24 months of age were administered five of the Uzgiris and Hunt (1975) scales: object permanence, space, imitation, causality, and means-end relations. Abilities measured by these scales occurred in that order of difficulty with a Guttman scale coefficient of .94.

Zachery's infants were compared on four general sentence categories based on semantic units produced per sentence. The four categories were: (a) two word utterances such as

naming or recurrence of objects, (b) utterances coding semantic relations such as agent-action and nominal-locative, (c) three term semantic relations such as agent-action-object and agent-action-locative, (d) four term semantic relations such as agent-action-dative-object and agent-action-object-locative. These 4 categories formed a perfect ordinal relationship of difficulty in the order presented.

Unfortunately, Zachery did not control for age factors when comparing sensorimotor and sentence production abilities. Sensorimotor abilities were reported as correlating .75 with age. In view of these limitations, Zachery's findings will be interpreted cautiously.

Zachery found 22 infants achieved stage 6 performance in object permanence; 16 infants produced one word utterances though not all were stage 6 performers. Ten infants produced two word utterances or sentences; these infants all achieved stage 6 performance on at least 3 different scales. Zachery's findings show a correspondence between sensorimotor activity and language development, a correspondence which is stronger at higher levels of sensorimotor activity (as indexed by the number of scales passed at a stage 6 level) and language production (such as sentences). High stage 6 performance did not mean advanced language skills. These findings support a hypothesis incorporating several aspects of sensorimotor intelligence to the development of advanced language.

Zachery's findings are in support of, but do not require,

but do not require a multi-faceted view of sensorimotor development (Piaget, 1954) as the basis for language acquisition (Ingram, 1978; Sinclair, 1973). Multi-faceted views of sensorimotor development have been developed by Bates (1976) and Snyder (1978) who describe Piaget's object knowledge as facilitating language intents of gaining attention from others. A second form of language intent, which maybe used with the first form, is language activity based on space knowledge. This second form is directed toward getting objects and actions by using people as agents to get desired objects or produce desired acts.

Bates (1976) conducted a longitudinally study of three children from 3 to 24 months of age. Bates observed that sensorimotor stage 5 goal oriented behaviors first appeared at the same time as communicative gestures of attention seeking and request making (for specific objects or actions). When sensorimotor stage 6 goal oriented behaviors first appeared, these communicative gestures were observed as being replaced by verbal utterances of the same intent. For example, a child repeatedly pointed to a kitchen sink to request water from her mother, a gesture which appeared when the child first used objects to extend reach. This use of objects for extension corresponds to a stage 5 understanding of "secondary supports" (Piaget, 1954).

Bates (1976) findings are intriguing but must be qualified, as standardized measures of sensorimotor activity were not used. Snyder (1978) addressed this problem by using all

of the Uzgiris and Hunt scales with measures of gestural and verbal language in controlled naming and request situations. Snyder assessed 15-month-old language-normal and 36-month-old language-delayed children; both groups had, on the average, the same number of words in their production vocabularies, and their MLUs were approximately one. Language-normal subjects produced significantly more linguistic imperative and linguistic declaratives ($\underline{M_s}$ = 5.0 and 3.4) compared to the language-delayed subjects ($\underline{M_s}$ = 1.4 and 1.06) across ten trials. The language-delayed subjects produced significantly more nonverbal and gestural "proto" imperatives and "proto" declaratives ($\underline{M_s}$ = 7.13 and 4.8) compared to language-normal subjects ($\underline{M_s}$ = 4.86 and 3.0) in the same ten trials. Generally, the language-delayed group expressed themselves nonverbally, and the language-normal group expressed the same intents verbally. Imperative and declarative use was not correlated with object permanence ($\underline{R_s}$ = .00 and .09). A Stepwise multiple regression using all Uzgiris and Hunt scale scores showed the means-end relation scale best predicted and differentiated the two groups on verbal and gestural use.

Snyder's findings indicate verbal responding relates to means-end relations development. All children in the study achieved stage 6 performance in object permanence, but only the language-normal children achieved stage 6 performance in means-end relations. The means-end relations scale specifically measures secondary support use within the general area

of space knowledge (Piaget, 1954). The relationship of means-end relations to verbal request making is consistent with observations made by Bates (1976).

Developmentally, Uzgiris (1973) and Zachery (1978) report findings similar to Snyder (1978), in the sense that object permanence develops before means-end relations. However, Uzgiris's (1973) distinction of early and late stage 6 in object permanence qualifies Snyder's findings since Snyder did not put into her regression analysis a fully differentiated object permanence measure, effectively restricting its range. Whether this restriction of range was sufficient to reduce the relationship of object permanence to the criterion variable in the multiple regression solution, and hence its final order in that solution, is not known.

Whether early speech is related to means-end relations or object permanence is not known since studies using differentiated object permanence scales that show relations to early speech (Corrigan, 1978; McCune-Nicholich, 1981; Ramsay, Campos, & Fenson, 1978) did not also assess means-end relations. These studies indicate that acquisition of certain speech forms and vocabulary are related to object permanence development.

Ramsay et al examined longitudinally early and late stage 6 object permanence and object word development in 24 infants from 10 to 21 months of age. Entry into early stage 6 preceded acquisition of the first object word by approximately one month ($\bar{X} = 10.9$ versus 12.4 months, $p < .006$).

Entry into late stage 6 preceded a rapid acquisition of object words ($\underline{M}_s = 17.1$ versus 17.9 months) for most subjects ($\underline{n}_s = 17$ versus 7, $p < .05$).

Ramsay et al's findings show strong links between object permanence development and object word activity, though the very few infants with accelerated object word acquisition rates before late stage 6 argue against an object permanence position. These atypical infants may be the result of measurement inaccuracies or due to the emergence of a second form of cognition, such as means-end relations.

Corrigan (1978) conducted a longitudinal study of productive language and object permanence development in 3 children from 10 to 22 months of age. The children increased their "language scores" after entry into early stage 6. The "language scores" were a combination of MLU and any other verbal output produced by the children. Words representing nonexistence (e.g. "allgone") were spoken after entry into late stage 6 in all children. Two of the three children spoke words representing recurrence (e.g. "more") after achievement of late stage 6. One child used the word "more" prior to late stage 6, but this use was limited to objects present to the child (e.g. "more raisin", "more top" meaning spin the top). This third child's use of the word "more" changed after entry into late stage 6, when "more" was used to request objects and actions not present to the child, a use of "more" comparable to the other two children.

McCune-Nicolich (1981) examined in a longitudinal study

object permanence and productive language development in 5 girls from 14 to 24 months of age. Most of the girls (4 of 5) produced words coding nonexistence while they were in early stage 6, and 2 of the 5 girls produced words coding recurrence while in early stage 6.

The studies of object permanence and language development agree that achievement of object permanence stage 6 is related to increases in language production. Early stage 6 was linked to acquisition of object words, increased verbal activity, and words coding nonexistence and recurrence. While Corrigan reports acquisition of these latter two word classes in late stage 6 in contrast to McCune-Nicholich's report of acquisition during early stage 6, the difficult and abstract nature of these two word classes and acquisition by some but not all of McCune-Nicholich's subjects during early stage 6, indicate individual differences on the production of these words. Both studies find these abstract words produced in stage 6, and not an earlier stage.

Throughout this paper, language development has been related to one or more aspects of sensorimotor development. Since studies using differentiated object permanence measures did not also measure other aspects of sensorimotor development, such as means-end relations development, verbal responsiveness may be related to either sensorimotor activity. For example, Corrigan's observation of increased verbal activity with early stage 6 object permanence development contrasts with Bates's and Snyder's observations of increased

verbal responsiveness and request making with stage 6 means-end relations development.

Though cognitive relations to language have been emphasized, another factor, environmental influences, may affect language and cognition. Environmental influences may explain some differences found by Corrigan, McCune-Nicholich, Ramsay et al, and Zachery. Corrigan had 1 of 3 subjects produce the word "more" prior to late stage 6, though use of that word changes when the child entered late stage 6. McCune-Nicholich found some children acquired words representing nonexistence and recurrence in early stage 6. Ramsay et al found some children acquiring object words before entry into early stage 6, as well as other children experiencing rapid word acquisition before entry into late stage 6. Zachery found complex sentence producers achieved stage 6 performance on at least 3 sensorimotor measures, though not all who achieved stage 6 performance on at least 3 measures produced complex sentences. To speculate on these differences, variations may exist in the children's language environments. Ramsay et al's subjects may have had many objects to label in their environments or had parents who encouraged acquisition of object labels. Parent encouragement may be planned or structured using daily sessions emphasizing object labeling, or parent encouragement may be without awareness, such as a sharp decrease in imperative use around their children. Different language environments may provide different forms of language acquisition opportunities in terms

of frequency and clarity of speech that interact with the child's cognitive sophistication and communicative intent. Possible environmental effects will be described in the next section.

Environmental effects on Cognition and Language

Gross enviromental characteristics, such as the number of hours per week of caregiver-infant contact or the number and type of toys available to young infants, have been related to early cognitive development (Bayley and Schaefer, 1964; Bradley and Caldwell, 1976, 1980; McCall, Appelbaum, & Gogarty, 1973; Paraskevopoulos and Hunt, 1971). Since the effect of environmental factors on early cognitive development has been well documented, this section will emphasize environmental influences on early language development.

Furrow, Nelson and Benedict (1979) compared infant and maternal language characteristics when the infants were 18 and 27 months of age. At 18 months of age, the infants were roughly equivalent in verbal language skill, belonging within Brown's (1973) stage one categorization with a MLU of approximately one. Several mother-speech behaviors when the infants were 18 months of age were significantly related to subsequent infant speech behaviors at 27 months of age. Higher frequencies of yes/no questions, interjections and noun-to-pronoun ratios in mother-speech to 18-month-old infants positively related to 22-month-old infant speech characteristics such as MLU, verbs per utterance, noun phrases per utterance, and auxiliaries per verb phrase. On the

other hand, higher frequencies of words, verbs, and pronouns by mothers to their 18-month-olds negatively related to 27-month-old infant language, such as MLU, verbs per utterance, and noun phrases per utterance.

The correlations found by Furrow et al between mother-speech to infants at 18 months and later infant speech at 27 months did not explain the correlations between concurrent mother and infant speech when the infants were 27 months old. When the infants were 27 months old, mother's use of imperatives and verbs positively related to child MLU, verbs per utterance, and noun phrases per utterance, while mother interjection use negatively related to the same child language variables. The number of significant correlations between mother-speech when the infants were 18 months old to infant speech at 27 months (20 out of 60 reported), was greater than the number of significant correlations of mother-speech to 27-month-olds to 27-month-old speech (11 out of 70 reported).

Furrow et al's results suggest two classes of mother-infant speech relations. First, some mother-speech to infants facilitates or hinders later infant speech acquisition. Second, some mother-speech relates to current infant speech. However, Furrow et al contend that most mother to infant speech has long term effects. Though mother-speech is modified for current infant comprehension producing current statistical relationships, these modifications reduce speech complexity, and reduced complexity is hypothesized as

facilitating long term language growth. Thus, mother fragment and "deleted frontal auxiliary yes/no question" use at 18 months have simple sentence structures correlating positively to infant MLU at 27 months ($r_s = .57$ and $.77$). These simplified speech productions still contain complex language elements. For example, verbs were defined as complex elements, since verbs have no specific referent. Furrow et al found mother verb use at 18 months negatively correlated with infant MLU at 27 months ($r = -.71$).

Newport, Gleitman, and Gleitman (1977) contend most mother-to-infant speech is for current communicative needs and has little long term effect. Newport et al examined mother-speech to their children in three age groups (12 to 15 months, $\underline{n} = 3$; 18 to 21 months, $\underline{n} = 6$; 24 to 27 months, $\underline{n} = 6$), and related this speech to infant speech 6 months later. Partial correlations, removing variability of infant speech and age during the first assessment, showed few significant relations. Mother use of yes/no questions positively related to "auxiliaries per verb phrase" ($r = .88$, $p < .001$) and marginally to MLU ($r = .50$, $p < .1$). Repetition negatively related to child "auxiliaries per verb phrase" ($r = -.50$, $p < .1$). Only 4 out of 50 relations were significant (10 out of 50 at $p < .1$). Newport et al conclude mother-speech to infants shows relations for acquisition of a few language forms, such as infant auxiliary use which was related to mother "yes/no question" use which emphasizes frontal auxiliaries. Newport et al suggest long term language

acquisition is due to increased language processing by infants. Such processing may be due to cognitive development or maturational factors.

