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The Relationship Between Language and Cognitive Development in the Second Year: A Longitudinal Study

Lorrie Sippola

A Thesis

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ABSTRACT
The Relationship Between Language and Cognitive Development in the Second Year: A Longitudinal Study

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Concordia University, 1990

This research tested the validity of the "Specificity Hypothesis" which proposes that children develop certain types of word meanings at about the same time they solve related cognitive problems. The language and cognitive abilities of nine English-speaking children were studied for a period of 12 months. During monthly visits to the lab, four of the Ordinal Scales of Psychological Development were administered to the children. Categorization ability was measured on visits 1,4,7,10, and 13 by an object manipulation task. Samples of the children's language were obtained from a 20-minute free-play situation and from checklists kept by parents between visits. It was expected that the temporal gaps between the age of acquiring a specific cognitive skill and the age of onset of related lexical categories would be shorter than the temporal gaps between specific cognitive skills and unrelated lexical categories. This study also examined the onset of the "naming explosion" and its relation to an object manipulation task in an attempt to determine if there is a specific relationship between categorization ability and language acquisition. Results of the study did not confirm the hypothesis. The temporal gaps between lexical categories and related cognitive abilities were not consistently smaller than the gaps between lexical categories and unrelated cognitive abilities. The study raises questions about the validity of the "specificity hypothesis" and has implications for future research.

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The first two years of life are characterized by a number of accomplishments which are unparalleled at other stages of development. The acquisition of a first language and the ability to represent the world in a symbolic, abstract manner are among the advancements observed during this period. The potential relationship between the achievements in these two domains has provoked much theoretical discussion and empirical research.

Different types of relationships between language and cognition have been proposed by theorists from different schools of thought. Behaviourists, for example, would propose that thought is simply internalized subvocal speech. In other words, language is thought or vice versa. Some behaviourists view the child as a passive recipient of environmental pressures who develops speech through reinforcement, imitation and shaping; principles which are similar to classical conditioning (Bohannon & Warren-Leubecker, 1985). Viewed from this perspective, the only relationship which exists between language and cognition are the underlying principles of training applied to both domains (classical and operant conditioning).

Another view proposes that cognition depends on language. The Whorfian hypothesis proposed that language influences both the logical and perceptual processes of an individual. According to this view, for example, differences in the structures of different languages would result in similar cognitive differences (Cromer, 1988). Both Bates and Snyder (1987) and Cromer (1988) note, however, that developmental research does not support this view and that consideration of developing cognitive abilities is required to

understand language acquisition.

More linguistic approaches assume that language is independent of cognitive functioning. Chomsky has proposed that an innate language component defined as a language acquisition device (LAD) exists in the brain which allows even the very young child to recognize linguistic universals (Bohannon & Warren-Leubecker, 1985). It is this innate ability to recognize linguistically significant sounds which allows the child to comprehend and eventually produce sentences never heard before. Thus, linguists disagree with behaviourists and postulate that language is not deliberately taught to children. Language is viewed as a skill which develops much like any other behaviour which depends on a maturing neural system, such as walking.

A third view which has generated much research in the area considers language acquisition as dependent on developing cognitive abilities. Piaget's views on language and cognition fall into this category and have provided the impetus for most of the empirical investigation of this relationship in early childhood and infancy (Edwards, 1973).

Piaget viewed mental development, including language, as an extension of biological organization and adaptation which allows the individual to interact effectively with the environment (Flavell, 1963). Contrary to others who proposed an innate structure for language development, Piaget argued that the appearance of language during the sensory-motor period of development is more than mere coincidence. This is a period in which the child's intellectual ability has become less reliant on overt sensory-motor functioning and is developing a capacity for inner, symbolic manipulation of

reality (Reiber & Voyat, 1983).

Piaget described six stages of development during the sensory-motor period beginning with the limited reflexive repertoire the child is provided with at birth. Through the processes of accommodation and assimilation, these reflexes are gradually built upon until the child is capable of internal, symbolic representations of sensory-motor problems (Flavell, 1963). Piaget's description provides a general outline of universal behaviours which were believed to act as precursors to linguistic development (Morehead & Morehead, 1974). He proposed that language acquisition is the crowning achievement of the sensory-motor period of development emerging during the sixth stage as the ultimate form of symbolic representation (Corrigan, 1979). Language emerging from this stage was believed to encode the cognitive concepts which had already been acquired (Gopnik & Meltzoff, 1986b).

There are several ways in which the relationship between early language and cognition as proposed by Piaget's theories has been empirically examined. Research conducted on the relationship between cognition and syntax will first be reviewed. This research has typically failed to accurately describe the relationship between language and cognition. Research on the first words used by children may provide a richer source of data from which a clearer picture of this relationship may develop.

The relationship between onset of syntax and cognitive development

A critical issue in research on the relationship between language acquisition and sensorimotor intelligence is the definition of language used. Possibly in response to Chomsky's position that grammatical structures are

innate (Reiber & Voyat, 1983) many authors who followed Piaget's constructivist views (ie. the view that the child's cognitive development results from an interaction between experience with the environment and built-in predispositions) proposed a relationship between the acquisition of syntax and the child's developing cognitive abilities.

Sinclair (1971) noted that cognitive and affective changes occur at around the same time that a child begins to utter first word combinations. These changes promote differentiation between self and the environment which, in turn, promote communication rather than contact. According to Sinclair, first word combinations represent true language in that they involve the use of objective, communicable signifiers. Since sensorimotor intelligence exists prior to the onset of syntax (first word combinations), Sinclair proposed that the cognitive achievements accomplished during this period may provide the infant with the cognitive structures which aid language acquisition.

Edwards (1973) proposed that the notion of the object may be the link between language and cognition which allows the child to acquire language. This author viewed the concept of "object permanence" as the cornerstone which unites all aspects of sensorimotor intelligence (objects, space, causality, and time) into a general picture of the child's world. Similarly the case object in grammar occupies a central position in defining the roles and relations among the rest of the conceptual system. The case object refers to the case of anything representable by a noun whose role in the action or state identified by the verb is identified by the semantic interpretation of the verb itself (e.g. John broke the glass; the table is red). Furthermore, both

the notion of object permanence and the case object are defined and conceptualized in similar action and relational terms; permanent objects are not simply things to which language applies labels but are also things that are understood and known in terms of the relations between objects, between persons and between persons and objects.

In summary, these authors have suggested that since sensorimotor intelligence exists before language (in this case the onset of syntax) it should be possible to determine prerequisite levels of intellectual functioning which would facilitate language acquisition. Furthermore, the object concept appeared to be the appropriate place to begin looking for such a prerequisite. However, empirical studies of the relationship between sensorimotor intelligence and production of multi-word utterances have been unable to provide conclusive support for these theoretical proposals.

In one of the first studies to use an instrument which operationalizes the intellectual achievements of the sensory-motor period described by Piaget, Zachry (1978) attempted to determine whether there are specific sensorimotor pre-requisites of language. He administered the Ordinal Scales of Psychological Development (Uzgiris & Hunt, 1975) to a cross-sectional sample of 24 children ranging in ages from 12 to 24 months. This instrument consists of six scales which contain a variety of items related to the specific intellectual behaviours of the sensorimotor period described by Piaget; object permanence, means-ends, causality, space, imitation and schemes for relating to objects.

Zachry administered five of the six Uzgiris-Hunt scales (object

permanence, space relations, imitation, causality, and means-ends). Only those items of each scale which were classified as representing stage IV, V, and VI functioning were administered. The criteria for each stage were based on Piaget's descriptions of children's behaviours during the sensorimotor period. Children were assigned a stage VI score based on the number of scales passed at the stage VI level. Samples of each child's spontaneous verbalizations from two 20-30 minute free-play situations with a familiar caretaker were also obtained. From this language sample, 16 semantic-syntactic categories of words were derived which corresponded to common parts of speech such as names of objects, action words, modifiers, and demonstratives. Similarly, a set of 17 semantic-syntactic categories for sentences was developed and arranged into four sentence types of increasing grammatical complexity. Language skill was measured according to the number of categories of words and sentences produced.

When the mean number of word and sentence categories used were correlated with the stage VI score, Zachry found an increase in spoken language skill as stage VI score increased. Furthermore, although the children in this study used single words before passing any of the subtests at the stage VI level they did not use sentences before passing at least three of the subtests at the stage VI level. Therefore, Zachry concluded that first words do not depend on representational ability whereas sentences do.

While these results appear to provide some support for Piaget's position, other authors have reported that multiword utterances occur prior to stage VI cognitive functioning. Ingram (1978) also placed subjects in a

particular stage of cognitive functioning based on observing a cluster of sensory-motor behaviours. In a longitudinal study, he found that one of his four subjects used syntax while still in Stage V sensorimotor development. Folger and Leonard (1978) compared the cognitive abilities of children using two-word utterances to those who were in the one-word stage (n=20; ages 14-24 months). The cognitive measures used were the means-ends and object permanence scales from the Uzgiris and Hunt Scales. Results of the study indicate that children in the two-word stage tended to perform at a higher level on the means-ends subtest of the Uzgiris and Hunt scales, however, partial correlations suggested that this effect was due mostly to age. Furthermore, although the majority of children in the two-word group were at stage VI on the means-ends scale, one child in this group did not reach stage VI on any of the subtests.

A problem in research examining the cognitive correlates of sentences or multi-word utterances in an effort to examine Piaget's hypothesis may lie in the definition of language being used. Piaget suggested that language begins when the child is able to use a linguistic symbol which is not tied to her/his ongoing actions (Flavell, 1963). He also suggested that single-word utterances were pre-representational (Piaget, 1954) therefore, the production of multi-word utterances were considered to be indicative of representational functioning. However, other authors have suggested that a clearer relationship between language and cognition may be established by examining the first words used by children rather than first sentences. Bloom (1973) noted that children tend to use single words prior to using syntax and

suggested that these utterances aid a child in discovering the special relationship between the form of speech they hear and particular aspects of their experience. Nelson (1973) also believed that early speech reflects a prior construction of the world which is later extended and refined as speech categories (syntactic and semantic) are acquired.

Researchers have used a variety of methods to examine the relationship between first words and cognitive development which have led to a reformulation of the original Piagetian hypothesis and provided new direction for research in this area.

General measures of lexical and cognitive development

Bates and Snyder (1987) have proposed a local homologies model of the relationship between language and cognition and have suggested that Piaget's original hypothesis fits this model. They suggest that "cognitive development...is related to language development insofar as the two domains are dependent on operative principles common to the two" (p. 269). Their research was aimed at uncovering consistent patterns of correlations between communication ability and cognitive development to support this model.

Bates, Benigni, Bretherton, Camaioni, and Volterra (1977) conducted a four-month study of 25 children from the ages of 9.5 months to 12 months. The Uzgiris-Hunt (1975) scales were used to provide a systematic assessment of cognitive development. As part of a larger study on cognition and communication, they examined the relationship between performance on the Uzgiris-Hunt scales with language ability as measured by frequency of word comprehension, frequency of nonreferential speech, frequency of

referential speech, and number of referential words. Language data was obtained from detailed maternal interviews. All of the six Uzgiris-Hunt scales were administered on each of four visits. A score was assigned for each scale based on the highest level passed at each visit. Results from the study indicate that each of the Uzgiris-Hunt scales predicted comprehension, but only the imitation and means-ends scales predicted production. It should be noted, however, that the measures derived (eg. frequency of referential speech and number of referential words) were not necessarily independent of each other and thus contribute to redundancy in the correlation matrix (Bloom, Lifter & Broughton, 1981). Although this problem could have been corrected by partial correlations, these were not computed, therefore, one cannot conclude that this study provides evidence for the local homologies model of the relationship between language and cognition.

A study conducted by Siegel (1979) reported significant correlations between early cognitive development and later language production. In this study, the cognitive and language development of 148 children from the ages of four months to 36 months was observed. All six of the Uzgiris-Hunt scales were administered at 4, 8, 12, and 18 months. The Bayley measure of cognitive development was also administered at 4, 8, 12, 18 and 24 months. Total scores were calculated for each of the cognitive measures. Language development was measured by the Reynell Developmental Language Scale which was administered at 24, 30 and 36 months. The Reynell provides a global measure of vocabulary which includes vocalizations other than crying, onset of adult-like words (including imitations) as well as

an overall vocabulary count. Furthermore, this study also examined the influence of the home environment through the use of the Caldwell Inventory of Home Stimulation when the children were 12 months of age.

Siegel reported that scores on the schemes, object permanence, means-ends, and space scales of the Uzgiris-Hunt at 4, 8, 12, and 18 months were the most predictive cognitive measure of language development at 30 and 36 months. It was also noted that these Uzgiris-Hunt scores predicted developmental delays in language production at 36 months although they were better at predicting cognitive delays at the same age. However, it should be noted that significant correlations were found between expressive language at 30 and 36 months and almost every other measure used in the study. Furthermore, the author did not use corrections for the multiple correlations which were calculated thereby increasing the possibility of Type I error.

Corrigan (1978) argued that previous studies erred in attempting to find relationships between general measures of cognitive development (ie. stage) and language development. Noting that a child's sensorimotor ability varies according to which skill is being measured (ie. the concept of decalage), Corrigan suggested that the assigned sensorimotor stage would vary according to the scale being used to measure it and also that correlations between general measures of language development and cognitive ability would be moderate because both develop with age. Furthermore, a relationship might emerge between object permanence and particular classes of words.

In Corrigan's study, the cognitive performance of three children (ages ranging from 9 months to 11 months) on a modified version of the Uzgiris-Hunt object permanence scale was observed over a period of 18 months. An object permanence score was assigned to each child based on the number of items passed on the object permanence scale (total=21; ranked in ascending order of difficulty). The language measure was a modified mean length utterance, referred to as a language score, derived by assigning a value of 1.00 to adult-type utterances and a value of .50 to vocalizations. Finally, vocabulary items were classified into semantic categories. Reported in the study were the categories of nonexistence and recurrence.

The results of Corrigan's study yield several interesting results. First, contrary to Siegel (1979) no significant correlation between the general language score and object permanence score was found. This finding has been replicated in following studies (Tomasello & Farrar, 1984). However, the greatest increase in vocabulary items (single words) occurred in either the session in which the child achieved a score of 21 on the object permanence task or the preceding session. Furthermore, an interesting relationship between object permanence score and the use of words to comment on the nonexistence and recurrence of objects or events (i.e. gone, more, etc) was also reported. These words first appeared in the child's vocabulary after attainment of the highest object permanence rank.

In summary, the results of research examining gross measures of cognitive development (eg. overall stage-scores) and gross measures of language development (eg. vocabulary size, frequency of words, etc) have

not provided clear evidence of a relationship between language and cognition. Corrigan's (1978) study, however, provided some insight into a more specific type of relationship which has stimulated research in a new direction.

Relationship between general measures of cognitive development and specific measures of language development

In 1981, McCune-Nicolich provided new direction for investigating the relationship between language and cognition. Corrigan's (1978) study indicated an interesting relationship between specific types of words (relational words which make reference to dynamic states rather than entities; i.e. more, gone, up, open, etc) and stage VI object permanence. McCune-Nicolich proposed that since not all first words contain the same complexity some might be learned later than others and require a more advanced level of object permanence. Specifically, a difference was noted between object words (ie. words which stand for things) and relational words (ie. words which refer to dynamic states, rather than entities). McCune-Nicolich was interested in observing the relationship between the onset of relational words and object permanence level.

The cognitive and language development of five girls (ages 1;2 to 1;6 at the beginning of the study) were studied over a period of seven to 11 months. The subjects were observed monthly in their homes during a thirty-minute free-play session with their mothers. The Object Permanence Scale of the Albert Einstein Scales of Sensorimotor Development was also administered at each session. The results of the study showed that the onset of relational words occurred abruptly in the subjects' lexicons within

one or two sessions of the beginning of the study. Furthermore, all of the subjects had entered stage VI object permanence at the time the study began which suggested that emergence of relational words occurred concurrently with entry into stage VI object permanence.

