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THE DEVELOPMENT OF THE MEANINGS OF THINK AND KNOW
THROUGH CONVERSATION

by

FREDDI KESSLER SHAW

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1999

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This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

The development of the meanings of think and know

through conversation

by

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Adviser: Professor Katherine Nelson

An apparent discrepancy in the literature on mental verbs between findings of experimental studies (young children fail to contrast terms) and observational studies (children use terms correctly in conversation) can be reconciled using Nelson and Lucariello's (1985) theory of word meaning development. According to their analysis, three aspects of word meaning develop in order: reference, denotation, and sense. For success at experimental tasks, children must have attained a system of interrelated word meanings (sense). However, children's initial uses of think and know take their meanings from the roles in the language games in which they occur (Wittgenstein, 1953).

In this study, 12 two-year-old and 11 three-year-old children were observed at four one-hour sessions over six months in their homes with their mothers. The ways in which think and know were used by both the mothers and children were described. The mothers differentiated their uses of think and know by person reference, time reference, lexical frames, and conversational function. The children differentiated the two verbs by conversational function. In addition, the two-year-old children first used think and know in different language game roles.

Each child used think or know in a conversationally embedded manner at a visit before (or at the same visit as) they used denotation, supporting Nelson and Lucariello's

model of word meaning development. The three-year-olds used denotation more than the two-year-olds, while only one three-year-old demonstrated any sense meanings.

Mother-child conversational processes that may support word meaning development were identified. For the two-year-olds' initial embedded uses, these included repetition, use tied to a particular event, role reversal, use of wh-questions, and the mother's contrast of related mental verbs. For the three-year-olds, acquisition of more advanced forms of use may be supported by the mothers' encouragement of discussions of the past, future, and general, suggestions of presuppositions of mental verbs, contrast of related mental verbs, use of relevant time vocabulary, logical statements and purpose explanations.

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Chapter 1: Introduction

The acquisition of the words think and know by the young child is an important topic of study for several reasons. First, the previous research on the relation between maternal speech and children's word meaning development has looked primarily at the acquisition of object words. It may be, however, that the process of learning object words differs from that of learning more abstract terms. Objects can be looked at, handled, pointed at, manipulated, and then named; thus joint attention can readily be established between adult and child. This is not the case for non-object words, and a significant portion of words that the child must and does learn to speak are not words for objects. What processes, then, are involved in the acquisition of more abstract words by the child in conversation, if not ostension? What clues does the mother provide for the child as to the meanings of non-object words? How do children first begin to use abstract words? Think and know are good choices for researching this topic because children do begin to use them at a fairly early age, despite the invisibility of reference.

Second, research on the child's understanding of the mind has led to an apparent contradiction in the literature: while observational research has demonstrated that children as young as two and a half years use words for mental states (including think and know) appropriately in naturalistic conversation, studies under the aegis of research on children's theory of mind have turned up failures on the part of three- and even four-year-olds on experimental tasks which contrast the use of mental terms.

In this literature review, I will argue that Nelson and Lucariello's (1985) theory of word meaning development can reconcile the differences in these research claims.

Further, the research conducted and reported on here on the development of meaning for

the words think and know can be used to test their theory. Validation of this theory is important because, if correct, it will provide a better explanation for changes in children's performance on theory of mind tasks: not that they first lack a mature understanding of mind, and later attain one, as theory of mind experimentalists would argue, but because reorganization of the lexical system places meanings of individual words, already having some conceptual founding, into relation with one another, so that correct performance on tasks calling for the contrast of related terms becomes possible. This explanation is better because it incorporates the observational data on children's appropriate usage of mental terms in conversation. It is also better because it is simpler; it does not require the assumption of theory change, a change in stance towards the topic matter, on the part of the child, but rather a systematization of the child's lexical entries, already having a conceptual basis.

In the literature review which follows I start with a review of the different meanings of think and know that researchers from varying perspectives have based their work upon, including the radial polysemous developmental view. In order to incorporate children's uses more closely into their definitions of the words, I introduce Finch's (1977) interpretation of Wittgenstein's idea of the language game (1953). Next I provide a brief review of some current theoretical approaches to early lexical development. I then present the experimental work on children's theory of mind tasks that use contrasting mental terms, and the observational work demonstrating children's competence in using mental terms. Then I attempt to reconcile these findings using Nelson and Lucariello's (1985) theory of word meaning development. To complicate the picture, I show how Bartsch and Wellman's (1995) observational research from a Theory of Mind perspective

contrasts with the Nelson and Lucariello view. Montgomery's (1997) discussion of Wittgenstein's private language argument is also compared with the Nelson and Lucariello view. I then move on to the presentation of research on word meaning acquisition via mother-child interaction, with a special emphasis on the role of context in this process. As I mentioned before, most of this research has looked at children's acquisition of object terms [but see Tomasello (1992), and Tomasello & Merriman (Eds.) (1995) for work on children's acquisition of verbs]. One significant exception to this trend is Nelson, Hampson, and Kessler Shaw's (1991) study on children's learning of non-object nouns. This last study is used as a basis for the development of the present study on the acquisition of think and know.