To speculate on Furrow et al's and Newport et al's findings, the pattern of relations may reflect the child's language competence and mother language facilitation effects. However, the 18 month old is largely non-verbal, yet all child language measures were verbal. Newport et al used partial correlations to correct for age and language differences in their sample. Furrow et al used simple correlations since their children were about equal in verbal language (MLUs about one). This emphasis on verbal language may mask underlying differences in receptive language. Furrow et al note that while their children were approximately equal in verbal skill, the 18 month olds differed in receptive language skills. These receptive language differences have been described by Benedict (1976; 1979) and include vocabulary size (ranging from approximately 50 to 150 words), and the number of words understood in an utterance (ranging from approximately 2 to 4 words). Unfortunately, receptive vocabulary size and the number of words comprehended at one time were not compared to any of the mother or child speech variables reported in the Furrow et al paper. Bohannon and Marquis (1978) report adults will increase their MLU to a 32 month old who appeared to understand their speech, and correspondingly decrease their MLU when the 32 month old appeared not to understand their speech. Receptive language differences

in Furrow et al's 18 month olds may have been related to their 27 month old speech. Mother speech to 18 month olds may then relate to 18 month old comprehension and not to their speech at 27 months.

Relationships between infant language competence and mother language behaviors may appear in several areas. First, mother word categories may influence acquisition of certain words and word categories in speech and comprehension, such as causality concepts in speech (Hood & Bloom, 1979) and auxiliary use in speech (Newport et al, 1977). Second, mother may differ in particular objects, actions or people they wish their children to know (Nelson, 1973). Third, mothers may play interactive games with their children which may differ in frequency and content (Lieven, 1978; Ninio & Bruner, 1978; Ratner & Bruner, 1978). Interactive games give infants exposure to conversational skills, such as initiating speech or asking questions. These games are also structured opportunities for the mothers to teach specific words and actions. Mothers may differ in the above three areas which may relate to infant language skills.

Mother speech to their children does not occur in isolation. Often there is a purpose or direction to the immediate conversation that provides a structure or topic that the mother or child uses as a reference point for speech.

The purpose of a situation can affect mother-child speech in that situation. Children can be placed or asked to engage in a "free play" with a variety of toys, with or

without mother participation (e.g. Benedict, 1976; Corrigan, 1978). Golinkoff and Ames (1979) compared mother-child speech in "free play" and "structured" play situations, and found mothers used more questions and less imperatives in the free play situation and the opposite pattern in the structured situation. Benedict and Truhon (note 1) compared mother-infant speech in free play, book reading, and structured play situations, and found mother speech in structured play compared to the other two situations as having: (a) the greatest number of utterances, (b) the highest ratio of imperative/ interrogative use, and (c) the lowest noun/pro-noun ratio. Mother speech in structured play contained speech associated with intents to change activity or non-activity of the infant-listener, especially mother use of imperatives and questions.

Benedict and Truhon also found infant utterances were lowest in structured play compared to book reading and free play, though MLU did not differ across situations. Frequency of speech and not its complexity appears to change across situations.

The contrasts between free and structured play indicate the importance of specifying the purpose of the interaction in which language samples are taken. Language acquisition of children, if dependent upon mother speech patterns, must also be dependent upon the situation that alter mother speech. Klein (1980) examined language samples of mother-child speech and father-child speech for the relatively long

time period of 6 hours within the infants' homes. The occurrence of "free play" of mothers or fathers to the infants was relatively rare, and when occurring, lasted for short periods of a few minutes. Mother-child speech patterns from free play situations may not be representative of the speech in typical mother-child interactions.

Summary

Four issues were discussed. First, receptive language skills were distinguished from productive language skills, and it was argued that measures of receptive language skills are more sensitive to the young child's (10 to 25 months of age) language competence. A second issue viewed arguments that sensorimotor development is multi-faceted in nature, with different parts relating to different forms of language activity. Third, object permanence may be divided into two periods of development during the sixth stage, the latter of which may relate to complex language activity. Fourth, the impact of environmental factors on language development was described. It was argued that the relationship among cognition and language may be aided by examining the language environment.

Statement of Purpose

Receptive and productive child language are compared to cognitive development, as measured by object permanence and means-end relations, and to language environment, as measured by mothers' speech to their children.

Since highly differentiated object permanence scales

have been developed (Corrigan, 1978), a pilot study was undertaken to develop new stage 6 behaviors for the means-end relations scale of Uzgiris and Hunt (1975). Adding new behaviors to the means-end relations scale may add sensitivity to the scale, especially since only 2 behaviors relevant for stage 6 activity are found in the current scale. In contrast, Corrigan's object permanence scaling has 10 separate behaviors for stage 6 activity.

Mothers' speech to their children was examined as a possible environmental factor on child language. The purpose of the interactions between mother and child was assessed in a series of videotaped interactions. A wide range of mother-child interactions typical during the first 2 years of life, such as feedings, diaper changes, and exploratory play with different toys and objects were filmed.

Hypotheses

1. Child MLU will not differ across situations, though frequency of speech may differ across situations, as reported by Benedict and Truhon (note 1).

2. Object permanence will relate to production of words representing nonexistence and recurrence in videotape situations and vocabularies (receptive and productive). Since object permanence is theoretically linked to object representation, object permanence will also positively relate to production and understanding of words relating to objects, such as nouns, proper nouns, and locations.

3. Means-end relations should relate to the number of

utterances produced in videotaped situations. Since means-end relations is theoretically linked to both representations and verbal requests of goal attainment, these links should also produce higher correlations to utterances made in toy and food situations, where specific goals and actions are present.

4. Child speech development will relate to mother-speech activity and the child's cognitive development.

Mother-speech is hypothesized as a major source of language which is being acquired by the children; cognitive development as described in hypotheses 3 and 4, is hypothesized as being linked to early language representations. Three mother-speech variables are compared, all having theoretical and empirical (Furrow et al, 1979) relations to child speech. Furrow et al report yes/no question use (both deleted frontal auxiliary questions, and fully formed questions) will positively relate to child MLU and auxiliary verb use.

Mother imperative use has been predicted by Furrow et al as being positively related to child MLU development; imperatives are more frequently spoken to children compared to adults, and this increased frequency marks for Furrow et al the importance of imperatives to "here and now" language processing of infants, which relates to later speech acquisition. Newport et al (1977) report mother imperative use is negatively related to child MLU and auxiliary/verb phrase acquisition; mother yes/no question use is hypothesized as relating to child auxiliary/verb phrase acquisition. Furrow

et al do report mother imperative use at 18 months is negatively related to child auxiliary verb use at 27 months. Yes/no question use should positively relate to child speech; imperative use should negatively relate to child auxiliary verb use; cognitive development should positively relate and increase the magnitude of the mother to child speech relationship.

PILOT STUDY

Introduction

The pilot study examined (a) potential new behaviors representative of sensorimotor stage 6 development for the concept of space (Piaget, 1954, 1967), as assessed in Uzgiris and Hunt's (1975) means-end relations scale, (b) possible alternative scoring for Corrigan's (1978) object permanence scaling, using errors as done by Jackson, Campos and Fischer (1978), (c) selection of type and sequence order of toys to be used in future videotapings of mother-child language interaction, (d) procedures for interview techniques, language diary administration, comprehension assessment, and Caldwell home inventory scale assessment.

Methods

Subjects Subjects were 17 infants, 9 to 24 months of age, from two-parent families. Parents were from middle class occupations or at least one parent had attended college for two or more years. Five infants were dropped from the study due to infant uncooperability ($\underline{n} = 2$), and inability to complete all of the cognitive measures ($\underline{n} = 3$). The remaining 12 infants ranged from 13 to 24 months of age, 6

males and 6 females.

Procedures Infants were visited in their homes twice in sessions lasting one to two hours, with sessions separated by approximately one week. Two infants were seen three times.

In session one, the object permanence measure, followed by the means-end relations measure, were administered. Frequent breaks were made, during which questions concerning the Caldwell home inventory, and toy preferences of the children, were asked. A set of toys were given to the children during a 10- to 15- minute break, approximately one hour into the first session to observe interest and play with the toys. The toys were: (a) mechanical car, (b) mechanical top, (c) boy doll, (d) girl doll, (e) foam rubber ball, (f) yellow 8" wood dowel, (g) multi-color wood block, (h) blue plastic 2" square box. At the end of session one, parents were given a sample language diary and a checklist, and parents were asked to make entries into each noting difficulties encountered.

Session two continued administration of the object permanence and means-end relations measures beginning from the child's highest score in the first session. Frequent breaks were again given, with breaks used to ask questions about the diaries, checklists, and Caldwell home inventory. During one break near the end of session two, the mother gave three commands to her child, and the child's responses were noted. The commands were: (a) Get the _____, (b)

Put the _____ on the _____, (c) Where's the _____.

Words known to the children, as marked on their checklist, were inserted into the blank spaces in the above commands. Procedures for giving the commands and scoring were developed by Benedict (1976) and are summarized in Appendix A.

Measures

1. Object permanence. The object permanence scale is a variation of the standardized Uzgiris and Hunt (1975) scale developed by Corrigan (1978). Corrigan's scaling adds several new "intermediate" hiding situations imbedded within hiding situations outlined by Uzgiris and Hunt. For example, the Uzgiris and Hunt scale uses one and three covers in both visible (object held in hand) and invisible (object held in container held in hand) displacements. Corrigan adds an intermediate step of two covers. Corrigan's scale also records direction of successful solution of object displacements. The present scale also records unsuccessful solutions similar to those reported by Jackson et al (1978). For example, an infant may search at locations A and B, but discontinue search before reaching target location, C. The object permanence measure is listed in Appendix B.

2. Means-end relations. The means-end relations scale is not as clearly divisible into new steps as the object permanence measure. While the object permanence measure is similar at all levels, the means-end relations measure uses different reaching behaviors, such as pulling pillow, grabbing string, and holding sticks at different scale steps. Also,

the final two steps in the scale do not require reaching, but instead require some ingenuity and an inhibition of overt grabbing responses for solution. The first of these last two steps involves showing the infant a long wooden bead necklace inside a tall and narrow vase. The infant is given the necklace and vase separately, and attempts to place the necklace into the vase are noted. The vase is sized so that the infant must hold it with one hand and use the other to insert the necklace. The critical behavior for success in this task is the wadding up of the necklace to ease placement. The second of the final two steps involves not placing a filled plastic ring onto a short stick, after being given several unfilled rings which go easily over the stick. The addition of new behaviors in the means-end relations scale will focus on steps that are intermediate to the necklace and vase situation and the filled/unfilled ring situation. The last two steps in the scale appear to require some capacity for representation of unseen goals, a capacity similar to Piaget's (1954, 1967) descriptions of sensorimotor stage 6 activity.

Six new situations were presented to the infants requiring a capacity for the representation of unseen goals, in the sense that overt grasping responses would not aid in success in the task. The six situations are:

1. The use of a 15" x 10" x 30" "cage" with three solid sides and a "front" with wooden $\frac{1}{4}$ " dowels spaced 6 cm apart. The cage is painted bright

blue, and a bright red wooden dowel 8" x $\frac{1}{4}$ " is placed inside it. Infants were observed reaching and attempting to get the dowel. Success required grasping the dowel at one end and pulling the dowel out of the cage at a perpendicular angle to the cage's "bars".

2. The pink and blue puzzle boards from the Bayley Scales of Infant Development (Bayley, 1969) were used. Item numbers 137 and 151, completion and completion after reversal, were recorded. Item number 155, completion of the blue board in 150 seconds, was recorded.