This study was one of the first to focus on the semantic content of first words and its relation to cognitive development. While it provided a new method of looking at an old problem, some important limitations have been noted by Tomasello and Farrar (1984). First, it is very difficult to establish a pre-requisite level of object permanence functioning for relational words because all of the subjects had entered stage VI prior to the beginning of the study and some were already using relational words. That is, it is difficult to establish a relationship between two structures when there is no variability between subjects on one of them (Bates et al., 1979). Second, the study was criticized because the data were collected in very limited contextual situations and with a long interval between sessions which would make it easier to miss the use of a word. Finally, treating relational words as a group fails to make an important distinction between types of relational words.

Tomasello and Farrar (1984) conducted an intensive, longitudinal study in an attempt to improve upon McCune-Nicolich's findings. The authors were interested in the child's use of present-relational (ie. words referring to the spatial transformation of objects/persons within the child's perceptual field) or absent-relational words (ie. words which refer to transformations that take place either partially or totally outside the child's perceptual field. Modified

versions of the object permanence and means-ends subscales of the Uzgiris-Hunt scales were administered monthly to six 12-month old children for a period of six months. Children were assigned to a particular stage of cognitive development based on their overall performance on these scales. Language samples were obtained weekly from maternal reports of novel words which were supplemented by observation of free-play. Results of the study showed that present relational words appeared first during stage V object permanence while absent-relational words did not appear until stage VI. Furthermore, absent-relational words appeared during stage V means-ends in one subject's vocabulary. This suggested a particular relationship between object permanence and the acquisition of absent relational words.

In summary, Piaget's original hypothesis has not been entirely supported by empirical research. It appears that some forms of language development may not depend on an overall level of cognitive functioning as suggested by Piaget's position that language emerges from the sixth stage of sensorimotor cognitive development. The research of Corrigan (1978), McCune-Nicolich (1981) and Tomasello and Farrar (1984) suggest that a more qualitative analysis of the first words used by children may ultimately reveal a very different relationship to sensorimotor intelligence than other types of language variables (eg. vocabulary size, emergence of syntax, etc). This research has also suggested that particular types of cognitive abilities may be more closely related to particular types of words.

The specificity hypothesis

In a study which examined the meanings children assign to the first

words they use, Gopnik and Meltzoff (1985) found that children tend to use "disappearance words" (eg. "gone") whenever they cannot see an object, when they turn away from an object, and when an object is visibly or invisibly displaced. They hypothesized that the concept of an object's continued existence when it moves out of sight may be related to the development of the object concept which allows the child to deduce the location of an invisibly displaced object. A similar relationship was proposed between the use of words which encode success or failure (eg. "there") and the ability to invent new solutions to means-ends problems using insight. Both involve the ability to consider and compare different plans. Studies examining this relationship have suggested that there are specific links between the child's developing cognitive abilities and the words used to encode similar concepts (Gopnik & Meltzoff, 1986a).

Gopnik (1984) conducted a longitudinal study (six months) of five 15-month old children. Unlike previous studies, children were not assigned to a particular stage of cognitive functioning. Rather, the relationship between the onset of disappearance words (ie. "gone") and the solution of specific items of the Uzgiris and Hunt object permanence and means-ends scales was examined. Results of the study indicate that the word "gone" appeared within a defined period of development related to object permanence. Specifically, this period was not before solution of task 13 on the object permanence scale, in which the child must find an object following one invisible displacement with three screens, but before or during the session in which the child solved task 14, in which the object is found after a series of

invisible displacements by searching in reverse order. Furthermore, this relationship did not exist between the means-ends scale and the word "gone".

Gopnik and Meltzoff (1984) extended these findings using the same subjects as Gopnik (1984) by examining the relationship between the acquisition of success/failure words (ie. "there") to performance on the means-ends scale of the Uzgiris-Hunt instrument. Results of the study indicated that solution of means-ends item 9 (the use of string vertically to obtain object) appeared to be a prerequisite for using success/failure words. None of the children in the study used a success/failure word prior to solving item 9. However, these types of words appeared either at the same time or shortly before acquiring any of the more difficult tasks (items 10-12).

Gopnik and Meltzoff (1986a) reported that the temporal gap between the acquisition of specific cognitive concepts and the use of words to encode these concepts is significantly shorter than the gap between these same concepts and unrelated words. They defined temporal gap as the absolute value between the age at acquisition of ability in one area and another. The study examined the cognitive and language development of 19 children whose ages at the beginning of the study ranged from 13 months 14 days to 19 months 11 days. A selection of items from the Uzgiris-Hunt means-ends and object permanence scales was administered either monthly (n=5), once every 2 weeks (n=6), or every 3 weeks (n=8). Subjects were tested until they had acquired both disappearance words and success/failure words and had passed both object permanence task 14 and means-ends tasks 10-12.

Results of the study showed that the temporal gap between solving object permanence item 14 and the first recorded use of a disappearance word ($\underline{M}$=27.95 days) was significantly shorter than the gap between the first use of disappearance words and solution of means-ends items 10-12 ($\underline{M}$=64.63;z=2.51, p<.05, Wilcoxon test). Similar results were found for the temporal gap between solution of means-ends tasks 10-12 and use of success/failure words ($\underline{M}$=13.53 days) compared to solution of object permanence task 14 and success/failure words ($\underline{M}$=55.68 days; z=-3.38, p<.01, Wilcoxon test). Correlations between the ages at arriving at solutions for each cognitive test and the onset of each word category (disappearance vs. success/failure) also supported the specific relationships.

In summary, Gopnik and Meltzoff (1986a) have suggested a reformulation of the original Piagetian hypothesis. The "specificity hypothesis" proposes that children develop certain types of meanings at about the same time that they solve related conceptual problems. Research which has examined the temporal gap between the acquisition of particular cognitive concepts and examples of words which are believed to encode those concepts lends some support to this hypothesis.

The approach of examining the temporal gap between concepts and related words provides a potential solution to the problem of inferring relationships from correlational data (Smolak & Levine, 1984). Temporal gaps indicate that the order of development is not consistent with Piaget's prediction that language depends on cognitive pre-requisites (Gopnik & Meltzoff, 1986b). In other words, cognitive competence does not always

precede the onset of related words. However, it does suggest some type of relationship in that children appear to be acquiring particular types of words which may be related to the conceptual problems they are in the process of solving.

One of the problems which can be identified in this approach, however, is the use of single words to represent acquisition of particular categories of words. If a child uses a single word to encode a particular meaning it could be argued that they have not acquired the general meaning to which that word applies. It is necessary, therefore, to examine the specificity hypothesis using a more stringent criteria for onset of category of words. Furthermore, it remains to be seen if similar relationships can be found between other types of early words such as locatives (Johnston, 1984), verbs (Huttenlocher, Smiley, & Charney, 1983), and causal connectives (McCabe & Peterson, 1985).

Categorization ability and naming explosion

Bloom, Lifter and Broughton (1981) have been critical of the use of contrived laboratory tasks such as the Uzgiris-Hunt and have identified empirical and theoretical flaws in the development and use of the scales for research on language and cognition. Furthermore, the lack of strong links between performance on this instrument and language development suggest that it should not be considered as the only method for testing the specificity hypothesis.

It has been noted that children will spontaneously manipulate and organize objects from various categories and that a qualitative change in this

behaviour can be observed in the 12-24 month period; a period when the child's language skills are also changing (Gopnik & Meltzoff, 1987). Furthermore, the ability to infer relationships between two different objects is believed to involve representational thought (Sugarman, 1981).

Previous research has shown that young children (eg. 15 months) may spontaneously pick out one group of objects from a given set indicating that they have some recognition of the features which are not shared with the other objects. However, at around 18 months children will spontaneously begin to sort the objects of the set into two groups or categories (Sugarman, 1981) suggesting that older children are motivated to classify objects into categories rather than to simply pick out individual objects which they recognize as sharing common features (Gopnik & Meltzoff, 1987b). Research has indicated that classification ability may have a particular relationship with language development which is qualitatively different than previously measured cognitive abilities (Smolak, 1980) and may serve a role in language development by facilitating the formation and elaboration of semantic and syntactic categories (Nelson, 1973).

Gopnik and Meltzoff (1987a) predicted that the qualitative change in categorization ability noted at 18 months would specifically be related to the "naming explosion", a phenomenon typically reported in the literature as a sudden burst in the acquisition of object names. Both of these tasks involve an ability and an inclination to place objects into categories. Thus they should emerge at roughly the same point in the child's development.

Twelve 15-month old children were observed over a period of five

months. Each child was given a classification level based on the type of grouping behaviour displayed. Level-1 categorization behaviour involved single-category grouping; level-2 involved serial touching of two kinds of objects; and, finally, level-3 involved two-category grouping in which the different types of objects were spatially displaced into two distinct groups. The objects to be grouped were similar to those that had elicited sorting behaviour in other studies; balls vs. pillboxes, rectangles vs. human-like figures, and dolls vs. cars. In addition to the categorization task, selected items from the object permanence and means-ends scales of the Uzgiris-Hunt Scales were administered. The results of this study showed that the naming explosion (defined as the first session in which more than 10 new names were acquired) was found to be closely related to the highest level of categorization. None of the children in the study had obtained the naming explosion before they had demonstrated level-3 categorization. Also, the mean gap (in days) between obtaining level-3 categorization and the naming explosion was significantly smaller than the mean gap between level-3 categorization and the solution of object permanence or means-ends tasks. However, correlations indicate that both level-3 categorization and acquisition of object permanence were both significantly related to the onset of the naming explosion.

Although these results suggest a relationship between categorization ability and the onset of the naming explosion, the relationship does not appear to be unique to categorization skill. Basically, a problem can be identified in this study which is similar to that of earlier research on language

acquisition and cognitive development. The method of measuring categorization ability used by Gopnik and Meltzoff (1987a) is a gross measure because of the nature of the objects included which may not reflect the more subtle changes that occur during the development of this skill.

Developmental research has reported that children acquire basic level names (eg. dog) before other hierarchical names (eg. collie, animal; Anglin, 1977; Brown, 1978; Blewitt and Durkin, 1982). According to Rosch (1978) the basic level category has the highest cue validity providing the most information for the least cognitive effort. Observing the relationship between the child's ability to manipulate objects which represent the basic level of categorization and the "naming explosion" may provide a better understanding of the child's developing language and cognitive abilities. Furthermore, the use of object grouping as a measure of categorization ability may underestimate the children's knowledge of taxonomic classification (Markman, Cox, & Machida, 1981). Mandler, Fivush & Reznick (1987) suggest that if children sequentially touch objects in the same category more often than chance then they must be selecting the items based on their relatedness. However, Gopnik and Meltzoff focused on displacement of objects as their criteria. Previous research has indicated that children in this age group rarely sort objects into separate spatial groups (Starkey, 1981). It is possible that examining order of touches, rather than physical displacement may provide a better method of examining the relationship between categorization skill and language acquisition.

Objectives of the study

Research on the relationship between language and cognition has more recently begun to focus on the particular types of first words children use and the types of cognitive skills they are acquiring. Whereas earlier research focused on the concept of stages of cognitive development researchers have more recently begun to focus on the actual behaviours of children during the sensorimotor period of development. Furthermore, Uzgiris and Hunt (1975) did not equate the tasks on their scales with stage level per se (Bloom, Lifter & Broughton, 1985) and many of the studies reviewed appear to have arbitrarily assigned items to stages "based on Piagetian principles" without explaining the procedures by which they arrived at their assignment (i.e. Zachry, 1978). It has also been noted that the use of different definitions of stage as well as the application of different criteria for passing or failing a particular item within a stage may affect the results obtained (Smolak & Levine, 1984). These observations suggest that one should be examining individual items within the Uzgiris-Hunt scales when trying to establish a relationship between sensorimotor functioning and language acquisition.

Gopnik & Meltzoff (1986a) have proposed the "specificity hypothesis" which suggests that specific temporal relationships exist between particular categories of words and the cognitive concepts they encode. Their research addresses the problems of the use of correlational statistics in this area. Correlations simply reflect the stability of individual differences on two measures and do not provide much of a description of the type of

relationship between them. One way to overcome these limitations is to examine the temporal gap between the acquisition of a particular cognitive task and the onset of related words. The examination of these temporal gaps, however, has been limited to a few cognitive tasks and a very small sample of the first words which are used by children. Furthermore, previous research on the specificity hypothesis has only examined the use of one word as an example of the acquisition of a particular lexical category. It is possible that a more stringent criteria which would more appropriately reflect acquisition of a category of words might provide a more accurate test of the specificity hypothesis.

The goal of this study was to expand upon the research conducted on the specificity hypothesis by examining more categories of words and the different cognitive skills which are developing at about the same time. As noted earlier, most studies have focused on the object permanence and means-ends scales in relation to various categories of words (i.e. success/failure, disappearance, relational, etc). The present study will be the first to examine the relationships between the concepts of space, and causality to the production of words used to encode these concepts. This study will also examine the relationship between the onset of the "naming explosion" and its relation to object manipulation in an attempt to determine if the specificity hypothesis extends to non-Piagetian measures of cognitive development.

If there are specific links between first words and cognitive ability, it is predicted that the temporal gaps between the age of producing a specific

lexical category and acquiring a related cognitive skill in the sensorimotor period, measured by the Uzgiris-Hunt ordinal scales will be shorter than the temporal gaps between acquiring a specific lexical category and unrelated cognitive skills. Furthermore, the age at which a particular lexical category is acquired should be more strongly correlated to the related cognitive concept than to unrelated concepts.

It is also expected that categorization ability at the basic level measured by sequential touching will have a closer temporal relationship with the onset of the naming explosion than any of the Piagetian concepts measured by the Uzgiris and Hunt Ordinal Scales.

Method

Subjects

Subjects were recruited by letters (Appendix A) after obtaining their names from birth lists provided by the Conseil de la Santé et des Services Sociaux du Montréal Métropolitain.

Nine children, six girls and three boys, and their parents participated. All children had English-speaking parents. All of the children were first-born except one girl. The average age of the sample at the beginning of the study was 12.9 months (range= 11.72-13.56; SD=.61) and 24.54 months at the end of the study (range= 23.79-25.43; SD=.45). Neither the subjects nor their parent's received financial compensation for their participation in the study. However, a "graduation ceremony" was held for the group at the end of the year and official certificates of participation were distributed.

Materials

Children were tested in a room in the Department of Psychology at Concordia University. The room was set up to be as warm and inviting as possible in order to make both the parent and child comfortable. Set up like a living room with pictures on the wall, the room contained a table for administering the cognitive tasks, a free-play area and video-recording equipment. The free-play area consisted of a carpet, a loveseat, and a small, square, end table.

Verbal Measures

Measures of the child's verbal ability were obtained from two sources: parental report and transcriptions of utterances produced during a videotaped

free-play period.

In order to keep a record of the child's language development between lab visits, parents were provided with checklists containing 579 words of particular interest to the study (see Appendix B). The words were taken from the Communicative Development Inventory (CDI) WORDS (Bates, Bretherton & Snyder, 1987) which is an inventory containing words that are likely to occur in the expressive vocabularies of infants from 1;0 to 2;0. Parents were asked to record the date when a word first appeared in the child's vocabulary, the context of use, and any variation of the word. It was decided that only recording first words would make the task much less imposing on the parents' time especially as the child's language repertoire increased. Checklists were brought to each lab visit and reviewed by the researchers to ensure that they were kept up to date.

Difficulties with parental reports of their child's developing language skills have been noted by Thal and Dale (1990). These problems include issues such as bias towards overestimating or underestimating their child's ability as well as the lack of specialized training in language development. It is also well known that parents' skills as language diarists tend to vary. However, parental report can provide data that are more representative of infant and toddler language than laboratory samples (Thal and Dale, 1990) since the data are based on more appropnate contexts than could ever be obtained in a clinic or lab. To compensate for the disadvantages of this approach, samples of each child's language production were collected during a free-play session.

The free-play session was a semi-structured, 20 minute play period between parent and child. The dyad was left alone in a room with a box of toys which were intended to initiate verbal production as well as a picture book containing magazine photos of various objects which was being used for a concurrent project on parental labelling. The toys used during this task were selected with the intention of initiating verbal production. A list of the toys used is contained in Appendix C. The parent was instructed to interact with her/his child as they normally would. A list of the objects represented by the picture book is included in Appendix D. All sessions were videotaped to facilitate transcription of the children's verbal utterances.