Definitions of Think and Know

What do think and know mean? In this section I make an attempt to present a framework within which to answer this question that includes both the variety of meanings for each word and the structure of the relations between the meanings. To accomplish this task I bring together dictionary definitions for the verbs with Lakoff's account of radial category structure. This framework is followed by a brief presentation of some other views of the word meanings from the related literature: those of the theory of mind experimentalists, theory of mind observationalists, and Booth and Hall's hierarchical view.

The Radial category view

This view begins with an attempt to answer the question of what the words mean to adults. One useful place to start looking for adult word meanings is in a standard dictionary. On my shelf stands a medium-sized dictionary, The American Heritage Dictionary, Second College Edition. (Boston: Houghton Mifflin Company, 1985.) In its introduction, it specifies that, unlike other dictionaries that present senses chronologically, it "endeavor[s] to present the most prevalent, contemporary sense or meaning of a word first, with the other shades of meaning following logically from this current, central concept". With this in mind, here are the dictionary's entries for the two words of interest:

know (nō) v. **knew** (nōō, nyōō), **known** (nōn), **know·ing, knows**. --tr. **1.** To perceive directly with the senses or mind; apprehend with clarity or certainty. **2.** To be certain of; regard as true beyond doubt. **3.** To have a practical understanding of or thorough experience with: *know how to swim*. **4.** To be subjected to; experience: "*a black stubble that had known no razor*" (Faulkner). **5.a.** To recognize (something) as being the same as something else previously known. **b.** To be acquainted or familiar with. **6.** To be able to distinguish; recognize: *Do you know him from his twin brother?* **7. Archaic.** To have sexual intercourse with: "*And Adam knew Eve his wife; and she conceived*" (Genesis 4:1). --intr. **1.** To possess knowledge. **2.** To be cognizant or aware. --**idiom. in the know.** Possessing correct or secret information.

think (thĩngk) v. **thought** (thôt), **think·ing, thinks**. --tr. **1.** To have or formulate in the mind. **2.a.** To reason about or reflect on; ponder: *Think how complex language is. Think*

the matter through. **b.** To decide by thinking: *thinking what to do.* **3.** To judge or regard; look upon: *I think it only fair.* **4.** To believe; suppose: *always thought he was right.* **5.** To expect; hope: *thought he'd arrive early but couldn't.* **6.** To remember; call to mind: *I can't think what his name was.* **7.** To visualize; imagine: *didn't think so many people would come.* **8.** To devise or evolve; invent: *thought up a plan to get rich quick.* **9.** To bring into a given condition by mental preoccupation: *She thought herself into a terror of going.* **10.** To concentrate one's thoughts on: *does nothing but think profits.* --*intr.* **1.** To exercise the power of reason. **2.** To weigh or consider an idea: *They are thinking of moving.* **3.** To recall a thought or image to mind: *thought of his childhood when he saw the movie.* **4.** To believe; suppose: *thinks of herself as a wit.* **5.** To have care or consideration: *think first of the ones you love.* **6.** To dispose the mind in a given way: *Think rich.* -- *idioms.* **think better of.** To decide against after reconsidering. **think much of.** To consider satisfactory; approve: *didn't think much of her new outfit.* **think nothing of.** To regard as routine or usual. **think twice.** To weigh something carefully.

These dictionary definitions, while extremely useful, are inadequate for a full understanding of the adult meanings of the words. Some questions remain unanswered: what are the relations between the numbered definitions of each word? One has a sense even at a casual reading that they are not independent from each other, but what is the nature of this interdependence? Know and think both seem to belong to a related domain, roughly of verbs for mental phenomena, but what is the relation between the two sets of meanings? To answer these questions we must seek guidance beyond the dictionary definitions.