3. A 4" x 10" x 3" plastic box with six different sized holes in the top was used. The infant is given three sticks of different diameters and the number of sticks placed into the box is recorded. Each stick was sized to fit into a different number of holes. One stick fit all holes, a second stick fit three holes, and the third stick fit one hole.

4. The child is required to choose a stick with a curved hook-like end from a variety of sticks of equal length, in order to reach a distant object.

5. The child is required to choose the longer of three sticks to reach a distant object.

6. The child, seated in a high chair, uses the

stick with the curved hook-like end from situation 4 to reach a target object with a "ring" that can be snagged by the hook. The child must ignore two other objects without "rings". Target and non-target objects were on a box approximately 2 feet below the child.

3. Language diary. The language diary records the date, situation, people present and the words understood or spoken by the child. Procedures and word lists of the language diary are presented elsewhere (see Benedict, 1976).

4. Language checklist. The language checklist permits parents to mark words their children know or speak from a list of frequently acquired words of children under 2 years of age. The checklist requires understanding or speaking a particular word in more than two situations before marked as known by the child. Procedures and words used in the checklist are presented elsewhere (see Benedict, 1976).

5. Caldwell home inventory. The Caldwell home inventory is a short standardized scale characterizing the infant home environment. The Caldwell scale examines mother interactions with her child and opportunities for the infants to explore and play.

Subject recruitment and confidentiality

Subjects were recruited by mail, their names obtained from public record birth announcements from a local paper from the greater Lansing area. The letters informed potential subjects of the study assessing cognitive and language

development in 1 and 2 year olds. A follow-up phone call was made approximately 7 days after the letters were sent. Subjects were then asked for their participation in the study, and if interest was indicated a home visit was scheduled. Subjects were asked for their participation after discussion of the study's time requirements and purpose (observing how children play with toys and objects, and how they can do simple problem solving tasks). All participants were informed they could leave the study at any time, even though participation was granted by them.

Participant confidentiality was protected by giving each subject an identification number. In all data analyses, these identification numbers were used. Access to the numbers was limited to the experimenter.

Results

The object permanence scoring is listed in table 1. Ten subjects produced behaviors scaled from the Uzgiris and Hunt measure. One subject's highest response was scored from the Corrigan measure, and one subject's highest response was scored from the Jackson et al procedure. The object permanence scale correlated .75 ($p < .05$) with age.

The means-end relations scoring is listed in table 2. Two children used the curve-hooked stick horizontally (situation 6), one child used the same curve-hooked stick vertically (situation 4), and one child chose the longest stick for reaching (situation 5). The new means-end relations responses inconsistently related to the Uzgiris and Hunt scale

Table 1

Object permanence performance

<u>Age^a</u>	<u>Sex</u>	<u>Scale Number</u>	<u>Hiding or Displacement</u>	<u>Method</u>	<u>Search Locations</u>	<u>Search Directions</u>	<u>Success</u>
23.00	male	27	displacement	invisible	3	single	yes
22.50	male	27	displacement	invisible	3	single	yes
22.25	male	28	displacement	invisible	3	both	yes
18.50	male	25	displacement	invisible	2	both	yes
17.00	male	27	displacement	invisible	3	single	yes
13.25	male	11	displacement	visible	3	single	no
24.00	female	27	displacement	invisible	3	single	yes
23.50	female	30	displacement	invisible	3	both	yes
22.50	female	30	displacement	invisible	3	both	yes
20.75	female	31	displacement	invisible	3	both	yes
18.00	female	29	displacement	invisible	3	single	yes
14.75	female	21	hiding	invisible	3	both	yes

^aAge shown in months.

Table 2

Means-end relations performance

<u>Age^a</u>	<u>Sex</u>	<u>Scale Number</u>	<u>Description of Behavior</u>
23.00	male	6	pulling vertical string to get toy
22.50	male	5	pulling horizontal string to get toy
22.25	male	8	necklace and vase
18.50	male	7	extending reach using string
17.00	male	8	necklace and vase
13.25	male	3	pulling pillow to get toy on pillow
24.00	female	5	pulling horizontal string to get toy
23.50	female	9	filled/unfilled rings
22.50	female	6	pulling vertical string to get toy
20.75	female	7	extending reach using stick
18.00	female	8	necklace and vase
14.75	female	7	extending reach using stick

^aAge shown in months.

steps of the necklace and rings. One child used the hooked stick horizontally (situation 6) but did not use the wooden necklace beads to facilitate vase placement. Another child did not use the necklace but could choose the longest stick for reaching (situation 5).

Successes for situation 1, 2 and 3 appeared more consistently and frequently (responses = 3, 5, 4) compared to situations 4, 5, and 6 (responses = 1, 1, 2). However, two children who completed the red board (situation 2) did not solve the necklace situation. Also, one of the two children completing the blue board (situation 2) did not succeed in the necklace problem. The standardized means-end relations scale (Uzgiris & Hunt, 1975) did not correlate with age ($r = .19$, $p < .10$) and did correlate with object permanence ($r = .65$, $p < .05$).

Toy preference was noted during a 5 minute free-play period during the first home visit. Preferences were recorded by marking which toy was being handled out of a set of toys given to the infant. Play frequencies are listed in table 3. More than one toy could be counted during each 10 second observation period. For example, simultaneous play with boy and girl dolls occurred frequently, as did play with stick and ball. Extended play occurred frequently for "movable" toys, the two "mechanical" toys, and the dolls with movable appendages and clothing, while less "movable" toys were ignored, with the exception of the foam rubber ball.

Table 3

Toy preferences during a five minute free play

<u>Toy</u>	<u>Frequency</u> ^a
Car	117
Top	70
Male doll	55
Female doll	48
Ball	45
Stick	21
Block	18
Plastic box	8
No toy play	63

^aObservations were recorded once every 10 seconds during the free play; more than 1 toy could be counted during each observation. All toys were presented as a group to each infant.

Discussion

Though object permanence behaviors observed here were consistent with the Uzgiris and Hunt (1975) measure, the intermediate steps described by Corrigan (1978) and Jackson et al (1978) were also observed, although not as frequently. A combined approach, using Corrigan's and Jackson et al's procedures with the Uzgiris and Hunt scaling appears appropriate for future use.

Several inconsistencies were found for the new means-end relations behaviors, especially situations 4, 5, 6 and situation 2's blue board. Situations 1, 3, and situation 2's red board have some consistency to the standardized Uzgiris and Hunt scale steps, and their tentative use seems appropriate.

Toy preference appears related to toy complexity, in as much as some toys contained movable parts. Movable toys, such as the toy car and top, elicited the most attention and play from infants. Social toys, such as male and female dolls, also elicited a great amount of attention. Non-movable toys were largely ignored. Infant agitation, crying and distress were more frequent at play session termination when the infants were playing with movable and social toys. Movable toys seemed to produce the most distress at play termination.

STUDY II

Introduction

This study examined infant language, both receptive and productive, as a function of: (a) object permanence, (b) means-end relations, (c) mother to infant speech across feeding, diapering and play situations, (d) infant environment as measured by the Caldwell home inventory. Modified versions of the object permanence and means-end relations scales of Uzgiris and Hunt (1975) as described in the pilot study were used. Language measures used parent checklists and diaries described in the pilot study. Infant speech was recorded on audio and video tapes. This redundancy of infant language measures helped to accurately characterize infant language competence.

Methods

Subjects Subjects were 30 first born white middle class children (15 male, 15 female) and their parents. Three age groups (14, 18, & 22 months, $n = 10$) were cross-sectionally examined. Only families with mothers working fewer than 30 hours a week were recruited because of the time requirements needed to maintain the language diaries. Middle class status was defined by Hollingshead's (1971) classifications 2, 3, and 4, though college families were also recruited (minimum of 2 years of college for at least 1 of the parents).

White middle class infants were recruited to limit possible social class effects from confounding results, and to enhance this study's comparability to other studies which have emphasized white middle class subjects.

After the start of data collection, 4 infants not included in the 30 infants mentioned, were dropped from the study. One mother asked to be dropped from the study, 2 families were dropped because of illness, the father in 1 case and child in the other. One family was dropped when it was revealed that the father's 2 years of college experience was for a G.E.D., since the father did not finish high school. This last family also did not belong to Hollingshead classifications 2, 3, or 4.

Subject recruitment and confidentiality The procedures for subject recruitment and confidentiality followed those described in the pilot study, except for the subject's first names which were not coded. First names were frequently mentioned by mothers in the tapes. Last names were removed from the transcripts, since these were much less frequent. Subjects were often referred to by their first names as well as by their code number. Parents were informed of this procedure before consenting to participate.

Procedures Each measure was administered in the infants' homes, in 5 sessions lasting approximately 50 to 90 minutes apiece. Four families were visited 6 times, and one family was seen 7 times. Home visits were scheduled at the parents' convenience, during hours infants were likely alert

and awake. The home is an infant's most familiar environment, likely increasing exploratory activities to the study's tasks, toys and situations, and decreasing non-study explorations found in unfamiliar environments such as a classroom. Home visits also facilitated observing specific infant language behaviors, such saying "chair" to one particular chair in the child's home. Two observers were present on most home visits. Observer 1 administered the cognitive, language, and environmental measures. Observer 2 recorded the data.

Language diaries were maintained for at least 3 weeks, beginning with the first visit. There were 2 diaries, 1 for comprehension and 1 for production. The parents were also given a checklist for their children's receptive and productive language on the first visit. Parents were instructed to mark the checklist within 3 days, and to add any new language activity to the diaries.

General procedures for sessions The first session involved introducing the mother to her role in the study, a role consisting of keeping a diary and checklist of her child's language during her study participation. Length of participation was determined by the scheduling of the home visits, though all diaries were maintained for at least 3 weeks. Mothers also uttered short commands to their children to assess receptive language, and were also filmed in videotaped sessions. Each mother was interviewed for the Caldwell home inventory, and was present during presentation

of the object permanence and means-end relations measures. The relatively large role that the mothers played in this study was intended to optimize language and cognitive performance by her child.

After the mother agreed to participate, she was shown the diary and checklist procedures. Four future sessions were scheduled at the end of the first session, though most mothers scheduled only the second session.

The second session examined performance on the object permanence and means-end relations scales. The mother's diary and word checklists were also reviewed, and mothers described circumstances under which their children had understood or had spoken words. Special care was taken to ask about words relating to locations, object features, possessives, non existence, and recurrence. Words recorded ambiguously, or in situations containing non-verbal cues (gestures), were dropped from the diary and future inclusion in the child's vocabulary.

Language comprehension was examined in the third and fourth sessions. Mothers read 21 stock sentences, containing 3 to 5 words apiece, to their children. The sentences contrast knowledge of possessives, locations, and relations between objects as developed by Benedict (1976). Words taken from the children's diaries were used in the sentences. Each sentence was repeated up to 5 times. (see Appendix B for list of sentences, scoring and procedures).

Toward the end of session 4, object permanence and

means-end relations measures were administered a second time. Each child started at the highest step solved in each measure in the first administration, and continued until 3 successive failures at a lower, same or higher level were reached.

The fifth visit involved videotaping of mother-infant interactions with toys. Videotapings of diaperings and feedings were made during the third, fourth, and fifth visits, depending on the spontaneous needs of the children. Audio recordings of the children were made during the last 3 home visits in free play situations. The free play situations lasted approximately 10 minutes, and provided estimates of child speech from a longer time period than the videotapes. Mothers were usually interviewed with the Caldwell home inventory questions during these free play sessions. Mothers also used this time as a break from data collection for coffee or refreshments.

Measures Many measures of the present study were used or reviewed in the pilot study. Measures of the present study are:

1. Object permanence
2. Means-end relations
3. Parent checklists and diaries for both
comprehension and production
4. Caldwell home inventory
5. Language comprehension procedures (see Appendix B)
6. Videotaping of 6 toy exploration situations,

a diapering and a feeding of a snack

7. Audiotaping of free play situations

Videotaping procedures All videotaping was filmed in the infant's home, in rooms appropriate for each situation and which were comfortable for the mother and infant. There were 8 situations in the study, divided into 5 groups (3 types of toys, diapering and feeding). Each situation was filmed for at least 90 seconds. The duration of a situation depended on both participants, though mothers primarily stopped the taping; general reasons for stopping were: (a) mother lost interest in showing a toy, (b) mothers perceived their infants as having lost interest in the interaction, (c) the interaction was completed. Maximum time for any interaction was set at 180 seconds.