Cognitive Measures

Standard Piagetian measures of sensory-motor development as well as an object manipulation task were used as measures of each child's cognitive development.

The Ordinal Scales of Psychological Development (referred to as the Uzgiris-Hunt scales) is an instrument which is based on Piaget's behaviourial observations of infants. This instrument is made up of six scales which contain a variety of items related to the specific intellectual behaviours of the sensory-motor period and an ordered listing of commonly observed reactions. The scales are used to assess specific cognitive achievements of infants in the sensorimotor stage of development (Gorrell, 1985). They have been used extensively in research on the relationship between language and cognition (Bloom, Lifter, & Broughton, 1985). Four of the six scales were administered in the following order:

1) The Development of Visual Pursuit and the Permanence of Objects; test the ability to visually and/or manually search for hidden objects;

2) The Development of Means for Obtaining Desired Environmental Events; tests the extent to which a child attempts to influence or problem-solve;

3) The Development of Operational Causality; a test of the child's ability to understand and try to activate some environmental event;

4) The Construction of Object Relations in Space; a test of the child's ability to understand and use containers and recognize space.

Uzgiris and Hunt have ordered the items within each scale in terms of difficulty and have obtained an approximate age when it could be expected that a child would successfully complete a particular task. Several of the items are related in that they seem to measure similar cognitive abilities, therefore, Uzgiris and Hunt state that it is not necessary to administer all of them to obtain a measure of the child's functioning. A sample of items from the space and causality subscales were selected which correspond to an increasing level of cognitive functioning according to the age at which a child could be expected to succeed. The items selected for the means-ends and object permanence subscales correspond to those used by previous researchers with the goal of facilitating a comparison between the results of this study with others. (See Appendix E for a description of the items administered) A list of the objects used in administering the Uzgiris and Hunt Ordinal Scales of Development is included in Appendix F.

The critical behaviours for inferring achievement on any item within a scale were similar to those described by Uzgiris and Hunt (1975). The criteria for giving a child credit with passing an item were adapted from several studies which have used the scales (Gopnik & Meltzoff, 1984; 1986A; Bates, et al., 1979) In the present study, a large number of tasks are being administered to the children during a single testing session, therefore, the number of trials administered varied to facilitate the most accurate assessment of each child's abilities in accordance with the original philosophy of Uzgiris and Hunt (1975). Consequently, the ages of the children when they first obtained the following pattern of success was used in the study:

1) if only one or two trials were administered, the child must pass all trials;

2) if three trials were administered, the child must pass at least two;

3) of four or five trials the child must pass at least three;

4) of six trials, four must be passed;

5) of seven trials (the maximum recommended trials for any particular item), at least five must be passed.

The difficulty with assigning stages to the Uzgiris and Hunt scales has been noted earlier; therefore, this study examined the age when the child passed a critical item on each scale. Critical items for the object permanence and means-ends scales were adapted from Gopnik and Meltzoff (1984), and Gopnik and Meltzoff (1987). These authors found that the critical items for inferring the acquisition of a particular cognitive concept were task 14 of the object permanence scale and any one of tasks 10-12 of the means-ends scales. The critical items for the causality and space scales were selected

based on the presumed ordinality of the scales (Uzgiris and Hunt, 1975). These were item seven and item eight of the causality and space scales respectively.

All administrations of the Uzgiris-Hunt scales were videotaped. Two observers who were unaware of the language development of the children scored the scales from the videotapes. Reliability of scoring between observers was obtained by examining the number of agreements over the total number of items administered.

An object manipulation task was also administered. Several toys, small enough to be easily manipulated by the child, served as the stimuli. The size, colour and texture of each toy varied. Three levels of categories were administered as part of an ongoing larger project; however, only one level was used in the current study. The "basic" level was represented by the categories of dogs, cars, trucks, horses, tables and chairs. Five toys were used for each category. (see Appendix G for a complete list of objects used and Appendix H for a detailed description of the comparison sets). Two different categories were presented at a time, therefore, the child was presented with a total of 10 different objects per trial (five objects per category). Results were obtained from two different trials at the basic level per session.

Children were seated on their parent's lap facing the experimenter. Parents were asked to avoid naming or touching the objects during the session to prevent them from indicating to the child which box they should go in. Transparent, plastic containers were placed on the table in front of the

experimenter, who showed the blocks to the child. After a warm-up trial with two different colours of blocks the test items were administered in the following manner. Ten objects (five from each of two categories) were set up in a scrambled array out of the child's reach. Once the experimenter had the child's attention she showed her/him that there were two different things on the table. The experimenter then placed one exemplar from each category into each box stating that "things like this go in this box, and things like this go in that box." The remaining items were then placed in front of the child and the instructions to put things that go together in the boxes were repeated.

If the child removed the exemplar from the box it was replaced only once and the child was told again that "things like this go in this box". If an object was dropped or pushed out of reach it was unobtrusively put back. If the child did not show any interest in any of the objects or showed too much interest in any single object, the experimenter encouraged her/him by passing her hand over all the items in a circular motion saying "What can you do with these? Can you put them in the boxes?" Each trial lasted two and one-half minutes or until all the toys were placed in the boxes, whichever came first. Each child received six trials; two at each category level (i.e. superordinate, subordinate, and basic). The trials were randomized to prevent any effects due to the order of presentation and also so that two trials at the same level never occurred consecutively (see Appendix I for a protocol sample).

All object manipulation trials were videotaped to enable coding. The

videotapes of the object manipulation task were analyzed for mean run length (MRL): the number of objects belonging to the same category which a child touches in sequence. The mean run length determines whether or not the sequential touching exhibited by a child differs significantly from chance performance (Mandler, Fivush, and Reznick, 1987). If a child sequentially touches items from the same category more often than would be expected by chance it would be expected that they are selecting these items based on their relatedness. The formula for calculating run length expected by chance was also taken from Mandler, Fivush, and Reznick (1987). This formula is based on the principle that once an item has been touched there are n-1 items left from that category that could be touched next and n items from the other category.

$$E[\text{run length}] = \frac{n}{n-1} \times \frac{\frac{n-1}{2n-1}}{1 - \frac{n-1}{2n-1}^{2}}$$

The following rules were followed to code sequential touching in the object manipulation task. 1) If ten seconds passed between touches, a break in the sequence of touches was coded. 2) A touch was not considered a part of a sequence if the attention of the infant was drawn to an object by the parent or experimenter or if two objects from two different categories were touched simultaneously. 3) A single touch was coded when the same object was touched in succession or when the infant touched two objects from the same category simultaneously. 4) Finally, if the infant was holding an object in her/his hand and touched other objects with it, the touches were counted

as part of the sequence as long as the child's attention was not only on the object held in her/his hand.

Inter-rater reliability for MRL was obtained by two observers who were unaware of the child's level of development on either the language measures or the Uzgiris and Hunt scales. Pearson correlations between the runs observed by each coder were calculated to determine the reliability of coding.

Procedures

The children were tested once every four weeks for a total of 13 sessions. During the first lab visit, parents were informed of the procedures of the study and signed consent forms (Appendix J). In this and subsequent sessions, the child's language and cognitive development was assessed by one of two female researchers.

The vocabulary checklist was given to each parent on the first visit. They were instructed on the manner in which the checklists were to be used and told to bring the checklists back on each subsequent visit for review by the researchers.

Measures of sensory-motor development and language samples were obtained at each visit, however, due to the length of test administration the object manipulation task was administered only during sessions 1,4,7,10 and 13. The order of administration for each child was as follows: Uzgiris and Hunt Scales, object manipulation, and free-play.

Parents were present throughout the testing session. Appendix K contains the general instructions given to the parents during the testing session. All sessions were video-taped and lasted for approximately 60-90

minutes depending on the number of tests to be administered.

Language Coding

Free-play transcriptions

Rules for transcribing the child's utterances in the free-play situation and the context in which they were made were adapted from language transcription guidelines developed by Bloom & Lahey (1978). Transcription rules are included in Appendix L and Appendix M contains a transcription sheet used in the study. All transcriptions were in English orthograph.

The video-tapes were transcribed by the author who was blind to the level of cognitive development of the subjects. Reliability of transcriptions was obtained by having another blind observer transcribe a random selection (15%) of the free-play sessions. Reliability was calculated by dividing the number of agreements between transcribers by the total number of utterances recorded (see Appendix N for detailed reliability rules).

Management of language data

Once all of the sessions were transcribed, each word and the context in which it was used were entered into an SPSSX data file to facilitate analyses by allowing the researcher to organize the information alphabetically, chronologically and by word category. The free-play data were combined with the words obtained from parents' checklists (rules for entering data can be found in Appendix O). Thus, data from both the checklists and free-play sessions were used as a single source of information about the child's productive language development.

Each word was coded for lexical category, order of occurrence (eg.

first, second, or third use), use in a multiple word utterance or by itself, source of information (free-play or checklist), frequency (up to 3), and the total number of times a particular word was assigned to any category. (See Appendix P) for a more detailed description of the coding scheme). A total of 8,439 words were coded. Appendix Q shows the breakdown of the total language sample into lexical categories.

Criteria for crediting a word as part of the child's productive language was based on previous language research (Nelson, 1973; Gopnik, 1986). First, the word had to be phonologically similar to the adult form. The word also had to be uttered spontaneously and not simply an imitation of an adult's utterance. Finally, it had to occur at least twice in different contexts regardless of the source (checklist or free-play) and not only in the same routine (eg. use of "down" only in a nursery rhyme).

If a word was recorded by a parent without any context the child would be credited with the word if it also occurred in the correct context in the free-play session. This additional criteria was established because of the number of words which were recorded in the checklists but for which the parents had not provided a context (n-538). A total of 763 words met all of the above criteria (types).

After all of the words were coded it was noticed that a large number of words had been recorded in the checklist with the appropriate context were not reproduced in the free-play sessions (n=1331). It is possible that the free-play session did not provide enough stimulation to gather a broad sample of different words. Furthermore, the inclusion of the picture book

task in the free-play session stimulated many imitations of parents' vocalizations. Therefore, words recorded in the checklists with the appropriate context were also included in the child's vocabulary. Combining these words with those which met the criteria described above meant that a total of 2094 words out of the 8,439 words coded were used in the final analyses.

Coding of Language Categories

Several categories of words were developed from the existing literature on language development (Benedict, 1979; Cox & Richardson, 1985; Goldfield & Reznick, 1990; Gopnik, 1981; Huttenlocher, Smiley, & Charney, 1983; Johnston, 1984; McCabe & Peterson, 1985; Nelson, 1974; Smith & Sachs, 1987; Tomasello, 1987). A description of each category will be found in Appendix R. It will be noted that there are more categories described than used in the current study. While developing the coding scheme it was found that many of the first words used by the subjects had meanings which did not fit into the categories being examined. As a result, the list was extended to include 17 categories which may be used for future research. Appendix S contains a detailed list of examples from each category.

As mentioned earlier, this study will be examining the age at acquisition of a particular word category in relation to performance on the various Uzgiris-Hunt scales. Consequently, the criteria selected which would indicate acquisition of a category of words was the production of two different types of words from each category (eg. allgone and more would indicate understanding of the category of absent-relational words). The age at

acquisition of the second word from a category was used in the final analyses. Only four of the categories were examined in the current study.

Absent-relational words were defined as words that refer to the transformation of people, objects or events that take place either partially or totally outside of the child's perceptual field. This includes transformations of objects that are initially present and then disappear (eg. gone), transformations of objects that are initially absent and then appear (eg. find, more) and transformations of objects that are initially absent and remain absent (eg. all gone, no shoes).

Volition words encode intentionality, desire, need, or an ability to do something (eg. want, need, have to, etc). This category also includes words such as "no" or "there" when these are clearly used in relation to success or failure of a planned action which is not an accident. Gopnik and Meltzoff (1986) referred to this category of words as "success/failure" words.

Two additional categories of words were used in the study to examine the specificity hypothesis. Locative words require locating something or putting something in a specific location. These include locative search words (eg. where, look at), locative actions (eg. put in) and spatial prepositions (eg. up, down, on, off, in, out, over, under, etc).

Causative terms and causal connectives were combined into one category. Causative terms were identified as words which encode a change of state of the object (eg. break, dry, cook, cover, etc). These words are different from general action words in that they encode relations involving change including spatial transfers or other changes in the state of affairs of

an object. The critical feature of the causal term is that the initiator's movement is efficacious in causing change whereas action words simply encode characteristic motions or sounds of initiators that do not produce easily observable change (eg. cry, cough, run, sing, talk, etc). Causal connectives were defined as words which encode logical, physical or psychological causality (eg. because, so, therefore, why, etc.).

Inter-rater reliability was established for the language categories by the author and a research assistant. The entire vocabulary used by one subject (N=2008 words) was coded by both. Examining the vocabulary of one of the most verbal children ensured a sample of all categories would be available for reliability. Reliability was determined by the number of agreements over the total of all agreements and disagreements.

Naming explosion

The criteria for determining the onset of the naming explosion was adopted from Gopnik and Meltzoff (1987). These authors found a sharp increase in naming at the point at which more than 10 new names were acquired. They suggest, therefore, that an appropriate criteria for the naming explosion is the session in which more than 10 new names have been acquired. They argue that criteria such as the session with the greatest increase in vocabulary does not capture the first, sudden burst of naming because of the increase in vocabulary that is related to age. Therefore, the age at which the child first acquired 10 new names in his/her vocabulary was used as the criteria for the naming explosion.

Results

Before examining the relationship between the cognitive and linguistic variables it is important to consider the developmental pattern of each domain and to compare it with other research. First, reliability of the coding scheme for the language data and scoring of the cognitive measures will be examined. Next, the data obtained from each measure used in the current study will be compared with previous research. This will be followed by analyses of the relationships between the linguistic and cognitive variables. For all variables, skewness and outliers were assessed using SPSSX frequencies. No transformations were required.

Inter-rater reliability

Reliability between transcribers of the free-play sessions was calculated by the number of agreements over the total number of utterances recorded. Results indicate that the transcriptions from the video-tapes were reliable with an 86% agreement level.

Reliability of the coding system for word categories was calculated by the number of agreements over the total number of words used by one child. Overall reliability between coders was 87%. Inter-rater reliabilities for each lexical category were also calculated. The lowest level of agreement for any of the lexical categories used in the present study was 95.1%.

Reliability of the scoring of the Uzgiris-Hunt scales was obtained by examining the number of agreements over the total number of behaviours coded during the Uzgiris and Hunt administration. Raters agreed on 91% of the total behaviours observed.

Finally, inter-rater reliability for scoring of the object manipulation task

was calculated by examining the Pearson correlations between the run lengths scored by two independent coders for 20% of the trials administered. The overall reliability was established at r=.89.

Linguistic Development

In order to ensure that the language development of the sample of children studied was within normal limits, the language development of the children being studied was compared to previous research. The monthly rate of vocabulary growth for each child is displayed in Figure 1. The average size of vocabulary at the beginning of this study was 2.11 words (sd=3.9; range= 0-12). At the end of the study (M age=24.54 months) the average vocabulary size was 233 words (SD=122; range=104-493). This is similar to the findings of Nelson (1973) who reports an average vocabulary of 185.9 words (SD=94.89; range=28-436) by the end of the second year.

Age at acquisition of the first 50 words (M = 19.53 months; SD=2.28) is also comparable to Nelson's (1973) study (M = 19.6 months; SD=2.89) and to a recent study by Goldfield and Reznick (1990). These authors report an average age at acquisition of the first 50 words to be 19.23 months.

The age at which the second exemplar of the four word categories used in the study was produced for each subject is presented in Table 1. Four of the subjects did not meet the criterion of obtaining at least two different words for the relational category. One of these subjects also did not use any words from either the causal or volitional categories. For these subjects, the age at the end of the study was used as the age of acquisition for these lexical categories.