Lakoff on Category Structure

Lakoff provides a helpful way to view the relations between the numbered definitions. In a book (1987) dedicated to exploring the forms that human categories take, one form, the radial category, seems especially applicable to the cases of think and know. Lakoff explains in detail the relations between the different meanings of mother, as an example of the radial category:

The category mother... is structured radially with respect to a number of its subcategories: there is a *central* subcategory, defined by a cluster of converging cognitive models (the birth model, the nurturance model, etc.); in addition there are noncentral extensions which are not specialized instances of the central subcategory, but rather are variants of it (*adoptive mother, birth mother, foster mother, surrogate mother, etc.*). These variants are not generated from the central model by general rules; instead, they are extended by convention and must be learned one by one. But the extensions are by no means random. The central model determines the possibilities for extensions, together with the possible relations between the central model and the extension models. We will describe the extensions of a central model as being *motivated* by the central model plus certain general principles of extension.

Lakoff, 1987, p.91

While Lakoff does not discuss think or know, we can make an attempt to extend the radial category to these cases. In the commentary that follows, I make no claims to giving a full description of the scope of the meanings and their relations. This is in

contrast to Lakoff, who provides fully detailed descriptions of the cognitive models involved in the subcategories, not only for mother but for a variety of abstract categories, and who is more successful than I am in identifying the motivations of the radial subcategories from the central cases. This is a first pass, a pointing to what is necessary to incorporate in an understanding of the complexity of their meanings. Despite its incompleteness, I believe the following outline is useful in giving us a picture of the complexity of the problem.

First of all, what is the central subcategory for the words? Conveniently, the dictionary we are using puts the central definitions first; let us use these as our central category. For know, the dictionary gives the central definition as "to perceive directly with the senses or mind; apprehend with clarity or certainty". Breaking this down to its simplest elements, we get four alternative statements:

1. To perceive directly with the senses
2. To perceive directly with the mind
3. To apprehend with clarity
4. To apprehend with certainty

Can four alternative statements together make up a central subcategory? If the dictionary-makers can place them all together as a single, central definition, we will have to assume they can. What makes these four statements different from each other? There are the five senses (sight, hearing, touch, smell, and taste) to include in the first statement; the second calls into consideration what sorts of things can be perceived directly with the mind, without the immediate help of the senses: perhaps episodic and general memories, and logical phenomena such as mathematical insights, inference and deduction could be

included here. Apprehending with clarity, and apprehending with certainty could be applied to both the phenomena in statement 1 or 2, but understanding is emphasized here and not perception per se. But do the four statements cohere in some way that justifies their placement together? All four may be said to involve mental content plus an attitude toward that content, justified truth value. We have to remember, however, that there are several ways provided for arriving at this general condition.

What of the central subcategory for think? The dictionary gives us, "To have or formulate in the mind".

Here we have only two statements:

1. To have in the mind
2. To formulate in the mind

These two statements provide both a static and process view of the contents of mind: "having" with no question of origin or change, but "formulating" as a process. In relation to know, while both involve the mind, for think the contents of mind are not perceived in any specified way, but are merely held or processed; as well, thinking or a thought is not necessarily clear or certain.

So far we have discussed only the central subcategories of think and know, as we extracted them from their primary dictionary definitions. What of the other definitions? How are they motivated from the central subcategories? I will not attempt here an exhaustive analysis of all the definitions, but shall look at only the first two or three from each word to demonstrate what needs to be taken into consideration when envisioning the radial structure.

The second definition given for know is:

2. To be certain of; regard as true beyond doubt

This appears to be related to statement 4, to apprehend with certainty. How do the two definitions differ? This second definition appears to be so related to statement four as to be redundant. Why did the dictionary-makers include this as a second definition? To understand why, we have to back up a step. We may not be able to arbitrarily take statement four away from its other three statements in the central definition. The four statements in the central definition work together as a whole to point to a central concept that implies them all: direct perception via the senses or mind, and apprehension with clarity or certainty. When we look at definition two now, we can view it as applying to, used in, situations in which only part of the central condition applies: the case of being certain of something, without necessarily having the perceptual or mental justification that is included in the central definition. It is a subcategory of knowing that is a deviation from the central case, just as a birth mother or an adoptive mother are subcategories of the central model of the mother who provides the egg, gives birth to, and cares for the child.

Let us now consider the third definition of know: to have a practical understanding of or thorough experience with: *know how to swim*. How is this motivated by the central definition? This sort of knowing has a different sort of content than the central definition. Certainty, clarity, and justification are not as important; but understanding, apprehension is shared with the central definition: in both conditions, there is something known. In the central subcategory, what is known is something mental; in definition three, it is a skill or familiarity with a phenomenon. It is not attitude towards mental content that matters here; it is the mastery of broader subject matter. As

Lakoff would argue, it is a matter of convention that the same word, know, is used to describe knowing that and knowing how, but it is nevertheless a motivated convention. Two of the remaining transitive definitions of know (4 and 5b) emphasize this dimension of experience or familiarity, de-emphasizing mental process; two others consist of variations on attitudes toward mental content (5a and 6, involving recognizing and distinguishing). (Archaic meaning 7 on sexual intercourse I leave aside as probably irrelevant to the early developmental problem, and perhaps to most modern adult individuals' category structures, as well.)