Six situations filmed infant play with objects and mothers showing their infants the objects. The objects and their presentation order were determined by the pilot study results. Because of time restrictions, each toy was taken from the child shortly after 180 seconds, and replaced with the next toy. This was usually no problem when the child was no longer interested in the toy, though some infants regained interest when replacement time arrived. The toys were therefore ranked in terms of interest by the pilot study results, and the presentation order was reversed, so that the least interesting toy was presented first, and each successive toy became more interesting. It was believed this procedure reduced disruption in this study from crying,

protesting infants.

The remaining situations, diapering and feeding, were filmed when feedings or diaperings naturally occurred. Due to the private nature of diapering and feeding, mothers were informed that these situations were optional.

The videotape equipment was set up in the living rooms (or room where administration of the measures occurred) for sessions 1,3,4, and 5 to reduce infant fear or curiosity during the actual taping. The videotape equipment was portable which permitted the videotaping of spontaneous feedings or diaperings in room(s) appropriate to that activity.

Mothers were informed of the videotapings during the first home visit, and they were told any taping (audio or video) could be stopped at any time, even in the middle of taping. All taping was discontinued when mothers received phone calls or visits. Each situation is described below.

1. The diapering videotaping was spontaneous. When the infant informed his/her mother of a diapering need, and that need confirmed, the mother then informed the experimenters. The experimenters then carried the videotape equipment to the diapering room. Videotaping began when the child was first placed on the diapering surface.

2. The feeding was more of a snack than a meal, consisting of milk (or juice or water) and cookies (or fruit or crackers or a sandwich), depending on the preferences of the mother and child. The feeding was taped in a location used for snacking, and in the usual manner for each child,

such as sitting in a highchair or adult chair, or standing up and free to run around. Videotaping began when mothers started to prepare or reached for food. Any child assistance in food preparation was recorded. Some children were asked to select their snack as a normal part of their snacking routine. These questions about food preferences were videotaped.

3. Toy videotapings were filmed in the fifth visit. Six toys were filmed. Each toy defined a new "situation", which could be used as a new conversational "focus" by the mothers or children. There were 2 object toys, 2 social toys, and 2 action toys. Short breaks were taken after each toy, with a longer break (2 to 5 minutes) occurring after the third toy. Videotaping began when mothers unwrapped a toy in front of their children from a small cloth blanket. Toy situations were taped in a room frequently used by a child for play. Before taping, the child's toys were removed from the room, usually before the start of the session to prevent interference with the study's toys. Video equipment was set up approximately 8 feet from the interaction, and the camera followed the child moving about the room. Mothers determined seating arrangements with her child (face to face, both facing toy, infant on lap, etc.). The following toys were videotaped in the order presented:

1. multi-colored stick
2. foam rubber ball
3. female doll

4. male doll
5. push-pull top
6. spring powered friction car

The diapering and feeding situations were spontaneous and no special instructions were needed prior to taping. Since the toy situations were structured, mothers were given the following instructions,

I want you to sit with your child in a way that's comfortable for both of you. Remember, I will be handing you toys and objects to show to (child's name), so please sit in a way that's also comfortable for you to show the toys and objects.

Once seated comfortably, mothers were also given the following instructions,

I am going to hand you several objects, one at a time. I would like you to show (child's name) something about each object. You may show your child as many or as few things about each object as you would like or as much as you think your child would like to know about each object. Please hand me each object after you're finished showing it. You can stop showing the object any time you think your child is no longer interested in the object. You can also stop any time you are no longer interested in describing the object, though I would like you to try to describe the object for at least one minute. Do you have any questions?

If no questions were asked, videotaping was started.

Data reduction and coding Data reduction and coding was made for mother and child speech in videotaped situations, and child speech in the audiotaped free play situations. All mother speech was categorized twice, once for lexical speech and once for syntactical speech, as done by Furrow et al (1979) These categories are described below.

Lexical categories

1. words: get, ball, Sandy, on.
2. sentences: Get the ball. Put it in here.
3. nominals
 - nouns: Jeffrey, ball, orange, table.
 - personal pronouns: you, I, me, they.
 - objective pronouns: this, that, one, there.
4. verbs
 - main verbs: eat, get, pull, put, go.
 - auxiliaries: should, shall, can, will, would.
 - copulas: be, is, seems, appears.
5. modifiers
 - noun modifiers: big, little, broken.
 - verb modifiers: (bring) up, almost, (come) here.
6. tense: This category codes future and past tense.
7. plurals: Both plural nouns and pronouns are coded.
8. genitives: my, daddy's, your, mine, his.
9. negatives: no, not, (do)n't, (ca)n't.
10. contractions: Categories code contractions in
 - copulas, auxiliaries, and negatives.
11. prepositions: All prepositions were coded, including prepositions without objects.
12. noun/verb ratio: Main verbs were used in this ratio.
13. MLU: Mean length of utterance was coded as described by Brown (1973).

Syntactical categories

1. declarative sentences: That is a ball. It's raining.

2. imperative sentences: You get the ball. John look at this.

3. questions

yes/no inversions: Can you do that? Do you like it?

Wh- questions: Where's the ball? What are you doing?

tag questions: You can see it, can't you? It's

pretty, isn't it?

yes/no other questions: You wanna get down? See the car?

4. interjections and fragments: and, well, the blue car.

Since different videotaped interactions contrast social and object oriented activities (dolls versus cars), the pronoun category in lexical coding was divided into personal and objective pronouns.

Fragments, coded within the syntactic categories, uttered with a rising intonation pattern (e.g. "No doll?") were counted as "yes/no other" type questions. Essentially complete sentences produced with a conjunction to start the utterance were counted as complete sentences (e.g. And there is the new dolly).

Data reduction and coding for child speech (videotaped and free play situations) were categorized for MLU, verbs/utterance, nouns/utterance, auxiliaries/verb phrase (Furrow et al., 1979; Newport et al., 1977), words coding non existence and recurrence (Corrigan, 1978), and verbal request making.

Child language recorded in diaries and checklists were

categorized into 15 word classes for both receptive and productive language (Benedict, 1976; Zachery, 1978). These word classes and some examples are presented below.

Vocabulary word classes

1. verbs: get, bring, do, where.
2. features: big, little, broken.
3. articles: a, the.
4. colors: blue, pink, yellow.
5. recurrence: more, again.
6. possessives: mine, yours, daddy's.
7. locatives: up, in, on. Locatives were coded in
reference to self and to other objects.
8. negatives: no, not, (do)n't.
9. positives: yes, OK.
10. non existence: allgone, all done.
11. amounts: some, all.
12. numbers: one, two, three.
13. nouns: table, chair, ball.
14. proper nouns: Jimmy, Fred, Billy.
15. total words: This category sums all words known
by the infant.

Locative terms coded whether the words were referenced in relation to the **child**, to other objects, or to both forms (Pick, Yonas, & Rieser, 1979).

A child's general level of word comprehension was assessed in home visits 3 and 4, during which mothers read 21 stock sentences to their children. Each sentence was read

up to 5 times apiece. The maximum number of words responded to by the children in any one sentence reading was recorded; comprehension of relational meanings was noted. Relational comprehension was scored with successful discrimination of several modifying adjectives embedded within the sentences. For example, a child's correct selection of a big ball and a little ball, in successive sentences, show the discrimination of the modifying word pair big/little. Also, relational comprehension was scored with an understanding of possessives across sentences, such as correctly selecting articles of clothing (shoe or sock) belonging to the child, child's mother, and child's father in 3 different sentences.

During the breaks in sessions 3 through 5, the children's vocabularies (comprehension and production) from their checklists and diaries were examined. Mothers reconstructed situations under which language activity occurred. For production, mothers were asked whether objects were present or actions ongoing, during the child's speech. Questions were asked on the production of modifiers, and abstract semantic categories, such as possessives, features, amounts, non-existence, and recurrence. Modifiers and abstract words, produced in situations with the object present or actions ongoing, were noted but not placed into the children's vocabularies. Words were included in a child's vocabulary when produced in more than two different situations. These selection procedures are consistent with those of Corrigan (1978), and these procedures eliminate words associated with

a particular context and modifying/abstract words associated with particular objects.

Mothers were also asked to reconstruct circumstances under which their children understood words marked in the children's diary and checklist. Words which were understood with the help of gestures were eliminated from the children's vocabularies. As in production, placement of a modifier or abstract word into a child's vocabulary required consistent comprehension of the word in two or more situations, and for abstract words (recurrence and nonexistence), the objects must have been out of view or the action not ongoing.

The children's productive vocabularies were supplemented with words produced in the video and audio tapings. The children's comprehension vocabularies were supplemented with child word comprehension behaviors from the sentence task of sessions 3 and 4.

RESULTS

Introduction

Transcript and coder consistency for the video and audio tapes are examined. Percent agreement, which is more conservative than correlations, was calculated to estimate this consistency. The relations of the new means-end relations behaviors to the standardized Uzgiris and Hunt (1975) scale are also examined.

A series of analyses of variance contrasting sex, age, videotaped situation to child attention, MLU, nouns/utterance, verbs/utterance and auxiliaries/verb phrase are presented. Next, partial correlations, with age variance removed are presented; these correlations relate means-end relations and object permanence to the children's vocabularies (receptive and productive) and child speech from the audio and video tapes.

Relations between mother and child speech are examined next, comparing different videotaped situations. Finally, three-way relationships between mother-speech and cognitive development are examined in series contingency tables and multiple regression equations. Discussion of these results is presented in the next section.

Transcript Coding and Consistency

The videotapes and audiotapes were transcribed by four

research assistants. Every transcript was reviewed twice by the principle investigator for errors and omissions.

Transcripts were coded for mother and child language categories by the primary investigator. As a check, 6 transcripts were completely coded for all categories by 2 independent raters. The 6 transcripts represented each sex by age cell in the study (male and female x 14, 18, & 22 months olds). Within cells, a transcript was randomly selected for the check by the roll of a die.

All coders were trained with a videotape of a mother playing with her 24 month old in their living room. Activities in the videotape included playing ball, book reading, and watching through a large picture window a dog running around outside the house. The training tape was approximately 45 minutes long.

Training tape transcript coding produced a percent agreement of 84% for rater 1, and 91% for rater 2 to the training tape coding of the principle investigator. All discrepancies were resolved through discussion.

Coding of the 6 videotaped transcripts produced percent agreements ranging from a low of 87% to a high of 93% to the codings of the principle investigator. Averaged percent agreement across all 6 transcripts was 90.1%.

Means-end relations scale consistency

Some means-end relations behaviors were infrequent (see Appendix C for raw data). Only 1 infant was able to remove the stick from the cage within 3 tries without getting

the stick stuck on the bars of the cage (Task #5). Because of the low frequency of this behavior, this situation was dropped from further analysis. The two remaining "new" situations show some discrepancies to performance on the standardized situations of the necklace and the rings. The sticks and the plastic box situation (#6) showed 10 successes, 8 successes accompanied by failures in the necklace situation, though 2 of these had successes in the rings situation. Since the Uzgis and Hunt (1975) scaling procedures record the infant's highest level of scale behavior, these latter 2 children were considered consistent with the scaling, reducing the discrepancies to 6 out of 10. Six out of ten discrepancies, however, appear very high so this situation was dropped from further analysis.

The red board from the Bayley Scales of Infant Development (#7) showed three successes, two of which were accompanied by failures in the necklace situation, though one of the failures was successful in the ring situation. Thus, discrepancies for the red board situation were one out of three. However, the discrepancy for this one child was severe since his next highest scoring behavior was horizontal string use, which is three steps below the minimum stage 6 situation of the necklace. Because of the severity of the discrepancy and that it represents a 33% error rate, and the low success rate, the red board situation was dropped from further analysis. Thus, the means-end relations scale used in this study was the standardized scale of Uzgis and

Hunt (1975).