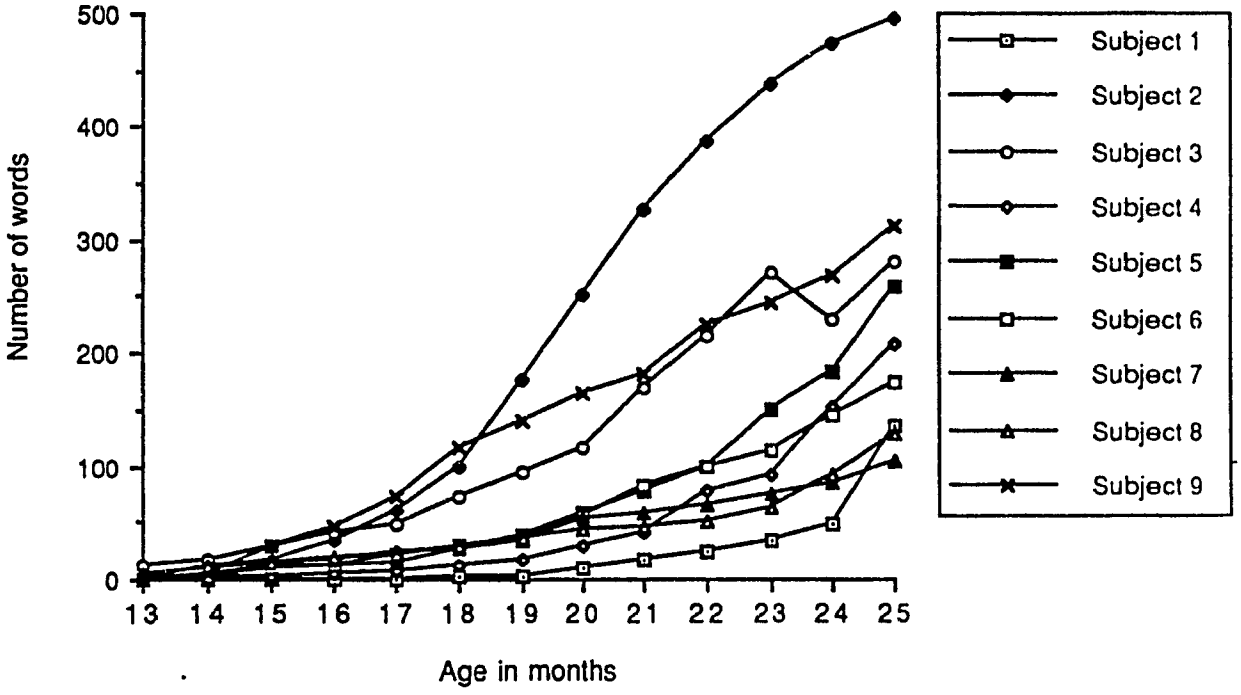

Figure 1. Rate of vocabulary growth

Table 1

Age (in months) at Acquisition of Lexical Categories

Subject	Lexical Category			
Number	Relational	Locative	Causal	Volition
1	24.39[a]	21.66	19.69	22.43
2	20.52	19.85	17.69	19.85
3	21.89	17.39	18.89	19.79
4	24.66[a]	21.62	19.89	21.72
5	24.52	20.52	19.79	21.69
6	24.26[a]	20.46	17.43	20.46
7	24.00	22.07	19.23	22.07
8	23.79[a]	17.00	23.79[a]	23.79[a]
9	19.00	15.75	17.69	19.69
Means	23.00	19.59	19.34	21.28
SD	2.05	2.30	1.93	1.42

[a]Categories not acquired; data replaced with age at end of study

In Table 2, the order of acquisition of lexical category is displayed. Scalogram analysis of the order of acquisition could not be completed because of the small sample size. Upon visual examination of the pattern, however, it appears that a fixed order of acquisition may exist. The first words used by all of the children in this study were names for objects/people (classified as object words or general nominals; hereafter referred to as "object"). Of the lexical categories examined in the present study, relational words were the last to be acquired. Furthermore, the causal and locative categories tend to emerge prior to either the volitional or relational categories. This order of acquisition is similar to previous studies (Corrigan, 1978; Gopnik, in press).

Six of the nine subjects who participated in this study acquired at least one word from the absent-relational category. Three of these words were "gone" and three were "more". Table 3 presents the first and second word used from each category. However, three of the children (33%) did not use any absent-relational words during the study. This is contrary to other studies which indicate that absent-relational words are generally acquired by children in their second year (e.g. McCune-Nicolich, 1981; Gopnik & Meltzoff, 1986). Surprisingly, not all of the children in this study produced the absent-relational word "gone". Four of the children did not use the word "gone" at all during the free-play sessions nor was it reported in the mother's checklists. The average age when "gone" appeared in this sample's language, when only the children who actually produced the word are examined, is 19.02 months (SD=4.98). This is later than reported by

Table 2

Order of Acquisition of Lexical Categories

Subject	Order of Acquisition				
1	Object	Causal	Locative	Volition	Relational[a]
4	Object	Causal	Locative	Volition	Relational[a]
5	Object	Causal	Locative	Volition	Relational
2	Object	Causal	Volition	Locative	Relational
7	Object	Causal	Volition	Locative	Relational
3	Object	Locative	Causal	Volition	Relational
9	Object	Locative	Causal	Volition	Relational
6	Object	Causal	Volition/Locative		Relational[a]
8	Object	Locative	Causal/Volition/Relational[a]		

[a]Categories not acquired

Table 3

First and Second Words Produced in Each Lexical Category

SUB		RELATION	LOCATIVE	CAUSAL	VOLITION	OBJECT
1	1st	--	here	open	no	tree
	2nd	--	there	up	there	cluck
2	1st	allgone	look	up	no	scarf
	2nd	find	outside	down	want	clock
3	1st	allgone	down	do	no	book
	2nd	more	out	eat	there	slipper
4	1st	--	there	down	no	bathtub
	2nd	--	in	eat	want	dog
5	1st	more	outside	down	no	girl
	2nd	gone	there	eat	want	flower
6	1st	--	outside	go	no	bottle
	2nd	--	here	wait	there	cat
7	1st	more	there	go	no	baby
	2nd	allgone	back	get	want	doggie
8	1st	more	up	--	--	raisin
	2nd	--	outside	--	--	shoes
9	1st	allgone	up	down	no	lamp
	2nd	all done	on	get	more[a]	bread

[a]Context of more clearly indicates the child's desire to obtain an object

previous studies (eg. McCune-Nicolich, 1981).

The vocabularies of the children who did not use absent-relational words does not appear to be different from those who did produce these words (see Appendix T which contains the composition of each subject's vocabulary by lexical category used in the present study).

The average age of acquisition of volitional terms appears to be comparable to previous reports (Bretherton, McNew and Beeghly-Smith; 1981). Finally, the age of acquisition of both causal and locative terms appears to be within normal limits according to previous studies (Huttenlocher, Smiley, & Charney, 1983; Tomasello, 1987).

The rate of acquisition of nouns for each child is presented in Figure 2. The mean age of onset of the naming explosion (20.32 months) is comparable to previous studies (eg. Goldfield & Reznick, 1990), however, this age is older than reported by Gopnik and Meltzoff (1987; 18.33 months).

In summary, it appears that the language development of the children in this study is comparable to other research, although some discrepancies between the present study and previous research by Gopnik (Gopnik, 1986; Gopnik, 1987) are apparent.

Cognitive development

Uzgiris-Hunt scales

As indicated in Table 4, the average age at which children passed the critical item for each scale is somewhat lower than would be expected according to Uzgiris and Hunt (1975). Similarly, the age at which children in this study passed item 14 of the Object Permanence Scale (M=14.97;

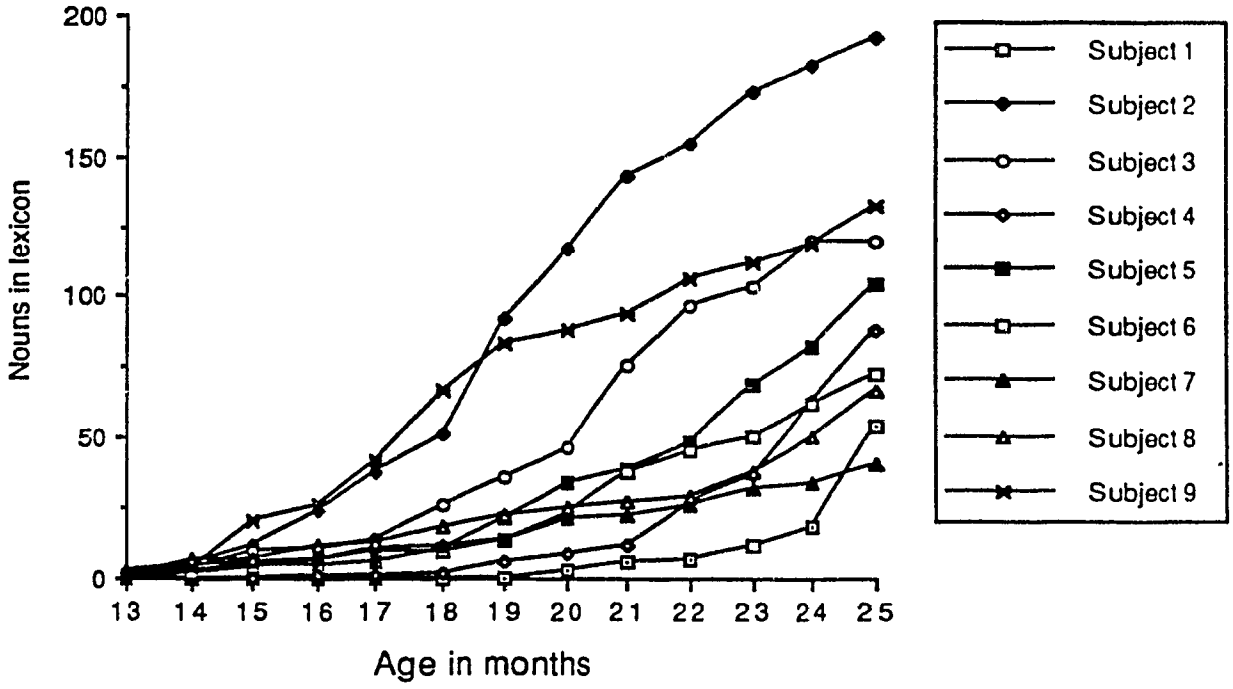

Figure 2. Rate of acquisition of nouns

Table 4

Age (in months) at Passing Critical Item on Uzgiris-Hunt Scales

Object Subject	Uzgiris-Hunt Scale			
	Permanence	Means-ends	Causality	Space
1	13.92	17.03	13.92	13.92
2	13.56	14.59	14.59	14.59
3	14.43	16.46	14.43	15.62
4	15.23	14.30	14.30	14.30
5	13.89	14.95	15.85	14.95
6	14.82	15.98	12.79	18.20
7	15.69	18.37	14.62	16.62
8	19.43	22.85	14.33	15.46
9	13.75	15.82	14.85	19.69
MEAN	14.97	16.71	14.41	15.93
	17.00[a]	19.00[a]	18.00[a]	15.00[a]

[a]Average ages taken from Uzgiris & Hunt (1975)

SD=1.82) and any of items 10-12 of the Means-Ends Scale (M=16.71; SD=2.63) appears to be much earlier than reported by Gopnik and Meltzoff (1986). The children in that study passed item 14 of the object permanence scale at an average age of 17.84 months and items 10-12 at an average of 18.46 months.

The order of passing the critical items of each cognitive scale for each subject is displayed in Table 5. It will be noted that there is not as clear an order of development of the cognitive measures as previously observed for the language measures. Furthermore, three of the children passed three of the critical Uzgiris and Hunt items during the same session.

Ordinality within the Uzgiris-Hunt scales

The items selected from the Uzgiris-Hunt object permanence and means-ends scales were identical to those administered by Gopnik and Meltzoff (1986). These authors examined the ordering of the cognitive developments and found the following order of acquisition; on the object permanence scale, task 13 tended to be solved prior to task 14. This order of passing items within the object permanence scale was replicated in the present study: seven of the nine subjects passed item 13 before or at the same time of passing item 14. The order in which items were passed on the means-ends scale, however, does not replicate the study by Gopnik and Meltzoff (1986). Those authors reported that on the means-ends scale task 9 was clearly solved before any of tasks 10-12 and tasks 10-12 of the means-ends scale were solved in any order. In the present study, only one of the nine subjects passed item 9 prior to item 10.

Table 5

Order of Acquisition of Uzgiris and Hunt Scales and Object Manipulation Task

SUBJECT	PATTERN
1	Object-Permanence/Causality/Space Means-Ends Categ[a]
2	Object-Permanence Means-Ends/Causality/Space Categ
3	Object-Permanence/Causality Space Means-Ends Categ
4	Causality/Means-Ends/Space Object-Permanence Categ
5	Object-Permanence Means-Ends/Space Causality Categ
6	Causality Object-Permanence Means-Ends Space/Categ
7	Causality Object-Permanence Means-Ends/Space Categ
8	Categ Causality Space Object-Permanence Means-Ends
9	Categ Object-Permanence Causality Means-End Space

[a]Categ=Object manipulation task

The average ages at which the sample passed each of the critical items on each of the scales is presented in Table 6. This order is comparable to that obtained by Uzgiris and Hunt (1987). However, an examination of the order of acquisition of all of the items within each scale (see Appendix U) reveals a large number of deviations from the order originally proposed by Uzgiris and Hunt (1975). Deviations were identified as "any instance where the higher of two adjacent steps was judged to have been attained earlier than the lower one...if a higher-level step was attained earlier than two lower steps, this was counted as two deviations" (Uzgiris, 1987; p. 149). In the current study, the percentage of deviations from the expected sequence was 38%. This is considerably larger than previous studies. In a longitudinal study, Uzgiris (1987) reports that, of the items administered, only 14% deviated from the expected order of acquisition.

As will be noted in Appendix U, some items appear to deviate most from the predicted sequence. On the object permanence scale, item 8 appears to deviate most often from the predicted sequence. Item 5 accounted for six of the seven deviations on the causality scale. Finally, items 6 and 7 appear to deviate most on the space scale. However, the deviations on the means-ends scale are not clearly the result of any particular item.

Object Manipulation Task

The children in the present study passed the criteria of MRL greater than chance at an average age of 15.43 months (range: 11.72 - 24.52 months). This appears to be correspond to findings from other

Table 6.

Average Ages at Passing Each Item of the Uzgiris-Hunt Scales

Item	OP	Item	ME	Item	CAUS	Item	SPACE
4	13.24	6	13.01	5	13.94	5	13.39
8	14.40	7	13.45	6	14.34	6	15.54
10	13.37	9	16.88	7	14.41	7	14.21
13	14.91	10	16.46			8	15.93
14	14.96	11	17.55				
15	17.06	12	19.18				

research (Mandler et al., 1987).

Relationships between Language and Cognitive Variables

Language Categories and Uzgiris-Hunt Tasks

The first analysis examined the relationship between words from each category and the cognitive tasks from the Uzgiris and Hunt scales. As noted earlier, four of the nine subjects did not use at least two words from the relational category. Consequently, this category was not included in the final analyses. It was expected that the temporal gaps between the age at acquiring the second word from a particular language category and the age at first solving the critical cognitive items on the related Uzgiris-Hunt scales would be shorter than the temporal gaps between language categories and the unrelated scales. Three repeated measures ANOVAs were conducted to examine the temporal gaps between the language categories and the Uzgiris-Hunt critical items. For example, the temporal gap between the age at acquisition of the volitional category of words and the age at passing the critical Uzgiris-Hunt item on the means-ends scale (volitional - means-ends) was compared to the temporal gaps between the volitional category of words and the unrelated scales (eg. volitional - object permanence; volitional - causality; volitional - space). The average temporal gaps between lexical categories and the related and unrelated Uzgiris-Hunt scales are displayed in Table 7. Two of the ANOVAs (volitional; $F(3,24)=3.03$; $p<.05$ and causal; $F(3,24)=3.97$;$p<.02$) indicated main effects due to the temporal gaps (see Tables 1-3 in Appendix V).

Univariate repeated-measures t-tests with Bonferroni corrections were

Table 7

Average Gap (in days) Between Age at Production of Lexical Categories and Age at Passing Uzgiris-Hunt Scales

	Related Gaps[a]		Unrelated Gaps[b]	
	Vol-ME	Vol-OP	Vol-CAU	Vol-SP
	139.35	192.39	209.47	163.14
SD	59.06	37.96	49.10	86.72
	Loc-SP	Loc-OP	Loc-CAU	Loc-ME
	142.16	161.18	161.78	131.79
SD	72.33	67.12	80.	71.80
	Caus-CAU	Caus-OP	Caus-ME	Caus-SP
	150.50	133.42	80.39	122.95
SD	59.81	31.29	50.51	70.56

[a]Absolute value between age of acquiring a lexical category and the age when first passing critical item of related cognitive scale

[b]Absolute value between age of acquiring a lexical category and the age when first passing critical item of unrelated cognitive scales

used as a post-hoc comparison to determine which temporal gaps were different. The mean gap between the volitional word category and the means-ends scale was significantly shorter than the gap between the same word category and the object-permanence scale ($t(8)=-3.91$; $p<.004$). Although the related gap was also smaller than either of the remaining unrelated gaps (volitional category - causality scale; $t(8)=-2.42$; $p<.04$ and the volitional category - space scale; $t(8)=-.73$; $p<.49$), these differences were not significant after Bonferroni corrections.

The temporal gaps involving two of the scales which were predicted to be unrelated to the causative category of words were smaller than the temporal gap involving the causal scale ($t=2.42$; $p<.04$ and $t(8)=1.93$; $p<.09$ respectively). However, these differences also did not remain significant after Bonferroni corrections.

Another way to examine the relationship between the Uzgiris-Hunt items and the word categories used in the study is to consider the correlations between the age at which the subjects acquired a category of words and the age at which they first passed the critical items on the related cognitive scales. Higher correlations were expected between lexical categories and related cognitive concepts than between lexical categories and unrelated cognitive concepts. Pearson correlations presented in Table 8 do not support the predicted relationships. Although the size of the correlation between the volitional category of words and the means-ends scale is significant ($r=.6950$; $p<.05$), a larger, significant correlation was observed between volitional words and the object-permanence scale ($r=.7317$; $p<.05$).

Table 8

Pearson Correlations Between Age Passing Uzgiris-Hunt Scales and Age at Acquisition of Lexical Categories

Lexical Category	Uzgiris-Hunt Scale			
	Object-Perm	Means-Ends	Causality	Space
Volitional	.7317*	.6950*	.0311	-.4373
Locative	-.2002	-.2830	-.1308	-.4730
Causal	.8517**	.7786*	.1684	-.4183

Note. **p<.01

*p<.05

Finally, significant correlations were found between the age at which children acquired the causative category of words and the ages at which they passed the critical item on the object-permanence scale (r=.8517; $p<.01$). Similarly, significant correlations were also found between the acquisition of the causative category and passing any of the means-ends tasks 10-12 (r=.7786; $p<.05$). The correlation between the causative category of words and the solution to the causal scale was not significant (r=1684; $p>.05$).

Acquisition of Exemplars of Word Categories and Object Permanence and Means-Ends Skills

One of the most consistent findings in research on the "Specificity Hypothesis" has been the relationship between absent-relational words such as "gone" and performance on the Uzgiris-Hunt Object Permanence scale (see Gopnik & Meltzoff, 1986). A relationship between volitional words such as "no" and "there" (defined as success/failure words by Gopnik & Meltzoff,1986) and the Means-Ends scale has also been reported. Since these are the words which have typically been used in examining temporal gaps, univariate repeated measures t-tests with Bonferroni corrections were conducted on the temporal gaps between onset of these words (first use) and passing item 14 of the object permanence scale and items 10-12 of the means-ends scale of the Uzgiris-Hunt.

In Table 9 the mean gaps (in days) between onset of the word "gone" and passing of the related or unrelated Uzgiris-Hunt scales are displayed for those children who produced the word "gone" (n=5). Contrary to expectations, the mean gap between the use of "gone" and the object-

Table 9

Mean Gap (in days) Between Age at Onset of "Gone" and Passing Uzgiris-Hunt Scales

Related Gap	Unrelated Gaps		
GONE-OP	Gone-ME	Gone-CAU	Gone-SP
125.23	95.77	106.81	121.63

permanence concept was the largest gap found, however, none of the temporal gaps were significantly different.

The mean gaps (in days) between the first use of "no" or "there" to encode intention or desire (volition) and passing of the related and unrelated items on the Uzgiris-Hunt scales are displayed in Table 10. Subject number 8 was not included in these analyses because this subject did not use either of these words. The mean gap between the use of either "no" or "there" and the related cognitive concept (means-ends) was smaller than any of the other scales. However, after Bonferroni corrections, the related gap was only significantly smaller than the temporal gap between the use of "no" or "there" and the solution of item 14 on the object permanence scale ($t(7)=-3.44$; $p<.011$).

Relationship Between Naming Explosion and Object Manipulation

The temporal gaps between age of onset of the naming explosion and each of the cognitive tasks were examined using univariate, repeated-measures t-tests with Bonferroni corrections. It was expected that the gap between the naming explosion and mean run length (MRL) would be smaller than the gap between the naming explosion and any of the Uzgiris-Hunt scales. Results indicated that the mean gap between the age of onset of the naming explosion and the age at of obtaining a MRL greater than chance was unexpectedly larger than any of the gaps between the naming explosion and the Uzgiris-Hunt scales (see Table 11). The temporal gap between the naming explosion and passing items 10-12 of the means ends scale appears to be the shortest temporal gap, although it is not significantly different.

Table 10

Mean Gap (in days) Between Age at Onset of "No/There" and Passing Uzgiris-Hunt Scales

Related Gap	Unrelated Gap		
No/There-ME	No/There-OP	No/There-CAU	No/There-SP
160.12	206.75*	206.52	167.33

*p<.05 Bonferroni Corrections

Table 11

Average Temporal Gap Between Age at Naming Explosion and Age at Passing Criteria for Cognitive Tasks

Related Gap	Unrelated Gaps			
Exp-OBJMAN	Exp-OP	Exp-ME	Exp-CAU	Exp-SP
192.96	163.18	116.71	180.26	166.74

Note. OBJMAN=Object manipulation task

Pearson correlations (see Table 12) also do not indicate a particular relationship between the object sorting task and the naming explosion.

Table 12

Pearson Correlations Between Naming Explosion and Cognitive Tasks

	Uzgiris-Hunt Scale				
	Object-Perm	Means-Ends	Causality	Space	Objman
Explosion	.50	.50	-.31	-.41	-.32

Note. Objman=Object manipulation task

Discussion

The purpose of the present study was to examine the relationships between the acquisition of particular lexical categories and the emergence of specific cognitive abilities. More specifically, the validity of the "specificity hypothesis" proposed by Gopnik and Meltzoff (1986) was investigated. It was expected that temporal gaps between each lexical category and the related cognitive task would be smaller than the temporal gaps between lexical categories and unrelated cognitive tasks.

Relationships Between the Uzgiris-Hunt Scales and Language Development

The expected relationships between performance on the Uzgiris-Hunt Ordinal Scales of Development and acquisition of related lexical categories did not emerge. Although the temporal gap between the acquisition of the volitional category of words and the related cognitive scale (means-ends) was smaller than the temporal gap between volitional words and the object permanence scales, the gap was not significantly different from either the causal or space scales. Furthermore, this relationship was not unique to the volitional category of words. As indicated by the temporal gaps, the means-ends scale was also more closely related to the acquisition of locative and causal terms and the naming explosion.

An attempt to replicate previous studies (ie. Gopnik & Meltzoff, 1986; Gopnik & Meltzoff, 1987) which reported a relationship between specific words and cognitive concepts also failed to find support for the specificity hypothesis. Although, the average temporal gap between the onset of the use of the success/failure words "no" or "there" and passing any of items 10-12 on the means-ends scale was smaller than any of the unrelated gaps, the

same relationship was observed between the onset of the use of the word "gone" and the means-ends scale. This is contrary to Gopnik and Meltzoff (1986a; 1987) who have consistently found that the use of "gone" was more closely related to the solution of item 14 of the object permanence task than to the means-ends scale.

Although these results appear to suggest that the ability to solve problems using insight is the only cognitive skill related to language development some problems in the current study have been identified. When the data obtained from the linguistic and cognitive measures used in this study are compared to previous research some discrepancies can be noted. Specifically, it appears that the children in the current study are acquiring some of the lexical items at a later age and are passing the critical items of the Uzgiris-Hunt scales at an earlier age than the children studies by Gopnik and Meltzoff (1986).

Language Development

In general, the language development of the children in the present study appears to be normal according to measures of vocabulary size and age of acquisition of the first 50 words. Furthermore, the acquisition of each lexical category also appears comparable to previous research. However, some discrepancies can be found between the present study and studies by Gopnik and Meltzoff (1986; 1987).

First, three of the children did not use any absent-relational words during the study. This result was completely unexpected. Previous studies have suggested that children should be using at least one absent-relational

word by 24 months (McCune-Nicolich, 1981; Gopnik and Meltzoff, 1986). Furthermore, much of the specificity hypothesis is based on the relationship between the word "gone" and cognitive development. It is surprising that, contrary to Gopnik (1984), the word "gone" was not produced by four of the nine subjects in the present study. It is possible that the structure of the free-play situation was such that it did not provide the child with the stimulation to use absent-relational words. Parents of the children were requested to name objects in a picture book as part of another study. Consequently, the 20 minute "free-play" session consisted of at approximately 10 minutes naming objects in a book. Furthermore, there were a substantial number of repetitions of words which may also have resulted in a limited number of toys available to stimulate conversation between parent and child. However, other researchers have also found that children do not spontaneously utter absent-relational words in their second year. Tomasello and Farrar (1984) report ages for use of absent-relational words which were estimated from follow-up interviews at 24 months of age for five of the six subjects. That is, five of the six children in that study also did not use any absent-relational words during weekly interviews or play sessions nor were these words recorded in the mothers' diaries of their childrens' vocabularies. Clearly, more investigation into the types of relational words used by children will have important implications for the specificity hypothesis if the relationship is specifically between the acquisition of <u>one</u> type of absent-relational word (eg. "gone").

Secondly, it appears that the children in the present study are

acquiring the volitional category of words at least two months later than the children studied by Gopnik and Meltzoff (1986; 1987). However, the results obtained in the present study appear to be comparable to other researchers in the area of language development. Bretherton, McNew and Beeghly-Smith (1981) reviewed several studies and report that the average age of acquisition of volitional terms was 21.4 months (SD=2.19; range=20 -25 months). The average age of acquisition of the volitional category of words in the present study was 21.28 months (SD=1.42; range=19.69-23.79). Gopnik and Meltzoff (1986) report an average age of 18.47 months (SD=1.86; range=15.18-22.89 months). It is possible that the criteria used for crediting a child with acquisition of a lexical category (ie. the production of at least two different types of word from each category) may contribute to this discrepancy. The average age at when the children in the present study acquired their first word from each lexical category (17.47 months; SD=.82) is more comparable to the results obtained by Gopnik and Meltzoff (1986). However, it also raises the question of what constitutes an understanding of the meaning of a category of words. Once again, if the specificity hypothesis relates only to specific examples of words from each lexical category and not to the category itself then the present study indicates that more research needs to be conducted on the production of those words.

The results of the language data obtained in the present study have important implications for future research. Gopnik has studied the use of "success/failure" and "disappearance" words extensively in developing the specificity hypothesis (Gopnik, 1984; Gopnik & Meltzoff, 1985). However, the

present study clearly indicates that other types of relational words emerge prior to these and further suggests that not all children use the same words to encode a particular cognitive concept. For example, four of the nine subjects in the current study did not use the word "gone" during the course of the study. Furthermore, the linguistic and cognitive development of these children did not appear to be different from those subjects who did use this word.

The pattern of onset of production of the lexical categories in the current study were consistent across all subjects in the study. That is, children acquired the absent-relational categories last. Few studies have examined the order of acquisition of these lexical categories in a longitudinal study. It would be interesting to see if the pattern of acquisition of these lexical categories can be confirmed in future research and if a similar pattern of development of cognitive skills can also be determined.

Ordinal Scales of Development

As noted earlier, the children in the present study passed the critical items of the Uzgiris-Hunt scales much earlier than previous studies. The earlier age of acquisition of the Uzgiris-Hunt items may have been due to the lenient criteria used for crediting a child with passing an item (ie. first pass of the critical item from each scale). Some researchers have used a criteria of passing an item in two successive sessions before giving a child credit for that item. Gopnik and Meltzoff (1986; 1987) reported two studies which used two different criteria for passing an item on the Uzgiris-Hunt scales. In the 1986 study, the authors examined the ages of the children at the second

successive pass of a critical item (eg. item 14 of the object permanence scale). The average ages for passing the critical items on the object permanence scale was 17.84 months. The average age at the second successive pass of the critical item of the means-ends scale (eg. any of items 10-12) was 18.46 months. However, another study conducted by the same authors (Gopnik & Meltzoff, 1987) suggests that the criteria used (ie. one or two passes) should not affect the age at which the child is credited with acquiring a particular cognitive skill. These authors reported that the average ages at which the children first passed item 14 of object permanence scale was 17.13 months. The average age when any of items 10-12 from the means-ends scale was first passed was 17.18 months. All of these ages are considerably older than found in the present study. Consequently, the less conservative criteria for considering a child's acquisition of a particular cognitive skill (first pass) does not necessarily explain the difference in ages.

It is possible that the children in the present sample may have been advanced in terms of their cognitive development as measured by the Uzgiris-Hunt scales. This would simply have made the expected gaps larger, however, a substantial number of items were "passed" at the same age which greatly reduced the variability one would normally expect between the acquisition of the different concepts (eg. Corrigan, 1978). Reducing the sample size by removing those subjects who passed several of the critical items for the different scales during the same session did not significantly change the results: the means-ends scale continued to be more closely

related to the categories of words examined than any of the other cognitive scales (see Appendix W for temporal gaps of reduced sample). The distortion of data due to administration errors may provide some explanation for these results.

A substantial number of deviations from the expected order of acquisition of items within each scale was found in the present study. Examination of the video-tapes of the administration of the Uzgiris-Hunt scales suggests that the research assistant failed to ensure that the child being assessed had actually passed an earlier item before ending the administration of that item. Consequently, the administration of some of the items stopped prematurely. The scale which had the most deviations due to administration errors was the means-ends scale. As seen in Table 6, seven of the nine subjects had deviations in the order of acquisition of items on this scale which were due to administration errors. The deviations appear to be randomly distributed across the items, therefore, one cannot conclude that the deviations may have been the result of the characteristics of any one particular item. However, administration errors cannot explain the deviations found on the remaining scales. Of the 20 deviations observed on the object permanence scale only one deviation was due to administration errors; the causality and space scales had only two and three deviations respectively which were due to administration errors.

The use of differential criteria for inferring success on the Uzgiris-Hunt scales has been noted to affect the results obtained (Corrigan, 1979; Smolak & Levine, 1984). The present study attempted to use similar criteria as

previous studies, however, deviations from the expected order of acquisition of items within each scale suggest that the procedures for administering the scales may also affect the results obtained. Unfortunately, there is a lack of information concerning administration procedures used by previous research which would allow others to assess the researcher's methodology. The present study suggests that a closer examination of the administration of the items used by different researchers is warranted.

Finally, the results of the present study add to the growing criticisms of the manner in which the Uzgiris-Hunt scales are being used in research in language and cognition (Bloom et al, 1981; Bloom et al, 1982). Some authors have criticized the use of the Uzgiris-Hunt Ordinal scales as a measure of Piagetian concepts of cognitive development on theoretical and empirical grounds (Bloom, Lifter, & Broughton; 1981). The critical items used in the research on the specificity hypothesis reflect behaviourial skills the child is acquiring and not necessarily the cognitive concepts which reflect Piaget's theories. Bloom, et al. (1981) point out the individual differences in the acquisition of the concepts of the sensorimotor period. Furthermore, they state that the ordinality of the Uzgiris-Hunt items are empirical in nature and not necessarily logical according to Piagetian theory. The focus of the scales is on whether a child displays a particular behaviour in response to an elicited situation and not on <u>how</u> the problems were solved. Bloom, et al. (1982) have suggested that the solution to some of these tasks may be the consequence of repeated administrations rather than the result of the organization of knowledge.