Examining the data for the standardized ring and necklace situations shows two children succeeding in the ring situation but failing in the necklace situation. This inconsistency represents a 50% error rate for the ring situation. Uzgiris and Hunt code a child's highest performance in a scale, and so this inconsistency was ignored for future analysis. That is, those succeeding at rings were counted as achieving the highest level in means-end relations. This approach is different from the analysis of the "exploratory" means-end relations behaviors, however a conservative approach was considered necessary for exploratory steps. Standardized coding procedures do report inconsistencies in the successful solving of the ring and necklace situations.

Uzgiris and Hunt (1975) report the inter-session stability average for the standardized means-end relations scale behaviors was 75.5%, and this stability averaged 56.9% for the necklace situation and 88.2% for the ring situation. These percentages indicate the probability of a child repeating a successful performance in a step within the same situation. The lower this stability percentage for a step, the greater the chance a child may fail one step and pass a higher step in a scale. Uzgiris and Hunt's scalogram analysis shows mean-end relations as having the second lowest index of reproducibility (consistency index = .81).

Hypothesis One

The first hypothesis analyzed child speech in the videotaped situations in a series of repeated measures analysis of variance.

A 2 x 3 x 6 (sex x age x situation) analysis of variance with situations treated as a repeated factor was calculated on the duration of each videotaped toy situation. This analysis compared the extent the children continued their play; since the 6 toys were presented in a fixed order, toys presented last may have been neglected due to fatigue.

Though duration of the videotaped situations may not perfectly correlate to actual infant attention to the toy of that situation, it is an index of the mother's perception of her child's interest in the toy. Occasionally, mothers reported stopping the interaction as they had run out of things to say about the toy.

The duration of the situation analysis indicates that attending differed as a function of the situation, $F(5,870) = 8.48$, $p < .01$. Trend analysis indicates that the linear trend accounted for 95% of the variance due to the situations factor. There were no other significant main effects, trends or interactions. Thus children increased the amount of time playing with the toys as the number of situations increased. This finding confirms the results of the prestudy in which static, non-moving toys were least interesting, and dolls and action toys were most interesting to the children.

Scores for utterances, MLU, nouns per utterance, verbs

per utterance, and auxiliaries per verb phrase were compared in a series of $2 \times 3 \times 8$ (sex $\times$ age $\times$ situation) analyses of variance (situations treated as a repeated factor). The number of utterances spoken by the children showed a significant sex $\times$ situation interaction, $F(7, 1218) = 2.19, p < .05$, and significant effects for age, $F(2, 174) = 5.73, p < .05$, and situation, $F(7, 1218) = 3.05, p < .05$. Cell means show the interaction was due to the larger number of utterances by females, and the attenuation of utterances in the diapering, toy top and car situations for all subjects.

Only age was significant in the MLU analysis, $F(2, 174) = 8.73, p < .05$, indicating speech increases in complexity with age. The verb/utterance analysis contained no significant main effects or interactions, though a marginal sex $\times$ situation interaction emerged, $F(7, 1218) = 1.97, p < .06$. Cell means show males produced more verbs in toy top, diapering and toy car situations, while females produced more verbs in feeding and toy block situations. The noun/utterance analysis showed significant main effects for age, $F(2, 174) = 2.88, p < .05$, and situation, $F(7, 1218) = 2.31, p < .05$. A posteriori comparisons indicate: (a) 22 and 18 month olds produced more nouns/utterance than 14 month olds and that they did not differ from each other, and (b) fewer nouns were produced in the toy top situation than any other situation.

The auxiliaries/verb phrase analysis indicates a significant main effect for age. Examination of cell means show that no 18- or 14-month old produced any auxiliaries/verb

phrase.

In sum, language complexity (MLU) did not change as a function of situation, though the frequency of speech did change. Children spoke less in the moving toy and diapering situations; girls tended to speak more than boys. Boys spoke more verbs when playing with the moving toys and diapering; girls spoke more verbs when playing with the block and during feeding. The children used verbs to describe ongoing activities, such as "Car mov(ing)" and "Eat now". The ability to speak nouns and auxiliary verbs is related to age. The present data supports hypothesis 1, MLU did not change across situations, frequency of utterances and verbs/utterance did change across situations; these changes in speech activity may alter the relations of mother-speech to the children across situations.

Hypothesis Two

The second hypothesis examines the relationship of object permanence performance to child speech in videotaped situations, receptive and productive vocabularies. The 6 toy situations were combined into 3 general categories:

- (a) non-moving toys consisting of the stick and ball,
- (b) social toys consisting of the male and female dolls, and
- (c) moving toys consisting of the top and car. Feeding and diapering situations were also analyzed.

Table 4 lists partial correlations of object permanence to child vocabulary categories. Table 5 list partial correlations of object permanence to child speech in the video

Table 4

Partial correlations of object permanence performance to
number of words in child vocabulary categories^a

<u>vocabulary category</u>	<u>object permanence performance</u>	
	<u>comprehension</u>	<u>production</u>
Total words	.15	.26*
Nouns	.23	.16
Proper nouns	.13	.04
Features	.33**	.20
Colors	.13	.06
Person-object locatives	.31**	.05
Object-object locatives	.06	-.06
Amounts	.15	.15
Possessives	.22	-.16
Nonexistence	.08	-.02
Recurrence	.35**	.08
Verbs	.18	.04
Sentence comprehension	.08	---
Relational comprehension	.19	---

Note. Uni-directional tests of significance were used since
positive correlations were predicted in hypothesis 1.

^aAge effects are removed from these correlations.

* $p < .10$

** $p < .05$

Table 5

Partial correlations of object permanence to child speech in free-play
and videotaped situations^a

Object Permanence	<u>Utterances</u>	<u>MLU</u>	<u>Verbs/ Utterance</u>	<u>Nouns/ Utterance</u>	<u>Auxiliaries/ Verb phrase</u>	<u>Causal Statements</u>
Free-play	.12	-.02	.08	.38**	-.18	.10
Diapering	.21	.36**	.22	.19	.12	.12
Feeding	.09	-.05	-.05	.04	.11	.05
Non-moving toys	-.06	-.03	-.18	.01	.17	.10
Social toys	.07	.19	-.16	.01	.06	.07
Moving toys	.10	.20	.10	-.09	-.02	.11

Note. Uni-directional tests of significance are used to compare these partial correlations, since positive relations are predicted in hypothesis 1.

^aAge effects are removed from these relations

*p < .10

**p < .05

taped and free play situations. Object permanence relates to nouns/utterance in free play ($\underline{r} = +.38$, $p < .05$), MLU in diapering ($\underline{r} = .31$, $p < .05$), though not to object locatives ($\underline{r} = .08$, $p < .05$).

Partial correlations, controlling for age, were calculated for object permanence to: (a) words coding recurrence in freeplay, diapering, feeding, and social situations, and (b) words coding nonexistence in freeplay. Correlations were not calculated for the remaining situations since not enough words coding recurrence or nonexistence were produced in those situations. The partial correlations of recurrence and nonexistence to object permanence were low (range $-.20$ to $+.24$, $p < .10$), suggesting little relation between these categories and object permanence once age factors are removed.

In sum, hypothesis 2 is partially confirmed; object permanence is related to some object-defined categories though these relations are mainly in receptive vocabulary. Other object related categories were not related to object permanence (nonexistence). Object permanence does not appear to relate to increased child speech, except for MLU in diapering and nouns/utterance in freeplay; object permanence relates more to vocabulary build-up.

Hypothesis Three

The third hypothesis examines the relationship of means-end relations to child speech in videotaped situations, receptive vocabularies, and productive vocabularies. As in

hypothesis 2, the 6 toy situations were combined into 3 general categories: (a) non-moving toys, (b) social toys, and (c) moving toys. Feeding and diapering situations were also analyzed.

Table 6 lists partial correlations of means-end relations to child vocabulary (receptive and productive) categories. Table 7 lists partial correlations of means-end relations to child speech in the videotaped and free play situations.

Generally, performance on the means-end relations scale negatively correlated (age variance removed) to production vocabulary categories, though only the nonexistence (in production) category reached statistical significance ($r = -.39$, $p < .05$, two-tailed test), and possessives (in production) were marginally negatively related ($r = -.33$, $p < .1$, two-tailed test).

Means-end relations negatively related to verbs/utterance in free play, diapering, feeding, and moving toys situations ($r_s = -.55, -.42, -.39, -.38$, $p < .05$); auxiliaries/verb phrase negatively related in feeding ($r = -.52$, $p < .05$). Causality statements marginally related to means-end relations in social and diapering situations ($r_s = .29, .28$, $p < .10$). Utterances marginally related to means-end relations in the social situation ($r = .26$, $p < .10$).

In sum, hypothesis 3 is weakly confirmed since causality statements marginally relate to means-end relations in 2 situations, social play and diapering; a marginal relationship

Table 6

Partial correlations of means-end relations performance
to child vocabulary categories^a

<u>vocabulary categories</u>	<u>means-end relations performance</u>	
	<u>comprehension</u>	<u>production</u>
Total words	.06	.27
Nouns	.28	.11
Proper nouns	.29	.16
Features	.01	-.24
Colors	-.11	.02
Person-object locatives	.08	-.18
Object-object locatives	-.16	-.11
Amounts	-.18	-.14
Possessives	-.10	-.33*
Nonexistence	-.06	-.39**
Recurrence	.22	-.02
Verbs	.13	-.14
Sentence comprehension	-.09	---
Relational comprehension	.03	---

Note. Bi-directional tests of significance were used to compare these partial correlations.

^aAge effects are removed from these relations.

*p < .10

**p < .05

Table 7

Partial correlations of means-end relations to child speech in free-play and videotaped situations^a

<u>Means-end Relations Performance</u>	<u>Utterances</u>	<u>MLU</u>	<u>Verbs/ Utterances</u>	<u>Nouns/ Utterances</u>	<u>Auxiliaries/ Verb phrase</u>	<u>Causal Statements</u>
Free-play	.19	-.06	-.20	-.55**	-.08	.21
Diapering	.14	-.34*	.05	-.42**	-.04	.28*
Feeding	-.06	-.10	.16	-.39**	-.52	-.04
Non-moving	.18	-.01	.10	-.21	.31*	.24
Social toys	.26*	.03	-.20	-.11	.22	.29*
Moving toys	.04	-.21	-.08	-.38**	-.33*	.11

Note. Uni-directional tests of significance are used to compare child speech categories of utterances and causal statements, since positive relations are predicted in hypothesis 2; all other relations use bi-directional tests of significance.

^aAge effects are removed from these relations.

*p < .10

**p < .05

also occurred in 1 situation, social play. Means-end relations negatively relate to verbs/utterance in free play, diapering, feeding, and moving toys situations; the last 3 situations were examined in the verbs/utterance analysis of variance in hypothesis 1 which showed increased verb use in moving toys and diapering situations by males, and in the feeding situation by females. Since only 4 subjects achieved stage 6 in means-end relations, the negative relations can be attributed to increased verb use in the situations cited rather than to a large number of stage 6 children producing few verbs. Increased verb use may assist protracted goal attainment which may be needed by stage 5 children in their reaching and tool use activities.

Hypothesis Four

The relationship of mother-speech and child cognitive development to child speech is explored in a series of partial correlations and multiple regressions; relationships are calculated for mother and child speech produced within each of the 5 major videotaped situations of social toys, non-moving toys, moving toys, diapering and feeding. Mother speech is examined in 2 categories: (a) sentence categories, and (b) grammatical categories. Child speech is examined by 6 variables: (a) MLU, (b) utterances, (c) verbs/utterance, (d) nouns/utterance, (e) auxiliaries/verb phrase, and (f) causality statements. These partial correlations are presented in tables 8, 9, and 10.