Object Manipulation and the Naming Explosion

Another goal of the present study was to determine if a more specific relationship could be found between the naming explosion and early categorization skills. Since children tend to acquire basic-level names first in their vocabulary, it was expected that a relationship between the onset of the naming explosion and the ability to differentiate between basic-level categories of objects measured by sequential touching would emerge. The results obtained did not confirm this hypothesis.

The ages at which the children in the present study passed the criteria for the object sorting task were much younger than the ages of the children studied by Gopnik and Meltzoff (1987) who examined spatial displacements of objects. This difference in ages of acquisition of the two different criteria (object grouping vs. sequential touching) is to be expected according to the literature on sequential touching (Sugarman, 1982; Starkey, 1981) and, thus, may account for the inability of the current study to replicate the relationship between object sorting behaviour and the naming explosion.

Gopnik and Meltzoff (1987) suggest that the ability to sort objects into different categories must be related to the naming explosion because both involve the inclination to place objects into categories. However, the objects used in that study appear to be unrelated to things that the child would actually be trying to attach a name to during the naming explosion (eg. yellow rectangles and transparent pillboxes). The present study used objects which were more ecologically valid in that they were objects for which the child more likely would have been acquiring the names (eg. dogs, cars, etc).

It is possible that different results may have been obtained had similar criteria for categorization (ie. object grouping) been used in the present study for object sorting at the basic-level category. The videotapes of the present study may be reviewed in future using this criteria to facilitate a clearer understanding of this finding.

Conclusions and Recommendations for Future Research

The results of the present study do not clearly support the specificity hypothesis. Although some difficulties in the administration of the Uzgiris-Hunt scales were identified, in general, the expected relationships between the onset of lexical categories and related cognitive concepts did not emerge.

Gopnik and Meltzoff have repeatedly demonstrated links between the acquisition of particular cognitive skills measured by the Uzgiris-Hunt scales and the production of types of relational words. The specificity hypothesis suggested that there are common concepts underlying the child's development in the two domains, however, the links found in previous research appear to be fragile and applicable to only a very few words and cognitive skills. Consequently, the specificity hypothesis appears to be a simplistic approach to a very complicated question. Although it may provide some evidence for a relationship between language and cognitive development it may be extremely limited in its application to language development in general.

Until the present study, the research on the specificity hypothesis had only examined the production of words encoding disappearance and success/failure. These words are easily recognized as words which encode

a particular concept (eg. gone). However, young children often use single words to encode a variety of meanings some of which include intentionality, desire, and disappearance (eg. the word "cookie" to comment on a cookie which was present but now is gone or to indicate the desire to have a cookie; McCune-Nicolich, 1981). Although it might be argued that these meanings are tied to the context in which the word occurs it is apparent that the semantic intent of these words is very similar to the types of cognitive skills being measured by the Uzgiris-Hunt scales. Furthermore, the application of adult-like meaning to the early speech of a child has been criticized for not taking into account the variety of meanings the young child is trying to express with a limited vocabulary (Kagan, 1981). Future research may be directed towards analyzing the semantic intent of an utterance from the context of the situation in which it was uttered and the relationship between this type of analysis and the child's developing cognitive skills.

In conclusion, the relationship between language and cognitive development appears to be extremely complex theoretically and difficult to examine empirically. It is possible that more than one type of relationship exists between language and cognition at various points of development. Bloom (1981) has proposed an "integration model" which views the relationship between language and cognition as "neither parallel nor serial but rather interdependent o. overlapping. Thus, developments in the two domains may or may not co-occur, but they will always influence and transform one another across the first years of life. In addition, the ways in which they influence one another may vary considerably across this developmental

period." The lack of consistent findings in research using various methods of measuring cognitive abilities, and various linguistic variables, suggests that Bloom's model may be the most valid. Consequently, future research should clearly define the period of language development being examined (eg. first words vs. multi-word utterances) and attempt to find better measures of the child's developing cognitive abilities. The acquisition of symbolic play (Shore, O'Connell & Bates, 1984), the observation of spontaneous, naturally occurring behaviours vs. elicited situations (Bloom, et al.; 1981), and the development of special populations (eg. autistic and mentally retarded children; Sigman & Ungerer; 1984) may assist in developing a clearer understanding of the relationship between language and cognition.

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Appendix A

Recruitment Letters Sent to Parents

January 31, 1986

Dear Parent(s):

My students and I will be conducting a study on language development in infancy beginning in February 1986. This research project will require 12 infants to come to our laboratory at Concordia once a month for 12 consecutive months. Each visit will consist of the administration of cognitive and verbal tasks and will last about 45 minutes. In addition, the parents will be required to keep a diary of their child's vocabulary during the 12 month period.

All the subjects included in the final sample will be first-born, full term babies with no hearing or visual impairments. They will be coming from unilingual English-speaking families where one parent is the primary caretaker of the child. Upon special permission, we were allowed to consult the birth lists from the Conseil de la Santé et des Services Sociaux du Montréal Métropoliltain. We selected your name on the basis of the information provided on these lists and would like to invite you to participate in our study.

There will be no monetary compensation for your participation. However, we will reimburse you the return taxi fare or parking fees for your monthly visit to the laboratory. Being involved in such a project should provide you with a unique opportunity to participate in the observation of your child's language skills as they develop.

If you have any questions about our project, we will be happy to answer them when we call you in a few days. We hope to determine at that time whether you are interested in participating in our research.

Sincerely yours,

Diane Poulin-Dubois,Ph.D.
Assistant Professor
Department of Psychology
Concordia University

Appendix B

List of Words Used in Parental Checklist

1. Animals (Real or Toy)

animal
bear
bee
bird
butterfly
cat
cow
dog
donkey
duck
elephant
fish
frog
giraffe
horse
lamb
lion
monkey
mouse
pig
puppy
rabbit
squirrel
tiger
turtle
other(s)

2. Vehicles (Real or Toy)

airplane
boat
bus
bicycle
car
motorcycle
stroller
train
truck
vehicle
other(s)

3. Food

apple
banana
beans
bread
butter
cake
cookie
cheese
cereal
carrots
coffee
egg
food
fruit
juice
meat
milk
orange
peach
pear
potato
raisin
toast
vegetable
water
yogurt
other(s)

4. Clothes

belt
bib
boots
button
coat
diaper
dress
gloves
hat
jacket
jeans
mittens
necklace

pajamas

pants

scarf

shirt

shoe(s)

slipper(s)

sneaker

snowsuit

sock(s)

sweater

swimsuit

underpants

zipper

other(s)

5. Body Parts

ankle
arm
belly-button
buttocks/bottom/bum
ear
eye
face
foot/feet
finger
hair
hand
head
knee
leg
lips
mouth
nose
penis
shoulder
teeth
toe
tongue
vagina
other(s)

6. Toys

ball bat
beads
Bert
Big Bird
block
book
bubbles
chalk
Cookie Monster
clown crayon
dolly/baby
doll/dollhouse
Ernie
football
game
page

pen
pencil
puzzle
Raggedy Ann/Andy
Snoopy
story
teddybear
toy
other(s)

7. Household Items

basket
blanket
bottle
bowl
box
broom
brush
bucket
camera
can
clock/watch
comb
cup
dish
fork
garbage
glass/glasses
hammer
heater
jar
key
knife
lamp
light
money
mop
nail
napkin
picture
pillow
plant
plate
pocketbook/purse
radio

scissors
soap
spoon
telephone
tissue/kleenex
towel
vacuum
other(s)

8. Furniture and Rooms

bathroom
bathtub
basement
bed
bedroom
bench
chair
closet
couch/sofa
crib
door
drawer
dryer
furniture
garage
high chair
kitchen
living room
oven
porch
potty/toilet
refridgerator
rocking chair
room
shower
sink
stairs
stove
table
tv
washing machine
window
other(s)

9. Outdoor Objects

barbeque
birdhouse
cloud
flag
flower
garden
grass
house
ladder
lawnmower
moon
pool
rain
rock
roof
sandbox
shovel
sky
slide
snow
snowman
sprinkler
star
stick
sun
swing
tree
water
wind
wood
other(s)

10. Places

beach
camping
circus
downtown
farm
gas station
church
home
movie
outside
park

party
picnic
playground
school
store
tore
woods
work
yard
zoo

11. People

aunt
baby
babysitter's name
babysitter
boy
clown
cowboy
daddy
doctor
fireman
friend
girl
grandma
grandpa
Indian
lady
mailman
man
mommy
nurse
(own name)
people
person
policeman
teacher
uncle

12. Words about Space

above
around
away
back
behind
down

here
here's
in/inside
in there
into
off
on
on top of
out/outside
over
there
under
up
up in
other(s)

13. Words about Time

afternoon
day
later
morning
night
now
time
today
tomorrow
tonight
yesterday

14. Pronouns

he
her
hers
him
his
I
it
me
mine
my
myself
that

their
them
these
they
this
those
us
we
you
your
your's
other(s)

15. Qualities, Attributes, and Qualifiers

all
all gone/gone
another
any
asleep
awake
bad
better
big
black
blah
blue
brown
careful
clean
cold
cute
dark
dirty
dry
each
empty
every
fast
fine
first
full
gentle
good
green
happy
hard

heavy
high
hot
hungry
hurt
last
little
long
loud
mad
more
naughty
new
nice
noisy
none
old
orange
other
ouch
poor
pretty
quiet
red
sad
salty
scared
short
sick
sleepy
slow
soft
some
sticky
stuck
thirsty
tiny
tired
wet
white
windy
yellow
yucky
other(s)

16. Question Words

how
what
when
where
which
who
why
other(s)

17. Verbs

bite
blow
break
bring
brush
build
bump
buy
call(on phone)
change
chase
clap
climb
close
comb
come
cook
cover
cry
cut
dance
draw
drink
drive
drop
dry
dump
eat
fall/fall down
feed
find
finish
fix
get

get up/down
give
go
gonna get you
help
hide
hit
hold
hug
hurry
hurt
jump
kick
kiss
knock
let's go
lick
lie
look
love
open
paint
play
pour
pretend
pull
push
put
read
ride
rip
rock
run
say
see
shake
share
shopping
show
sing
sit down
skate
sleep
smile
spill
spit
splash
stop

sweep
swim
swing
take
taste
tear
tell
think
throw
tickle
touch
turn around
turn on/off
wait
walk
wash
watch
wipe
work
write
other(s)

18. Exclamations

Boo
bye bye
goodbye
help
hello
hi
oh boy
oh gosh
Ok
ouch
please
see
shh
stop it
thank-you
uh-oh
your welcome
other(s)

19. Activities & Games

bath
breakfast
choo-choo
dinner
lunch
nap
pattycake
peek-a-boo
pee-pee
snack
this little piggy
other(s)

20. Miscellaneous (auxilliaries, articles, prepositions, etc.)

am
and
are
because
can
could
did
does
gonna
gotta
havta
lemme
let
like
me too
need to
no/yes
ought to
should
try/tryin to
wanna
was
were
will
would
other(s)

Appendix C

Toys Used in Free-Play

1. "Playskool" alphabet blocks (purchased at Toy World).
2. "Duplo" plastic blocks; six of which are used in the sorting task.
3. "Jumboni" train engine which has a clock face on front with hands that turn, a squeaker, coloured movable beads on sides, and a wheel which turns and reveals names and pictures of animals, fruit, plants, etc.
4. Two plastic, toy telephones.
5. Two puppets; one which is large enough for the parent, one which is small for the child.
6. Nerf ball; also used for the Uzgiris-Hunt instrument.
7. A small train engine.
8. A cardboard fruit puzzle.

Appendix D

Object List for Picture Book Task

Page	Item	Page	Item
1	Poodle	16	High Heel shoes
2	Kitchen table	16	sneaker
3	Race car	16	moccasin
4	Cowboy hat	16	cowboy hat
5	Polar bear	16	Work shirt
5	Panda bear	17	German Shepard
6	Sofabed	17	Poodle
6	Bunk beds	17	Semi-truck
6	Brass bed	17	Sofabed
7	Semi-truck	17	T-shirt
7	Tow truck	18	Ping-Pong table
7	Pickup truck	18	Polar bear
8	Work shirt	18	Moccasin
8	Dress shirt	18	Ocean Liner
8	T-shirt	19	Convertible
9	Collie	19	Rocking chair
9	Polar bear	19	Tuque
9	Owl	19	Swan
10	Coffee table	20	Top hat
10	High chair	20	Collie
10	Sofabed	20	Coffee table
11	Stationwagon car	20	Station wagon
11	Sailboat	21	Panda
11	Semi-truck	21	Bunk beds
12	Tuque	21	Dress shirt
12	T-shirt	21	Pickup truck
13	Eagle	22	Bunk beds
13	Owl	22	Sneaker
13	Poodle	22	Sailboat
14	Brass bed	22	Panda bear
14	Rocking chair	23	Pickup truck
14	High chair	23	High heel shoe
14	Arm chair	23	Owl
14	Kitchen table	23	High chair
15	Sailboat	24	Dress shirt
15	Ocean Liner	24	Arm chair
15	Canoe	24	Eagle
15	Race car	24	Canoe
15	Tow truck		

Appendix E

Tasks Administered from the Uzgiris and Hunt

Ordinal Scales of Psychological Development (1975)

Scale 1: The Development of Visual Pursuit and the Permanence of Objects

Situation:

4. Finding an object which is completely covered (3)
   a) loses interest
   b) reacts to loss, but does not obtain object
   c) pulls screen but not enough to obtain object
   *d) pulls screen off and obtains object
   Other:_____

8. Finding an object after successive visible displacements (3-5)
   a) does not follow successive hidings
   b) searches only under the first screen
   c) searches under screen where object was previously found
   d) searches haphazardly under all screens
   e) searches in order of hiding
   f) searches directly under the last screen in path
   Other:_____

10. Finding an object following one invisible displacement (3)
   a) loses interest
   b) reacts to loss, does not search
   c) searches only in the box
   *d) checks the box and searches under the screen
   *e) searches under screen directly
   Other: _____

13. Finding an object following on invisible displacement with three screens (5-7)
   a) loses interest
   b) searches haphazardly under all screens
   *c) searches directly under correct screen
   Other: _____

14. Finding an object following a series of invisible displacements (4-6)
   a) searches only in E's hand

b) searches only under first one or two screens in the path
*c) searches under all screens in the path in the order of hiding
*d) searches directly under the last screen in the path
Other: _____

15. Finding object following a series of invisible displacements by searching in reverse of the order of hiding (2)
a) searches only under last screen
b) searches haphazardly under all screens
*c) searches systematically from the last screen back to the first
Other: _____

Scale 2. The Development of Means for Obtaining Desired Environmental Events

Situation

6. Use of the relationship of support (2)
a) Reaches for object on the support
b) tries to get object by climbing
c) appeals to another person to get the object
*d) pulls the support after demonstration
*e) pulls support without demonstration
Other:_____

7) Understanding of the relationship of support (1-2)
a) pulls support expecting to obtain object
b) pulls support but reaches for object at same time
*c) does not pull support without the object on it
Other:_____

9) Use of string vertically (2-3)
a) indicates desire for object, ignoring the string
b) drops string to floor and becomes unhappy
c) plays with the string itself
d) pulls the string, but not sufficiently to get the object
*e) pulls string and obtains object after demonstration
*f) pulls string and obtains object without demonstration
Other:_____

10) Use of stick as means (2)
   a) plays only with stick
   b) reaches for object, disregarding stick
   c) plays with stick and object, does not get object closer
   *d) uses stick to get object after demonstration
   *e) uses stick to get object without demonstration
   Other:_____

11) Foresight in the problem of the necklace and the container
   a) does not try to put necklace into container
   b) attempts to put necklace in, but fails repeatedly
   c) succeeds in putting necklace in after several unsuccessful attempts
   d) invents a method which is successful after a failure
   *e) adopts a method which is successful from the first
   Other:_____

12) Foresight in the problem of the solid ring (2-3)
   a) does not stack rings
   b) uses force in trying to stack solid ring repeatedly
   c) attempts to stack solid ring once and avoids it subsequently
   *d) sets aside the solid ring without attempting to stack it
   Other: _____

Scale 4. The Development of Operational Causality

Situation

5) Behavior to a spectacle created by an agent (1-2)
   a) shows interest only during spectacle
   b) shows excitement, but no dominant act during pauses
   *c) a dominant act during pauses suggests a "procedure"
   *d) touches E and waits during pauses
   *e) attempts to imitate E
   Other:_____

6) Behavior to a spectacle created by an agent acting on an object (2-3)
   a) shows interest only during spectacle
   b) a dominant act during pauses suggests a "procedure"
   *c) touches E or the object and waits
   *d) gives object back to E
   e) attempts to activate object
   Other: _____

7) Behavior to a spectacle created by a mechanical agent (1-2)
   a) plays with object only
   b) makes object perform its activity manually
   c) touches E or object and waits
   *d) gives object back to E
   *e) attempts to activate object mechanically after demonstration
   *f) attempts to discover a way to activate object mechanically before demonstration
   Other: _____

Scale 5. The Construction of Object Relations in Space

5) Recognizing the reverse side of objects (2-3)
   a) grasps object with no sign of appreciation of reversal
   b) withdraws hands and appears surprised at reversal
   *c) grasps object, but turns it around immediately or by comparing both sides indicates appreciation of reversal
   Other: _____

6) Using the relationship of the container and the contained (2-3)
   a) does not put objects in; only touches those inside
   b) takes object out, does not put any in
   c) puts objects in and takes them out one by one
   *d) puts or drops objects in, reverses container to get them out
   Other: _____

7) Placing objects in equilibrium one upon another (2-3)
   a) does not try to build tower
   b) approximates two objects, but does not leave the second on the first
   *c) builds a tower of at least two objects
   Other:_____

8) Appreciating gravity in play with objects (2-3)
   a) does not attempt action
   b) acts without showing appreciation of gravity
   *c) acts with appreciation of the force of gravity
   Other: _____

Appendix F

Materials Used in Administering Uzgiris-Hunt Scales

1. One clear plastic box, 7" x 5 1/2" x 4"
2. Three screens made of folders taped to trimmed coat hangers
3. One hand towel
4. One yellow plastic car, 4" x 2 1/2"
5. One yellow plastic baby bottle
6. One blue, plastic car, 4" x 2 1/2"
7. One battery operated durm, cymbal and Christmas carol-playing bear, 11" tall
8. Two metal bells on a twist tie
9. Several mechanical wind-up toys; a bear riding a unicycle, a gorilla that flips over, a hopping dog, a bird that hops and pecks, and a Fisher Price radio which plays "Over the Rainbow".
10. Five small articles for the object permanence scale; a bird, airplane, truck, motorcycle and tiny doll
11. One stuffed animal on a long string
12. One string of large beads 22" long
13. One helicopter, 4" long, with moving propellers
14. Playskool wooden blocks (same as those used in free-play)
15. One set of Fisher Price stacking rings
16. One wooden dowel, 18" long.

Appendix G

Materials Used in Object Sorting Task

2 clear plastic boxes, 7" x 5 1/2" x 4"

6 identical "Duplo" blocks, 3 yellow and 3 red (for familiarization trial)

Test Stimuli (all stimuli are toy models of objects)

SUPERORDINATE CATEGORIES:

1. Furniture: round table, grandfather clock, couch with flowered upholstery, bed, chair.
2. Vehicles: car, truck, train, airplane, motorcycle
3. Animals: bird, cow, horse, grizzly bear, dog (German Shepard)

BASIC CATEGORIES:

1. Table: 2 round wooden tables, 1 oval table, 1 square table, 1

Appendix H

Stimuli Used in Comparison Sets for Object Sorting Task

Level of Abstraction	Category: Animal	Vehicles	Furniture
Superordinate	dog	car	table
	horse	truck	chair
	cow	airplane	bed
	bear	motorcycle	couch
	bird	boat	clock
Basic	dogs	cars	chairs
	horses	trucks	tables
Subordinate	poodles	sedans	kitchen chairs
	collies	sports cars	rocking chairs

Appendix I

Contents of Protocols Used in Object Sorting Task

A1 = Animals vs. Vehicles

A2 = Animals vs. Furniture

A3 = Vehicles vs. Furniture

B1 = Dogs vs. Horses

B2 = Cars vs. Trucks

B3 = Chairs vs. Tables

C1 = Poodles vs. Collies

C2 = Sedans vs. Sports cars

C3 = Kitchen chairs vs. Rocking chairs

Protocols: (randomized)

1. A1-B3-C2	3. A3-B1-C3	5. B1-C2-A2
A2-B2-C1	A2-B2-C3	B2-C3-A1
A3-B1-C3	A1-B3-C1	B3-C1-A3
2. A2-B2-C3	4. A1-B3-C1	6. B2-C1-A3
A1-B3-C1	A3-B1-C2	B1-C3-A1
A3-B1-C2	A2-B2-C3	B3-C2-A2

7. B3-C1-A3
   B1-C2-A2
   B2-C3-A1

8. B3-C2-A2
   B2-C1-A3
   B1-C3-A1

9. C1-B2-A2
   C2-B3-A1
   C3-B1-A3

10. C2-B3-A1
    C3-B1-A3
    C1-B2-A2

11. C3-B1-A3
    C1-B2-A2
    C2-B3-A1

12. C1-B3-A1
    C3-B2-A2
    C2-B1-A3

Appendix J

Parental Information and Consent Form

Mother's name:_____ Occupation:_____

Mother's education:_____

Father's name:_____ Occupation:_____

Father's education:_____

Infant's name: _____ Gender:_____

Birthdate:_____

Address _____

_____ Telephone:_____

Language at home:_____

The objective of this study is to study children's language and cognitive development during the second year of life. We will be videotaping your child's behavior once amonth and will provide you with a check-list to record the development of your child's vocabulary. All data will be confidential.

_____

Diane Poulin-Dubois,Ph.D.
Assistant Professor

The nature and purpose of this research have been satisfactorily explained to me and I agree to allow my child to participate in the study as described above. I understand that we are free to discontinue participation at any time if I aso choose, and that the investigator will gladly answer any questions that arise during the course of the research.

Date:_____ _____

Signature of Parent

Appendix K

General Instructions to Parents for Object Sorting, Free-Play, and Checklists

1. Sorting task: "Please avoid naming the objects or touching the objects while your child is playing with them."

2. Free-play session: "We would like you to play with your child as you would normally do at home. Make sure that your child stays on the carpet so the he/she will stay within the camera angle. I will leave the room now and come back in 20 minutes. During that period, we would like you to name the pictures in this book. When a page contains more than one picture, please name those marked with a star or an arrow. You can use one or more than one word to name the pcitures. There are 24 pages in the book. Make sure you go over each of them."

3. Parent's checklists: "Please check all the new words that your child will start to use over the next three weeks. If a word is used in more than one context, please list them all. For example, if dog is used to refer to cat, horse, and cow, you write these words in the context column beside the word dog and the date under the last column."

Appendix L

Transcription Rules

Format

1) Enter verbal dialogue from left to right; e.g. parent's non-verbal, parent's verbal, child's verbal, child's non-verbal.

2) Non-verbal behaviour: written on same line as verbal if simultaneous with utterance; written above or below if preceding or succeeding utterance. Note- if parent's non-verbal precedes child's verbal but the parent doesn't say anything, put the parent's non-verbal on the same line as the child's verbal.

E.g. parent's non-v parent's verbal child's verbal child's non-v

holds up toy ---------- /doggie/ pts. to toy

3) Sequencing: parent's verbal and child's verbal on the same line means that parent spoke first followed by child;

:child's verbal on one line followed by parent's verbal on successive line (or parent's non-verbal if no response occurs) means that child spoke first;

:child's verbal only (ie. the example used in (2)) make sure that you note in that no verbal response was given and note the reaction the parent has to the child's verbal. (eg. does the child's verbal influence the parent's behaviour?)

4) If in doubt make a note and use separate lines. If parent/child utterances occur simultaneously note this in brackets in the non-verbal. (i.e. want to know if the child imitates/simultaneously uses a word).

Punctuation

1) Questioning: Parent: use a question mark Child: use a rising arrow

2) word followed by a (-) means a long, drawn out utterance. (e.g. when parent's are emphasizing the pronunciation of a word)

3) all utterances should be contained within slashes (/word/) to indicate the end of an utterance. Sometimes an utterance takes more than one line, therefore, we have to know when it ends.

4) long pauses within the same utterance are noted by (---)

5) s/c means self-correct for either parent or child.

6) imitations: indicated by /=/ for parent; means that parent has repeated exactly what child has said; /word=/ is used to indicate imitations for child if the pronunciation is different from parent. Use /=/ only if child's utterance is exactly like parent's.

7) A long dash at the end of an utterance is used to indicate an interrupted utterance. (e.g. Parent interrupts child)

8) repetitions of a word are indicated by placing an "x" after the word (e.g. /doggie/x/x/x indicates the word was stated 4 times)

9) unintelligible words (child is mumbling or sound quality is poor) are marked by /CH/ (can't hear) or /CU/ (can't understand). Also make sure to note the time on the tape when the word occurred.

10) Word variations: enter the word the way it was pronounced by the child, underline it then indicate in square brackets the word it represents. E.g. /<u>hossie/</u> [horse].

11) Idiosyncratic pronunciations: should be placed inside slashes (/word/) then in square brackets the word it is meant to represent. E.g. /kuk/[truck]. Idiosyncratic pronunciations are words which are often used by the child to

represent an object, whereas variations may simply be the result of the child trying to say a word for the first time.

12) When you are not certain of a word but think that you know what the child is saying enter what you think is being said but then place a ? immediately following the utterance. Also note the time that the utterance occurred on the tape . REmember that we are interested in words which can be understood by observers so if you have any doubts about the utterance note it.

Notes

1) If the child is out of sight and you're not sure of the word used, note the time it occurred on the tape.

2) If the free-play session is longer than 24 minutes stop transcribing.

3) It is important to describe the context in which the word occurred very clearly. Remember that someone who has not watched the video must be able to understand the context. It is especially important to clearly state the situations in which certain words, such as verbs and "no", occur. This is because the meaning of the word may change as the child develops and we would like to be able to monitor this change. If you have any doubts discuss them with Lorrie. There will be situations, such as naming pictures from the picture book task, in which a simple statement will be sufficient. Note it is also important to note the parent's verbal and non-verbal behaviour prior to and following a child's utterance in order to determine if the word used has been used appropriately.

Appendix M

Sample Transcription Sheet

Tape start:_____ Child's Name:_____ Age:_____ Sex:_____ Parent:____

Date of Session:_____ Tape Number:_____ Session:_____ Coder:_____ Date coded:_____

Parent's non-verbal	Parent's verbal	Child's verbal	Child's non-verbal

Appendix N

Reliability Instructions

1. Formula for establishing reliability:

$$\frac{\text{\# of Agreements}}{\text{Largest \# of Utterances}}$$

NOTE: an "utterance" is contained within slashes (eg. /doggie/

2. Agreements:

i) Both transcribers entered the same word.

ii) Both transcribers enters (?)/(CH)/(CU).

iii) One transcriber entered a word which is either underlined (i.e. a phonetic transcription of an utterance) or has a (?) behind it and the other transcriber has simply entered a (?)/(CH)/(CU).

iv) One transcriber has entered a word with a (?) behind it which is phonetically similar or is similar to the word entered by the 2nd transcriber which either does/doesn't have a (?) behind it.

v) When one transcriber has entered a (?)/(CH)/(CU) and the other has not entered anything it is an agreement although it is not included in the final total of utterances. These instances should be marked in red/blue ink square brackets so that when obtaining the total # of utterances they are not counted.

3. Disagreements: Basically, there are two types of disagreements:

i)True disagreement (TD): each transcriber has entered different words for the same utterance

ii) (?) vs. word (D?vsW): one transcriber has entered a (?) and the other transcriber has entered a word without a (?) behind it. In this case it would be beneficial to review the tape together to come to an agreement or true disagreement.

4. Omissions: occur when one transcriber has entered a word without a (?) behind it or without being underlined and the 2nd transcriber has not entered anything.

5. Procedure for establishing reliability:

i) utterances should be compared for context to make sure that the correct utterances are being compared.

ii) follow the above guidelines for deciding agreements/disagreements/omissions and mark each utterance on each transcription sheet (eg. /bye/(a) or /bye/(td) or /bye/(o with initial of transcriber who omitted)

iii) count the total number of utterances from each transcription sheet; the largest number should correspond to the tallys of agreements, disagreements and omissions.

iv) tally agreements, disagreements and omissions on summary sheet then use the formula to establish reliability value.

Appendix O

Rules for Entering Language Data

Free-Play

1) If a word is a part of (PO) multi-word utterance; enter the utterance under 'context' followed by a slash (/) then enter the context in which the sentence occurred.

eg. "NOUNOU"

PO mon nounou/serre G.

2) Responses to mother's/father's questions:(M/F Q); if the response is correct just enter 'response to M's Q' under context;

if the response is incorrect enter 'response to M's Q re: auto de course'in other words assume that the word is used in the correct context unless "re:" appears in the context.

3) If a word is said in relation to the picture book enter "PB" under context and then the object referred to ONLY if the word used is incorrect:

A) Word used by child=cat
Data entered= PB/dog
This means that the child was looking at the picture book and saw a picture of a dog but called it a cat.

B) Word used by child= cat
Data entered= PB
This means that the child was looking at the picture book; saw a picture of a cat and named it spontaneously.

C) Word used by child=cat
Data entered=PB/response to Q
This means that the child and Parent were looking at the picture book and the parent asked the child to name the object; child responded appropriately

D) Word=cat
Data entered=PB/response to Q re:dog
This means that the child and Parent were looking at the picture book and the parent asked the child to name the object; child responded incorrectly

4) If word is used more than once in the same situation only enter it once but note that it was repeated several times.

5) Imitations: means that Mother or Father said word and child repeated it.

6) Variations: enter the word that the variation represents under 'word' then enter the variation under context:

eg. "CAA" for "CAR" word=car

context=CAA/saw a parked car

Parental Checklists

7) If parents failed to put a date beside the word don't enter it.

8) If parents failed to enter context in which word was used enter "no context".8) Follow instructions for Free-play transcriptions where applicable.

9) If there is information missing (eg. dates) enter 0 for missing data.

Both

10) Each word is entered separately; i.e. each child's name is entered as often as there are words.

11) Codes for source: 1=diary

2=free-play

Appendix P

Longitudinal Coding System

ORDER OF USE (ORDER)

0 = not used (when used inappropriately/imitated/no or questionable context/non-adult utterance)

1 = first use (appropriate)

2 = second use (appropriate)

3 = third use (appropriate)

4 = first inappropriate use; but within category (eg. dog for horse)

5 = overextension (after 4)

USED IN SINGLE OR MULTIPLE WORD UTTERANCE (MULTI)

1 = one word

2 = used in multiple word utterance

LOCATION (was word found in one or two sources)

1=only in one source; either diary or free-play

2=found in both diary and free-play

TOTAL PRODUCTION (for each word)

1 = total times produced in data is once

2= total times produced twice

3= total times produced three or more times

Appendix Q.