The partial correlations do not show a statistically

Table 8

Partial correlations of mother speech to child MLU and utterances in videotaped situations^a

Mother speech	Diapering		Feeding		Non-moving toys		Social toys		Moving toys	
	MLU	U	MLU	U	MLU	U	MLU	U	MLU	U
Declaratives	-.03	-.03	.07	.26	-.18	-.11	-.12	-.11	-.11	-.23
Imperatives	-.23	-.20	-.11	.11	-.09	-.03	-.37*	-.18	-.45*	-.39*
What questions	-.06	.21	.15	.33	.01	.06	.08	-.11	.34	.25
Tag questions	.68*	.08	-.16	-.04	-.20	-.16	-.11	-.10	.35	-.03
Yes/no questions	.02	.18	-.03	.16	.15	.20	-.15	.00	.22	.22
Yes/no inversions	-.18	-.16	-.08	-.29	.17	.23	-.29	-.22	.06	-.21
MLU	.16	-.16	.52*	.62*	-.11	-.14	-.15	.11	.22	.15
Noun/verb ratio	.49*	.11	.36	.13	-.01	-.24	-.18	-.13	.44*	.18
Contractions	.19	.04	.14	.11	-.09	-.19	-.16	-.17	.15	-.08
Fragments	-.51*	-.24	-.30	.02	-.09	-.25	-.16	-.33	-.22	-.02
Nodes	.11	-.24	.12	.32	-.01	.04	-.41*	-.45*	-.13	-.24
Objective pronouns	.05	.09	.05	.26	-.05	.06	.11	-.05	-.24	-.24
Personal pronouns	.14	.16	-.11	.04	.11	.16	-.11	-.10	-.08	-.03
Verbs	-.20	-.04	-.13	.00	-.10	.05	-.43*	-.35	-.21	-.26
Noun modifiers	.15	-.21	.18	.11	-.35	-.39*	-.18	-.32	-.02	-.30
Verb modifiers	-.22	.02	-.05	.13	.00	-.02	-.46*	-.21	-.38*	-.38*

^aAge effects are removed from these correlations

*p < .05

Table 9

Correlations of mother speech to child verb (V) and noun (N) use in videotaped situations^a

Mother speech	Diapering		Feeding		Non-moving toys		Social toys		Moving toys	
	V	N	V	N	V	N	V	N	V	N
Declaratives	.06	.12	-.19	.27	.15	-.27	-.16	-.09	-.06	.03
Imperatives	-.42*	-.05	-.05	.04	-.06	-.13	-.39*	-.16	-.31	-.12
What questions	-.03	.01	-.13	.09	.32	-.24	.11	-.13	.04	.23
Tag questions	-.12	-.11	-.05	-.13	.04	-.10	-.15	-.10	-.02	.05
Yes/no questions	-.12	-.11	-.08	.05	.24	-.17	-.15	-.01	-.45*	.34
Yes/no inversions	-.16	.00	-.12	-.18	.34	-.04	-.14	.10	.05	.06
MLU	.38*	.10	.26	-.01	.07	-.20	-.29	.09	.29	.28
Noun/verb ratio	.34	-.07	.31	.28	.09	-.16	.06	.28	.47*	.28
Contractions	-.13	-.17	-.23	-.07	.15	-.12	-.11	-.16	-.02	.18
Fragments	-.24	-.30	-.48*	-.08	-.05	.08	-.13	-.24	-.28	-.18
Nodes	.00	-.04	-.24	-.07	.18	-.26	-.37*	-.15	-.22	.02
Objective pronouns	-.08	-.18	-.38*	-.06	.19	-.25	-.27	.05	-.15	.06
Personal pronouns	-.39*	-.34	-.10	-.19	.28	-.14	-.24	.29	-.12	.05
Verbs	-.27	-.21	-.32	-.17	.21	-.37*	-.57*	-.07	-.30	.01
Noun modifiers	-.07	-.07	.21	.00	-.01	-.29	-.53*	-.15	-.06	.16
Verb modifiers	.01	-.10	-.09	-.09	-.03	-.13	-.44*	-.38*	-.20	-.35

^aAge effects are removed from these correlations.

*p < .05

Table 10

Mother speech relations to child auxiliary (A) and causality (C) use in video situations^a

Mother speech	Diapering		Feeding		Non-moving toys		Social toys		Moving toys	
	A	C	A	C	A	C	A	C	A	C
Declaratives	-.14	-.12	.18	.33	-.12	-.05	-.13	.08	.18	-.19
Imperatives	.22	.06	.01	-.09	-.06	-.22	-.15	-.23	-.15	-.47*
What questions	-.06	-.06	-.24	.43*	.05	-.15	.12	.03	.10	.34
Tag questions	-.14	.09	-.10	-.07	.00	-.03	-.19	-.09	.24	.02
Yes/no questions	-.16	-.02	.06	.35	.21	.19	.01	.01	-.04	.17
Yes/no inversions	-.14	-.19	.10	-.23	.15	.23	-.12	-.17	.18	-.03
MLU	.04	.44*	.17	-.13	-.21	-.08	-.17	.02	.30	-.20
Noun/verb ratio	-.06	.07	.13	.32	-.14	-.24	-.28	-.20	.37*	.15
Contractions	.08	.08	.30	.27	-.10	-.07	-.12	-.04	.33	-.08
Fragments	-.21	-.38*	-.10	.07	-.22	-.19	-.20	-.09	.06	-.07
Nodes	.07	-.28	.10	.36	.07	-.09	-.18	-.18	.14	-.22
Objective pronouns	.05	-.11	.17	.02	.26	.06	.19	.29	.11	-.19
Personal pronouns	-.16	.08	.21	.12	.00	.13	.02	.02	.15	-.03
Verbs	-.28	-.20	.18	.03	.00	-.11	-.23	-.25	-.02	-.27
Noun modifiers	-.10	-.47*	-.20	.26	-.24	-.25	-.30	-.10	.32	-.31
Verb modifiers	-.22	-.08	.05	.07	.02	-.16	-.32	-.31	.29	-.31

^aAge effects are removed from these correlations.

*p < .05

reliable pattern (minimum $r: \pm .31$, $p < .1$, 2 tailed test), for mother to child speech across situations, though the direction of the relationships were similar across situations. This correlational pattern containing few significant relations is similar to the concurrent correlations of mother to child speech at 27 months reported by Furrow et al; mother imperative use positively related and mother interjective (fragment) and verb use negatively related to child MLU, nouns/utterance, and verbs/utterance. In the present study, mother interjection (fragments) and verb use negatively related to child speech, though mother imperative use also negatively related to child speech. Situations substantially altered observed relationships. Mother imperative use negatively related to child speech in social and moving toy situations; mother verb use negatively related to child speech in the social toys situation.

Furrow et al predicted positive relationships for mother speech to 18 month olds to child speech at 27 months for (a) wh- questions, (b) yes/no questions, and (c) deletions (yes/no questions with deleted frontal auxiliary verbs); negative relations were predicted for mother speech variables of: (a) declaratives, (b) MLU, and the frequency per utterance of (c) sentence nodes, (d) pronouns, (e) verbs, (f) modifiers (noun and verb), and (g) contractions. Mother to child speech in the present study showed positive relations for wh- questions and MLU, and negative relations for verbs, noun modifiers, and verb modifiers across situations, with

significant relations appearing in the diapering, feeding, social and moving toys situations. Thus, the pattern of relationships from this cross-sectional study is similar to Furrow et al's concurrent (mother speech to 27 months to 27 month old speech) relations. Mother grammatical speech categories were twice as likely to be related to child speech than mother sentence categories (9.9% versus 5%, $p < .05$, or 15.3% versus 10.6%, $p < .10$).

The combined effect of mother speech and child cognitive development to child speech is examined in a series of exploratory multiple regression equations predicting 2 complex measures of language development, MLU and causality statements, and one measure of speech frequency, utterances, produced in each of the 5 major videotaped situations. Age, object permanence, means-end relations, and mother use of yes/no questions, imperatives, and deletions (yes/no questions with deleted frontal auxiliary verbs) were used as predictors. Variables placed in the regression equations required attaining an F ratio at the 95th percentile of the F distribution for 30 subjects ($F = 4.17$); once placed in the equation a variable was dropped if its F ratio (predictive value) fell below the 90th percentile of the F distribution ($F = 2.88$, $n = 30$). The variable age was not subject to these statistical requirements; age automatically entered the equations as the first predictor to eliminate age variance from all subsequent predictors. Table 11 lists the results from the multiple regression equations.

Table 11

Multiple Rs (MR) and Beta weights predicting children's speech in videotaped situations with age, object permanence, means-end relations, mother yes/no question and imperative (IMP) use as predictors.

<u>Situation</u>	<u>Child speech</u>	<u>MR</u>	<u>Predictor</u>	<u>Beta</u>
Diapering	MLU	.46**	age	.46
	Utterances	.39*	age	.39
	Causality	.53**	age	.53
Feeding	MLU	.28	age	.28
	Utterances	.65**	age	.65
	Causality	.50**	age	.50
Non-moving toys	MLU	.55**	age	.55
	Utterances	.37*	age	.37
	Causality	.42*	age	.42
Social toys	MLU	.52**	age	.32
			IMP	-.35
	Utterances	.52**	age	.52
	Causality	.38*	age	.38
Moving toys	MLU	.52**	age	.19
			IMP	-.44
	Utterances	.59**	age	.41
			IMP	-.35
	Causality	.64**	IMP	-.42
			age	.40

*p < .05

**p < .01

Age predicts MLU in the diapering, non-moving toys, and social toys situations; imperatives are significant predictors in the social and moving toys situations. Examination of the Beta weights show the impact of the imperatives as reducing MLU in these situations.

Age also significantly predicts utterances in all situations. Imperatives significantly predicted utterances in the moving toys situation; Beta weights show the impact as negative, though this reduction may be related to the general reduction of utterances reported earlier for this situation.

In sum, hypothesis 4 is not supported. There is no apparent combined relationship of cognitive development and mother speech that is positively related to child speech; mother imperative use is related to decreases in MLU, utterances, and causality statements in the moving toys situation, and to MLU in the social toys situation. Partial correlations of mother speech to child speech have relations that agree with concurrent and predictive correlations reported by Furrow et al. Implications and interpretations of these relationships are made in the discussion.

DISCUSSION

The present study explicitly examines 4 variables thought to contribute to child language and speech development: (a) situational effects, (b) object permanence, (c) means-end relations, and (d) mother speech, and one implicit variable, age. Age related to most aspects of child speech, language, and cognitive development. Many first order correlations between variables were statistically reliable when age factors were not controlled; few relations were reliable once age factors were controlled. Newport et al (1977) reported similar findings in which most relations were substantial until age and initial child speech factors were controlled in their longitudinal study; since the present study was cross-sectional in nature only age factors were controlled.

Hypothesis one

This hypothesis measures child speech activity across situations in a series of analyses of variance.

The present situational analysis is consistent with the findings of Benedict and Truhon (note 1); child utterances decreased in the moving toys situation which is comparable to the decrease in utterances in the complex shape toy situation of the Benedict and Truhon study. MLU did not differ

across situations in the present study, replicating Benedict and Truhon's finding of no MLU differences across book reading, free play, and directed play (complex shape toy) situations. More engrossing situations are associated with decreases in child utterances, probably due to the children attending or acting upon the complex display.

It appears that children presented with an interesting phenomenon will concentrate on that phenomenon, perhaps because of its novelty or in an attempt to understand its principles, and in doing so reduce their speech. Utterance reduction may be an attempt by the infant to functionally increase its ability to gather information about an interesting event. When the children do talk, it appears the situation does not affect the general complexity of speech (MLU) though components of speech, especially verbs/utterance do change across situations.

Infant interaction with each toy was short, lasting between one-and-one-half and three minutes for each situation; short periods reduce potential utterances which may affect child speech characteristics. In post taping interviews, all mothers reported engaging their infants in a manner similar to the filmed sequences. Most situations were completed before reaching the full amount of time allowed. The short time period for each situation appears typical of mother to infant play interactions, indicating infant speech was appropriately measured.

Hypothesis two

Relations of object permanence to child language and speech are examined in hypothesis 2.