VOCABULARY SUMMARY

	Word Category																	
Sub	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
1	0	3	14	0	17	2	7	54	22	7	1	0	9	0	7	1	0	136
2	5	16	45	2	47	7	19	192	92	21	1	0	40	5	2	2	4	495
3	2	10	12	2	16	3	19	121	48	13	2	0	25	4	8	0	4	279
4	0	7	14	0	17	2	14	88	42	11	1	0	9	3	1	0	1	208
5	2	10	24	0	28	2	9	104	40	10	0	0	25	3	8	0	1	258
6	0	5	14	3	8	3	16	72	23	15	0	0	7	6	4	0	1	173
7	2	5	6	0	3	3	12	41	9	5	0	0	12	4	14	0	2	104
8	1	3	3	0	5	0	11	67	23	7	0	0	7	0	4	0	0	127
9	5	11	24	1	30	5	18	132	46	9	0	0	22	7	2	0	3	313

Appendix R

Word Category Description

1. Relational (absent) words: (object permanence)

   Words that refer to the transformation or potential transformation of people, objects or events that take place either partially or totally outside of the child's perceptual field. This includes transformation of objects that are initially present and then disappear (eg. gone), transformation of objects that are initially absent and then appear (eg. find, more), and transformations of objects that are initially absent and remain absent (eg. allgone, no shoes).

2. Locative terms: (space)

   Words that require locating something or putting something in a specific location. Includes locative search words (eg. where, look at), locative actions (eg. put in) and spatial prepositions (eg. up, down, on, off, in, out, over, under, where, behind, outside, here, there, above, etc.)

3. Causative terms: (causality)

   General action words encode actions that cause the **motion** of an object whereas causative terms (change verbs) encode the **change of state** of the object; eg. kick vs. break, blow vs. dry, etc.). There are similarities between the two types of words. For example, both types of words have a transitive form that encodes the causal role of an initiator in creating the movement or state change (ie. Susan is turning the globe; Harry is opening

the window). Both terms also include intransitive forms which simply encode what is happening to the affected object; eg. Although Susan is the initiator, only the globe is turning; likewise, it is the window is which is opening. However, the critical feature of the causal term is that the initiator's movement is efficacious in causing change. General action words encode temporary relations among entities, some of which encode an initiator's goal to change the state or location of an object, but they are not defined in terms of success of the effort (eg. walking, carrying, turning). These words may also simply encode the contact between an initiator and an object (eg. kissing, touching, hugging, etc.). Causal terms, on the other hand, encode relations involvi ange including spatial transfers or other changes in the state of affairs (eg. go, cook, cover, etc.).

The word "put" has been categorized as a change term by the previous authors. In the current study, it was noted that this particular word only appears in relation to another word identifying a specific location (eg. put in, put out, put back, put off, put there, etc). In other words, "put" is the only causative term which meaning depends entirely upon a locative term. Other words typically used with a locative term (ie. fall, sit, and lie) can, by themselves encode an action and a location. Therefore, for the purposes of the current study the more

appropriate category for the word "put" was locative based on the combination of this word with a locative term.

4. Causal connectives: (causality)

   Words which encode logical, physical or psychological causality (eg. because, so, therfore, why)

5. General Action words:

   Verbs that encode characteristic motions or sounds of initiators that do not produce change (eg. cry, cough, run, sing, talk, wait, kiss, etc.)

6. Volition words: (means-ends)

   Words that encode intentionality, desire, need, ability to do something. (eg. want, need, have to, can, hard) (Bretherton & Beeghly, 1982); also include no, there, and Uh oh when these are clearly used in relation to success or failure of a "planned" action; not accidents.

7. Personal-social words: (imitation)

   Words that express affective states and social relationships (eg. please, thank-you, bye-bye, nite-nite, hi, etc.). Also includes social action games (eg. peek-a-boo; hide and seek)

8. Object Words: (categorization)

   Words used to refer to members of a category (eg. objects, animals, people [girl, boy, etc.]; things that exist in the world that can be counted. (excludes substances; eg. milk, snow, etc)

9. General Nominals

Words used to refer to objects not easily counted (eg. substances like milk, snow, rain, etc).; pronouns, letters, numbers; body parts.

10. Specific nominals:

    Words that refer to only one exemplar of a category; usually, but not necessarily proper names. (eg. Daddy, pets' names, favorite objects' names)

11. Object words overextended:

    Used when a nominal is used for another member of the same category (eg. dog for horse, car for truck)

12. Object words errors:

    Used when a nominal is used for an incorrect category (eg. dog for car, horse for truck, dog for hat, etc.)

13. Modifiers:

    Words that refer to properties or qualities of things or events (eg. big, pretty, hot, dirty, mine). Includes possessive adjectives and possessive pronouns.

14. Function words:

    Words that fulfill a grammatical function (eg. with, by, to, for, at, for, a, the, what, etc). Usually adverbs, prepositions, articles.

15. No context/imitation

    Used for words which are either imitated or which do not have a clear context.

16. Other: To be used on those RARE OCCASSIONS when a word doesn't

fit into any of the prescribed categories. (eg. when another refers to a present relational transformation)

17. Mental Terms:

Words which encode the psychological state of the child or another person (eg. know, guess, sad, happy, etc.)

Appendix S

Examples from Word Categories

a	function words (14)
above	locative (2)
accident	gen nominal (9)
airplane	obj word (8)
all gone	relational (1)
all finished	relational (1)

(only when used like all gone; example "drink all finished"; "book all finished"; "finish book"; finish drink)

another	relational (1)

(only when used to request or speak about an object that is not in child's perceptual field; ie. NOT when child is requesting another cup while holding one in her/his hand.)

any food (solid)	obj word (8)
any eating utensils	obj word (8)
apple	obj word (8)
at	function words (14)
baloney	obj word (8)
banana	obj word (8)
bathroom	gen nominal (9)

because	causal connect (4)
behind	locative (2)
big	modifier (13)
bite	gen action (5)
block	obj word (8)
blow	gen action (5)
boat	obj word (8)
bounce	gen action (5)
box	obj word (8)
boy	obj word (8)
bread	obj word (8)
break	causative term (3)
breakfast	gen nominal (9)
bring	causative term (3)
broken	modifier (13)
brush	gen action (5)
build	causative (3)
bump	gen action (5)
buy	causative (3)
by	function words (14)
can	volition words (6)
can (as in garbage can, tin can etc.)	obj word (8)
car	obj word (8)
careful	modifier (13)

carry	gen action (5)
cat	obj word (8)
clean	causative (3)
close	causative (3)
cold	modifier (13)
collie	obj word (8)
come	causative (3)
cook	causative (3)
cough	gen action (5)
country	gen nominal (9)
cover	causative (3)
cry	gen action (5)
cut	causative (3)
cute	modifier (13)
Daddy	spec nominal (10)
daddy's	modifier (13)
dance	gen action (5)
days of the week	gen nominal (9)
dinner	gen nominal (9)
dirty	modifier (13)
do	causative term (3)
doctor	obj word (8)
doesn't	function word (14)
dog	obj word (8)

don't	function word (14)

(when used as an auxilliary verb; eg. "I don't have the book")

don't	causative term (3)

(when used alone to stop an action; eg. "daddy don't"; "don't touch")

down	locative (2)
draw	causative (3)
drink	causative (3)
drive	gen action (5)
drop	causative (3)
dry	causative (3)
eat	causative (3)
eyes	gen nominal (9)
fall down	causative term (3)
fast	modifier (13)
feet	gen nominal (9)
find	relational (1)
fingers	gen nominal (9)
finish	causative (3)

(when used to indicate an action: I will finish the book)

finished	modifier (13)
(when inicating the status of an action: "The book is finished")	
fit	gen action (5)
(ie. does it fit?)	
fix	causative (3)
fly	gen action (5)
foot	gen nominal (9)
for	function words (14)
garbage truck	obj word (8)
George	spec nominal (10)
get	causative term (3)
girl	obj word (8)
give	causative (3)
go	causative term (3)
goes	gen action (5)
going to (gonna)	volition words (6)
going	gen action (5)
gone	relational (1)
Grandma	spec nominal (10)
guy	obj word (8)
hair	gen nominal (9)
hallowe'en	gen nominal (9)

hand	gen nominal (9)
happening	gen action (5)
(ie. What's happening?)	
happy	pers-soc (7)
has	function (14)
(when used as an auxilliary verb: "I've done it")	
has	gen. action (5)
have	gen. action (5)
(when used alone to indicate possession; eg. I have the book)	
have to	volition words (6)
have	function (14)
(when used as an auxilliary verb: "I've done it")	
head	gen nominal (9)
heart	gen nominal (9)
hello	pers-soc (7)
here	locative (2)

hi	pers-soc (7)
hit	gen action (5)
hot	modifier (13)
hurt	causative (3)
I	spec nominal (10)
in	locative (2)
it	gen nominal (9)
it	gen nominal (9)
jump	gen action (5)
kick	gen action (5)
kiss	gen action (5)
knock	gen action (5)
leave	causative (3)
legs	gen nominal (9)
letters of the alphabet	gen nominal (9)
lie down	causative term (3)
little	modifier (13)
look at	locative (2)
make	causative term (3)
man	obj word (8)
milk truck	obj word (8)
mine	modifier (13)
Mommy	spec nominal (10)
mommy's	modifier (13)

more relational (1)

must volition words (6)

need (need to) volition words (6)

night-night pers-soc (7)

no functional (14)

(when used to reinforce or negate relational term: eg. all gone no, no gone, no more, etc)

no relational (1)

(when used to indicate the absence of an object: eg. initially absent and remaining absent--"no shoes"; "no doggie" etc)

no pers-soc (7)

(used when refusing or denying or rejecting a proposal made by another person or him/herself: No (I don't want to lie down), No (I don't want to say doggie) etc.)

now causal connect (4)

eg. Now, I'm going to play ball; implies that the child was doing something before but is going to doing something different

off locative (2)

off	causative term (3)
(when used to indicate an action: ie. turn the light off)	
oh!	pers-soc (7)
on	causative term (3)
(when used to indicate an action: ie. turn the light on)	
on	locative (2)
one, two, three etc	gen nominal (9)
open	causative (3)
out	locative (2)
outside	locative (2)
over	locative (2)
party	gen nominal (9)
pat	gen action (5)
pick up	causative (3)
play	gen action (5)
please	pers-soc (7)
pour	causative (3)
pretty	modifier (13)
pull	gen action (5)
push	gen action (5)
put in, put on, put back, put off	locative (2)

racing car	obj word (8)
read	gen action (5)
ride	gen action (5)
run	gen action (5)
sad	pers-soc (7)
sick	gen action (5)
sing	gen action (5)
sit (down)	causative term (3)
sleep	gen action (5)
snowman	obj word (8)
so	causal connect (4)
spill	causative (3)
squirrel	obj word (8)
station wagon	obj word (8)
stay	gen action (5)
take	causative (3)
take	causative (3)
talk	gen action (5)
thank-you	pers-soc (7)
that	gen nominal (9)

eg. as in "what's that" when asking a parent to name an object

eg. "that" used to identify a particular object ie. "that is Jerry's truck"

that	locative (2)

occassionally used when responding to parent's request to point out an object (eg. Q: Which one is the truck? A: That one; while pointing to an object)

that — modifier (13)

Used in front of another object word to indicate a specific object (eg. I want that truck)

the — function words (14)

there — locative (2)

therefore — causal connect (4)

this — gen nominal (09)

used to ask a parent a question (eg. what's this?)

this — modifier (13)

used in front of another word to indicate a specific object (eg. I want this rabbit)

throw — causative (3)

tickle — gen action (5)

to — function words (14)

touch — gen action (5)

tow truck — obj word (8)

train — obj word (8)

truck — obj word (8)

turn — gen action (5)

under	locative (2)
up	locative (2)
wait	gen action (5)
walk	gen action (5)
wash	gen action (5)
wave	gen action (5)
what	function words (14)
where	locative (2)
why	causal connect (4)
wiggle	gen action (5)
wipe	gen action (5)
with	function words (14)
woman	obj word (8)
write	causative (3)
yes	pers-soc (7)
you	gen nominal (9)
your	modifier (13)

Appendix T

Lexical Categories: Percentage of Total Vocabulary

Subject	Lexical Category				
	Rel	Loc	Causal	Volition	Object
1	0	2	10	1	40
2	1	3	9	1	39
3	.7	4	5	1	43
4	0	3	7	1	42
5	.7	4	9	.8	40
6	0	3	9	2	42
7	2	5	6	3	39
8	.8	2	2	0	53
9	1	4	8	2	42

Appendix U

Ordinality of Items Within the Uzgiris-Hunt Scales

Subnum	Scale	Order of items	Total Deviations Per Scale
1	Object-Perm	(4,10,13) (14,15) (8)	20
2	Object-Perm	(4,10,14) (8,13,15)	
3	Object-Perm	(10,13) (4,8,14) (15)	
4	Object-Perm	(4,8) (10,13,14) (15)	
5	Object-Perm	(4,8,10) (14) (13) (15)	
6	Object-Perm	(4,10) (8,13) (14) (15)	
7	Object-Perm	(4) (10) (13,14) (8) (15)	
8	Object-Perm	(4,10) (13,14) (15) (8)[a]	
9	Object-Perm	(4,8,10,13) (14) (15)	
1	Means-Ends	(6,7) (10) (11) (12) (9)[a]	25
2	Means-Ends	(6,7) (11) (9) (10) (12)	
3	Means-Ends	(6,10) (7) (12) (11) (9)[a]	
4	Means-Ends	(6,7) (10) (9) (11) (12)[a]	
5	Means-Ends	(6,7) (9,10) (12) (11)[a]	
6	Means-Ends	(6) (10) (12) (7,9,11)[a]	
7	Means-Ends	(6) (7) (12) (9,11) (10)	
8	Means-Ends	(6) (9) (12) (10,11)[a]	
9	Means-Ends	(6,7) (10) (9) (12) (11)[a]	

Subnum	Scale	Order of items	Deviations Per Scale
1	Causality	(6,7) (5)	7
2	Causality	(5) (6,7)	
3	Causality	(6,7) (5)[a]	
4	Causality	(5,6) (7)	
5	Causality	(6,7) (5)[a]	
6	Causality	(5,6) (7)	
7	Causality	(5,7) (6)	
8	Causality	(5) (6) (7)	
9	Causality	(5,6) (7)	
1	Space	(5,6) (7,8)	13
2	Space	(5,8) (6,7)	
3	Space	(5,7) (8) (6)	
4	Space	(7) (5) (8) (6)[a]	
5	Space	(5,6) (7) (8)	
6	Space	(5) (6) (8) (7)[a]	
7	Space	(5) (7) (6,8)	
8	Space	(5) (8) (6,7)[a]	
9	Space	(7) (5) (6) (8)	

[a]Administration ended before item passed

Appendix V

Table V1

Temporal Gap ANOVA (Volitional Category)

Source	Sum of squares	DF	Mean square	F	p
Within	68874.29	24	2869.76		
Gaps	26072.77	3	8690.92	3.03	.049

Appendix V

Table V2

Temporal Gap ANOVA (Locative Category)

Source	Sum of squares	DF	Mean square	F	p
Within	45813.77	24	1908.91		
Gaps	5888.43	3	1962.81	1.03	.398

Appendix V

Table V3

Temporal Gap ANOVA (Causal Category)

Source	Sum of squares	DF	Mean square	F	p
Within	48545.23	24	2022.72		
Gaps	24077.54	3	8025.85	3.97	.020

Appendix W

Table W1

Average Temporal Gaps Between Lexical Categories and Uzgiris-Hunt Scales: Reduced Sample

Related Gaps[a]	Unrelated Gaps[b]		
Vol-ME	Vol-OP	Vol-CAU	Vol-SP
134.81	189.83	190.08	113.58
Loc-SP	Loc-OP	Loc-CAU	Loc-ME
120.23	148.41	148.66	94.24
Caus-CAU	Caus-OP	Caus-ME	Caus-SP
124.99	124.75	69.73	82.29

[a]Absolute value between age of acquiring a lexical category and the age when first passing critical item of related cognitive scale

[b]Absolute value between age of acquiring a lexical category and the age when first passing critical item of unrelated cognitive scales

Appendix W

Table W2.

Pearson Correlations Between Lexical Categories and Uzgiris-Hunt Items: reduced sample (n=5)

Lexical	Uzgiris-Hunt Scale			
Category	Object-Perm	Means-Ends	Causality	Space
Volitional	.5172	.3476	.3360	-.5107
Locative	.0982	.109	.7475	-.8867*
Causal	.7500	.4663	-.0834	-.4333

NOTE. *p<.05