All significant relations of child vocabulary and object permanence occurred in receptive categories; these categories were: (a) features, (b) recurrence, and (c) person to object locative relations. Relations of receptive vocabulary categories to object permanence were higher than corresponding production vocabulary categories in 10 or 12 categories (exceptions were: (a) total words, $r_s = .15$ versus $.26$, and amounts, $r_s = .15$ versus $.15$). These partial correlations, though most were not significant, are consistent with the view that language comprehension is "more directly in line" to basic concepts or cognitions underlying a language category (Cromer, 1979).

Cromer (1979) hypothesizes cognition is the product of two interacting factors: (a) structural factors consisting of components such as short term memory, and (b) operation factors consisting of sensorimotor and cognitive abilities such as object permanence and reversibility. Linguistic developments interact with cognitive developments when a concept first forms; further developments proceed as a function of linguistic properties. Cromer supports his hypothesis by describing Bellugi's (1971) findings on self reference. Bellugi found children: (a) initially use their own names for self reference, (b) gradually acquire the pronouns "I" and "me" but incorrectly place these pronouns in their

utterances, and (c) correctly use the pronouns within their utterances. Increased self reference sophistication as indicated in Bellugi's sequences does not show a change in the children's self awareness, but only how self is expressed to others. Cromer's hypothesis would predict higher object permanence relations to receptive language compared to productive language.

Cromer's hypothesis requires some delineation of the unique language development factors which would cause higher relations for receptive language. Menyuk and Menn (1977) hypothesize language development consists of 2 processes, comprehension and speaking. Menyuk and Menn view language development as a phenomenon in its own right, though cognitive and social factors that impact on language are included. Their model includes: (a) social perception, described as learning words within situations and knowing when to produce these words, (b) memory, described in terms of recalling the appropriate sound pattern constituting a word for a situation, and (c) cognition, described as using words to reach goals within novel situations. Their full model is outlined below.

A. Comprehension processes

1. Readiness in processing speech

- a. distinction between speech and nonspeech
- b. discrimination between speech sound categories and prosodic patterns
- c. production of consonant-vowel sequences marked prosodically

2. Analysis of meaningful unit(s)

- a. phonological sequences and situation
- b. phonological analysis and situational analysis
- c. analysis of syllabic features of phonological sequences
- d. analysis of distinctive feature content of sequences

B. Speaking processes

- 3. to learn to produce a variety of vocal sounds
- 4. to learn to produce vocal sound patterns so that they more or less match sounds which are heard
- 5. to learn to remember certain sound patterns well enough to produce them without just having heard them
- 6. to learn to produce specific sound patterns in situations where they have been produced by others or by oneself in the past
- 7. to become able to produce a word in a novel setting as a means to an end

The Menyuk and Menn model is a descriptive model of language and speech development, which does not specify initial concept formation as described by Cromer; the model does emphasize additional processing stages needed for language production. Presumably, children comprehending language may need to complete processing of the first 2 steps plus some minimal level of object permanence development. Language production requires completing new steps (3 to 7). Complex or abstract speech requires increased knowledge in means-end relations (step 7), and social perception requires knowing when to speak (step 6). Practice effects are outlined in steps 3, 4 and 5 for all types of production (children in the present study did not need to produce fully formed adult-like words for vocabulary inclusion). Tentatively, productive vocabulary categories appear more

"distanced" than corresponding receptive vocabulary categories to object permanence development; processes similar to those described by Menyuk and Menn may explain this distancing.

The 3 receptive language categories related to object permanence all contain words that modify object characteristics and locations; knowledge implied by knowing these words should relate to object permanence performance. The first category, features, consists of words that modify objects, such as big, little, broken, or dirty. Children knowing these terms should know more about distinctive parts of objects which may assist in recall of that object, or in object permanence, an awareness that a particular object was hidden which can enhance continued search for that object. The second category, recurrence, is made up of words that indicate objects and actions that disappear and return, such as more and again. Children knowing these words have awareness of hiding situations such as those used in object permanence. The final category, person to object locative relations, includes words marking locations relative to the child, such as up, down, front, back, or side. Children knowing these words are aware of spatial locations in reference to themselves, knowledge that enhances their object permanence performance. Increased "objective" locative knowledge, as indicated by knowing words marking locations from a vantage point away from the child, is not related to object permanence performance; "objective" locative words may relate to higher order cognitions such as reversibility,

but for object permanence a knowledge of self to locations appears necessary.

Receptive vocabulary categories, which did not relate to object permanence performance, but are associated with objects, were nouns, proper nouns, colors, amounts, possessives, and nonexistence. Ramsey et al (1978) report first object words are acquired with acquisition of stage 5 of object permanence; relations of nouns, which tend to code object words, may have been attenuated since most children in this study were assessed at a stage 6 level, well past the time of initial concept acquisition. Latter acquisition of nouns may develop as a function of linguistic factors (Cromer, 1979; Menyuk & Menn, 1977), or factors not related to object permanence development. Object related categories not appearing to tap knowledge required in object permanence performance are: (a) amounts, such as all and some, which focus on groups, (b) nonexistence, which logically relates to object disappearance, but not knowledge that assists in the recovery of objects, and (c) possessives, which denote ownership. Colors, like features, should relate to object permanence as a way to recall characteristics that make hidden objects distinct; a focus on colors may not be efficient for this task.

Object permanence did not relate in taped situations to speaking words coding: (a) recurrence, (b) nonexistence, and (c) causality statements; a result consistent with the finding that object permanence is not related to production vocabulary categories. Speaking words coding nonexistence and

recurrence have been reported as occurring after attaining the highest levels in object permanence (Corrigan, 1978), and stage 6a by McCune-Nicholich (1981); these reports do not use correlations but rather mark the occurrence of the speech after cognitive development. Most children in the present study performed at object permanence stage 6b (24/30); this large number of children may have attenuated relations because of a time lag between the minimum conceptual level needed for acquisition and the resulting "drift" as both areas developed. The present study supports McCune-Nicholich's finding that words coding nonexistence and recurrence occur after achievement of object permanence stage 6a. Diary records show stage 6a children producing and comprehending words coding recurrence (ns = 1, 2), and nonexistence (ns = 1, 3); though only stage 6b children produced these words in taped situations.

Object permanence positively related to nouns/utterance in free play ($r = .38$, $p < .05$). This relationship may be linked to the large number of toys in free play; 11 children frequently held up toys to show to mothers and experimenters, then named the toys. These children named toys in free play (typically 2 to 5 toys) up to 10 times apiece.

In sum, object permanence is related to a small set of receptive vocabulary categories; a model of "distance" from an initial concept acquisition to receptive and productive vocabulary build-up appear to best explain this pattern.

Hypothesis three

Hypothesis 3 examines relations of means-end relations to child speech and language development. Means-end relations negatively related to child verbs/utterance in most taped situations; marginally positive relations to causality statements were found in 2 situations. Lower levels of means-end relations were related to increased verb use, while higher levels marginally and positively related to increased causality statements.

Correlations of means-end relations scores from the first administration to the second administration was .93; three children changed their scores, 2 increased and 1 decreased though changes were small, comprising of no more than 2 scale steps.

The 6 subjects performing within stage 6 on this measure were inconsistent since 2 children succeeding in the ring situation did not solve the necklace situation, a lower scale step. Examination of the subjects' stage 5 behaviors show consistency across steps; 2 of 30 subjects had out of sequence scores and both subjects did not pull a string to get a vertically displaced toy, but used sticks to extend reach. Means-end relations appears to accurately and consistently measure reaching activity using implements, and less consistently measures the planning and execution of acts to obtain unseen goals. This inconsistency in stage 6 steps is important as stage 6 processes coordinate planning and execution of actions in the "physical world"; processes

hypothesized as underlying the ability to make and talk about causal inferences and request making to independent causal agents (Bates, 1976; Snyder, 1978).

The standardized means-end relations scale (Uzgiris & Hunt, 1975) was used in the present study; only 2 steps in this measure assess stage 6 activity. The inconsistencies of stage 6 performance may have attenuated relationships of means-end relations to causality statements in the present study; increasing the number of stage 6 steps in this measure may help clarify any existing relationship.

Means-end relations marginally and positively related to causality statements in 2 situations, diapering and social toys. The similarity of activities in these 2 situations may in part explain these relationships; all 18 and 22 month olds removed some article of clothing from a doll, and 7 children attempted to diaper a doll (5 22-month-olds and 2 18-month-olds). Diapering may present a familiar situation to the children to expect certain activities, facilitating talk about these activities. Diapering activities include taking off clothing, powdering, locating new clothes, and putting on the new clothing. Speaking a number of causality statements within a situation may require facilitating situational support as well as cognitive activity.

Causality statements in feeding may have been reduced since mothers often offered children more food during feeding, reducing the need to request something from a separate causal agent. Mother use of all forms of yes/no questions

were highest in feeding (40.7%) compared to all other situations (diapering = 26.8%; non-moving toys = 32.9%; social toys = 28.5%; moving toys = 20.8%). Most (84.3%) of all yes/no questions in feeding were related to food requests.

Causality relations in the non-moving toys situation may have been attenuated since the toys did not possess moving or removable parts; reducing the opportunities for action requests and questions. The moving toys situation contained toys capable of independent action and presumably presented many opportunities for requests and causal statements; means-end relations was not related to causality statements in this situation. The situation may have been too difficult for many of the children who may have been engrossed with the toys reducing complex elements of their speech. This interpretation is elaborated upon following a discussion of verbs produced per utterance.

The negative relations of means-end relations to verbs/utterance in diapering, feeding and moving toys situations are linked to increased verb use by males in diapering and moving toys situations, and to increased verb use by females in feeding. Since only 6 subjects achieved stage 6 in means-end relations, the increased verbs/utterance can be attributed to stage 5 children. Increased verb use by stage 5 children maybe related to inefficient and protracted goal reaching and tool using activities in diapering, feeding and moving toys situations. In the moving toys situation, the verbs "go" and "push" (or their equivalent) were spoken

most often during play with the car and top; these verbs mark the most salient action of the toy in their respective situation. Verb use in the moving toys situation make a descriptive account of events in that situation; an explanatory account of events in the moving toys situation is linked to the production of causality statements which for this situation may have been attenuated since children were still forming their explanatory hypotheses.

In sum, means-end relations is related to many child speech behaviors, and is not related to receptive language. This is the opposite pattern found for object permanence relations to language. Bates (1976) and Snyder (1978) hypothesize means-end relations are linked to tool use and the developmental use of intermediate goals to attain an end goal in language and object manipulation for stage 5; higher level inference making and causally oriented request making are hypothesized for stage 6. The findings of the present study support these views, especially when verbs are considered as descriptive markers of events. Situations altered the relations of verbs and causal statements; differences in the type of interaction found across situations are hypothesized as causing these differences.

Hypothesis four

Hypothesis 4 compared the relations of mother speech and child cognitive development to child speech development.

Mother speech data in videotaped situations consist of 60 mother utterances in the combined toy situations, and 30

utterances in diapering and feeding; Newport et al (1977) examined more than 100 utterances in a free play situation. The lower number of utterances were a consequence of the taping procedures as described in the methodology. Fewer utterances may increase sampling error since less data are analyzed. However, most situations were stopped by mothers before the maximum time allowed. Interview indicate most mother-child play interactions are described as being of short duration. Klein (1980) reports the typical mother-child interaction lasts a few minutes, not the 10 or more minute interaction often used in assessing mother-child speech relations. In the present study, only 6 mothers engaged in prolonged free play with their children. Generally, mothers did not interact with their children except for smiling and encouraging them to play until the children requested assistance or when mothers believed help was needed. Most mothers ($n = 27$) stated in interviews that they would usually engage in similar interactions with their children, a general monitoring of their children's activity with focused intervention when needed. Intervention consisted of accomplishing a specific purpose such as straightening clothes, comforting, or showing how a toy worked.

Mother to child speech relations across situations show a pattern similar to concurrent (for mother use of fragments and verbs) and predictive (for mother use of nodes, pronouns, verbs, modifiers) relations presented by Furrow et al (1979). Most mother sentence categories were not related to child

speech, except for imperatives.

Increased use of imperatives relates to decreases in child MLU and verbs/utterance, especially in diapering, moving toys, and social toys situations. The negative relations suggest mother imperative use caused children to attend to their mothers, or carry out the action requested in the imperative effectively diverting the children's attention away from speaking.

Mother grammatical speech categories tend to show negative relations for inherently complex and abstract categories (fragments, nodes, pronouns, modifiers, verbs), and positive relations for categories that can be fine tuned (MLU, noun/verb ratio) to levels of child speech; these relations change across situations but not dramatically, for example, positive correlations in one situation for a set of variables tend to be positive in another situation.

The pattern of cross-sectional relations of mother to child speech is important for making longitudinal inferences. The present results show mother speech complexity, abstractness, and intent relate to child speech; the size of these relations qualify longitudinal relations. Furrow et al's relations of mother speech to 18 month olds correlated to child speech at 27 months, were not the same as the mother to child speech relations at 27 months. However, Furrow et al did not present cross-sectional mother to child relations at 18 months, nor were relations of child speech at 18 months to child speech at 27 months presented. Furrow

et al studied children who were equivalent in language skill (MLU about 1.0); differences in their sample's comprehension skill were noted but not described. It is possible that mother speech is, at least partially, related to aspects of child behavior not involved in actual child speech. Mother speech maybe related to the child's comprehension skill, cognitive development or vocabulary knowledge; skills and developments in these non-speech areas may provide the basis for latter speech development. In this view, mother speech occurs as a function of situational characteristics and feedback from children's non-speech and speech behaviors, and that long term development of speech occurs as a function of conceptual and language comprehension developments.

The impact of child non-speech relations to mother speech can be examined in mother imperative use. Imperative use negatively related to child MLU in social and moving toys situations ($r_s = -.37 \text{ \& } -.45, p < .05$); imperative use positively related to child relational comprehension ability (as assessed in the third and fourth home visits) to the same situations ($r_s = .54 \text{ \& } .40, p < .05$), the remaining relations in the other situations were not significant (r_s range from $-.08$ to $.16, p < .10$). The social and moving toys situations had relatively complex toys which could be actively manipulated and explored. The procedures for relational comprehension assessment emphasize complex imperative-like commands. Mothers in the social and moving toys situations may have used imperatives which were successful

in previous encounters with complex toys, increasing their children's understanding or activity in a situation but decreasing their speech.

General summary and conclusions

The present study confirms previous findings that general speech complexity as measured by MLU does not change for young children across a variety of situations. However, specific speech forms do differ across situations (verbs/utterance); these differences may be linked to cognitive development (means-end relations) and attempts to understand or describe ongoing events. Causality statements are marginally related to cognitive development (means-end relations); situational characteristics and task familiarity may provide opportunities to demonstrate this language behavior.

Object permanence is related to some object oriented vocabulary categories, but only in comprehension. These object categories appear to reflect an awareness of concepts that are useful for success in tests of object permanence.

Many forms of mother speech relate to child speech. The general pattern is that inherently complex speech negatively relates to child speech; fine tuned speech positively relates to child speech. Also, some mother speech relate to child relational comprehension.

REFERENCE NOTE

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APPENDICES

APPENDIX A

APPENDIX A

LANGUAGE COMPREHENSION ASSESSMENT

The language comprehension assessment consist of 21 stock sentences written in either a modified imperative or question form. The sentences contrast a variety of verb and object names; the object names are left blank in the sentences so that particular object names known to the children can be inserted into the sentences for contrasts. Each of the 21 stock sentences are reproduced below.

1. Where's the O-1 and the O-3?
2. Get Mommy's shoe.
3. Give R-2 the broken O-C.
4. Put the O-4 in the L-1.
5. Where's (child's name) C-1?
6. Get mommy the shoe.
7. Throw me your ball.
8. Get the O-F2 from mommy.
9. Where's mommy's C-2?
10. Get the little O-C.
11. Get the OF1 for mommy.
12. Give the big O-B to R-2.
13. Get (examiner's name) the book.
14. Give the O-2 and O-3 to mommy.
15. Show me mommy's C-2.
16. Give the O-1 to R-2.
17. Get (examiner's name)'s book.
18. Put the O-2 in the L-1.
19. Get the O-3 and O-4.
20. Give me the O-1 and O-2.
21. Put the pillow on the baby.

The symbols represent words to be inserted into the sentences; these symbols can also mark the intent of most sentences. The "O" words with numbers represent toy contrasts (O-1, O-2, O-3, O-4); "O" words with letters represent size

or broken-object contrasts (O-B = broken object). The "O" words with letters and numbers represent contrasts of "for" and "from". The "R" words contrast recipients and the "L-1" word represents a location. No objects or people are repeated across different symbols; for example, O-1 may be a small toy car for sentences 1, 16 and 20 but that car cannot be used for any other sentence.

Administration procedures

Object names needed for the stock sentences were obtained during the first and second home visits from parent interviews and from the diaries and checklists. The third or fourth home visits were scheduled at a time when a recipient (for sentences 3, 12 & 16) could be present.

On the testing day, all toys except those used in the contrasts were removed from the room in which the contrasts were to occur. The contrast toys were usually placed in a pile on the floor of that room. The sentences were written in bold ink on index cards (one sentence to a card). Mothers were given the cards one at a time and told to read the sentence in a natural manner as possible when prepared. Each trial lasted for 60 seconds; mothers were instructed to look at the floor after each reading and not to repeat the sentence until 60 seconds had elapsed. Each sentence was read up to five times apiece. Fewer repetitions were read on trials where disinterest or successful responding to the sentences had occurred.

Scoring procedures

For each sentence and its' repetitions, the following responses were recorded by the 2 experimenters.

1. Objects looked at by the child.
2. Objects pointed to by the child.
3. Objects touched by the child.
4. Objects picked up by the child.
5. Objects given to various people, or objects placed in various locations by the child.
6. Words spoken by the child.

Discrepancies were resolved by discussion after each trial. In initially correct responses, the sentence was repeated a second time latter that session. The best response to a sentence was taken. Contrasts were latter compared across sentences. For example, responses to toy cars were noted as was differentiation to small and large cars; similarly differentiation for broken objects, such as broken and intact balls, was noted.

APPENDIX B

APPENDIX B

OBJECT PERMANENCE ASSESSMENT

The object permanence assessment combines procedures derived from the Uzgiris and Hunt (1975) scaling by Corrigan (1978) and Jackson et al (1978). There are 4 main levels of task difficulty: (a) visible hiding, (b) visible displacement, (c) invisible hiding, and (d) invisible displacement. Each level contains 2 or 3 locations for object hiding or displacement. Object permanence steps are summarized below.

Level I: visible hiding

1. Hide object at A, infant finds object.
2. Hide object at B, infant searches at A.
3. Hide object at B, infant searches at A, then B.
4. Hide object at B, infant goes to B first.
5. Hide object at A or B alternatively, infant searches initially at correct location.
6. Hide object at A, B or C alternatively, infant searches initially at correct location.

Level II: visible displacement

7. Hide object under A, then place object by hand under B, infant searches only at A.
8. Hide object under A, then place object by hand under B, infant goes to A then B.

9. Hide object under A, then place object under B; infant searches directly at B.
10. Hide object under A, then place object under B; infant searches directly at B when direction of displacement occurs in either direction.
11. Hide object under A, then displace object to B and then C; infant searches at A or B.
12. Hide object under A, then displace object to B, then C by hand, infant searches at A or B before going to C.
13. Hide object under A, then displace object to B and C by hand, infant searches directly at C.
14. Hide object under A, then displace object to B, then C by hand; infant searches directly at C when displacement occurs in either direction.

Level III: invisible hiding

These steps are the same as those described for visible hiding except the object is first placed inside a small container in front of the attentive infant before hiding; after hiding the object at the terminal location for a trial, the empty container is shown to the infant.

15. Hide container at A, infant finds object at A.
16. Hide container at B, infant searches at A.

17. Hide container at B, infant searches at A before finding object at B.
18. Hide container at B, infant finds object by first searching at B.
19. Hide container at A or B alternatively, infant searches initially at the correct location.
20. Hide container at A, B or C alternatively, infant searches initially at correct location.

Level IV: invisible displacements

These steps are similar to those described for visible displacements, except the object is first placed inside a small container in front of the attentive infant before hiding; after hiding the object at the terminal location for a trial, the empty container is shown to the infant.

21. Displace container from A to B and hide object at B; infant searches only at A.
22. Displace container from A to B and hide object at B; infant initially searches at A before finding object at B.
23. Displace container from A to B and hide object at B; infant first searches at B.
24. Displace container from A to B and hide object at B; infant first searches at B from 1 direction only, searches from A to B from the other direction.

25. Displace container from A to B and hide object at B; infant can search initially at B from either direction of displacement.
26. Displace container from A to B then C, hide object under C; infant searches at A or B.
27. Displace container from A to B then C, hide object under C; infant searches at A or B before finding object at C.
28. Displace container from A to B then C, hide object under C; infant searches at C initially.
29. Displace container from A to B then C, hide object under C; infant searches at C initially from 1 direction only, searches from A or B then C in the other direction.
30. Displace container from A to B then C, hide object under C; infant searches at C initially from either direction of displacement.
31. Displace container from A to B then C, hide object under A; infant searches at C initially before searching at B then A.

These object permanence steps were repeated across 2 sessions. Children were counted as attaining a step when passing that steps 3 times in 1 session.

APPENDIX C

APPENDIX C

Table A

Children 14, 18 and 22 months old passing (p) and
not passing (n) means-end relations scale steps

<u>Age</u>	<u>Sex</u>	<u>H^a</u>	<u>V^b</u>	<u>Extend Reach^c</u>	<u>Necklace</u>	<u>Cage</u>	<u>Box and Stick</u>	<u>Red Board</u>	<u>Filled Ring</u>
14	f	p	n	n	n	n	n	n	n
14	f	p	n	n	n	n	p	n	n
14	f	n	n	n	n	n	n	n	n
14	f	p	n	n	n	n	n	n	n
14	f	p	n	n	n	n	n	n	n
14	m	n	n	n	n	n	n	n	n
14	m	p	p	n	n	n	n	n	n
14	m	p	n	n	n	n	n	n	n
14	m	p	n	n	n	n	n	n	n
14	m	p	p	n	n	n	n	n	n
18	f	p	n	n	n	n	n	n	n
18	f	p	p	n	n	n	p	n	n
18	f	p	n	n	n	n	n	n	n
18	f	p	p	n	n	n	n	n	n
18	f	p	p	n	n	n	n	p	n

^aThis step is the horizontal string pull.

^bThis step is the vertical string pull.

^cThis step is extending reach using a stick.

Table A (cont'd)

Children 14, 18 and 22 months old passing (p) and
not passing (n) means-end relations scale steps

<u>Age</u>	<u>Sex</u>	<u>H^a</u>	<u>V^b</u>	<u>Extend Reach^c</u>	<u>Necklace</u>	<u>Cage</u>	<u>Box and Stick</u>	<u>Red Board</u>	<u>Filled Ring</u>
18	m	n	n	n	n	n	n	n	n
18	m	n	n	n	n	n	n	n	n
18	m	p	n	p	n	n	n	n	n
18	m	p	n	n	n	n	n	n	n
18	m	n	n	n	n	n	n	n	n
22	f	p	p	p	p	n	n	n	p
22	f	p	p	p	p	n	p	p	n
22	f	p	p	n	n	n	p	n	p
22	f	p	p	p	p	n	p	n	p
22	f	p	p	p	p	p	n	n	n
22	m	p	p	p	n	n	p	p	p
22	m	p	n	n	n	n	p	n	n
22	m	p	p	p	n	n	p	n	n
22	m	p	n	n	n	n	p	n	n
22	m	<u>p</u>	<u>n</u>	<u>n</u>	<u>n</u>	<u>n</u>	<u>p</u>	<u>p</u>	<u>n</u>
totals		83%	40%	23%	13%	3%	33%	13%	13%

^aThis step is the horizontal string pull.

^bThis step is the vertical string pull.

^cThis step is extending reach using a stick.