I move on now to further definitions of think. Definition **2.a.** is: to reason about or reflect on; ponder: *Think how complex language is. Think the matter through.* This definition is more closely related to the second, process statement of the central definition: to formulate in the mind. Reasoning, reflecting, and pondering could be said to be specialized forms of formulating. What other sorts of formulating might there be? One alternative to be included in the central case is creative formulation: composing, inventing, improvising, dreaming up. The second part of the second definition, **2.b.**, to decide by thinking: *thinking what to do*, is another process, a specialized sort of formulating. Again it is a matter of convention that the processes of reasoning or decision-making can be specially emphasized and understood using the word think, despite their noncentral status. Definition three, to judge or regard; look upon: *I think it only fair*, demonstrates yet another conventional, noncentral variation of the central definition: judging, regarding, or looking upon are special instances of the process of formulation. Further definitions for the most part give further variations on the central

formulation model: believing, supposing, remembering, calling to mind, visualizing, imagining, devising, evolving, inventing, considering.

What can be said about the relations between the meanings of know and think?

Think in its several meanings includes both a static having of mental content and a variety of mental processes. Know includes justified perception and understanding, but also familiarity, experience, and recognition. When the spectrum of uses is laid out is not possible to specify the relations any more than to say that both can, (but do not always) involve mental processes. The multitude of uses of each verb brings up the problem of how it is known what shade of meaning is implied on each occasion of use. Here Wittgenstein's (1953) notion of the language game, to be spelled out in much greater detail in another section, is useful: words' meanings are inextricably woven into the language activities that they occur in. To more completely describe the meanings of the words know and think, one must look in detail at their uses in actual human conversations and activities. This is one of the goals of this dissertation: to learn more about the shades of meanings of the words by looking at their actual uses in conversation. Little is known about the roles these words play in adult conversation. Despite this hole in the literature, it is possible to explore the roles they play in child-adult conversations.

To summarize this view of the adult meanings of the verbs, each verb has a radial structure with a central subcategory that motivates the secondary subcategories by convention. More needs to be discovered about the roles that these subcategories play in conversational activities. The dictionary definitions give us clues as to the variety of roles they might play, but how they actually fit into conversations is not known. The verbs both belong to the domain of mental verbs, but the relations between them also remains

unknown. More could be uncovered about the relations between the verbs by seeing how they are compared and contrasted in conversation.

What of the meanings of the verbs to children? Children start out by learning the roles that the verbs play in conversation piece by piece. There is no question at first of a central subcategory and motivated radial subcategories; all the pieces are unrelated. At this point, word meanings are embedded in conversations. Exploration of the roles that the words play in Wittgensteinian language games can show how they are embedded in conversational routines. At some later point in time, the central subcategory is formed, and the secondary subcategories are linked to it. This marks the move to denotation. Only finally are the relations between verbs formed- an overarching domain with contrasts and similarities noted. These are sense meanings. This hypothesized view contrasts with the current prevalent view of word meaning development, a mapping of concept to word.

Other Views

Many experimentalists have defined the verbs know and think with respect to their factivity. Kiparsky and Kiparsky (1970) differentiated between two types of mental verbs that are followed by sentential complements: those that presuppose the truth of the complement (factives) and those that do not (nonfactives). The verbs know and think are said to differ in their presuppositions of the truth of their complements. Thus, for example, Abbeduto and Rosenberg (1985) claim that for know, a factive verb, the subject of the mental verb has unambiguous evidence, either perceptual or inferential, as to the truth of the complement, whereas for think, a nonfactive, the subject does not have such evidence. Other experimentalists who defined the verbs think and/or know with respect to their factivity in this way include Macnamara, Baker, and Olson (1976), Johnson and

Maratsos (1977), Miscione, Marvin, O'Brien, and Greenberg(1978), Johnson and Wellman (1980), and Bassano (1985).

Moore and colleagues [Moore, Bryant, and Furrow (1989), Moore and Davidge (1989)] have looked to the work of Urmson (1963), who pointed out that a common function of mental verbs is to mark the degree of certainty with which a statement is made. Thus know is used to indicate that the speaker has a high degree of certainty, whereas think marks less certainty.

Whether the focus is on factivity or certainty, the experimental researchers indicate that the verbs differ from each other by one feature only. As I have shown above, this is far from the case: each verb has a number of related meanings. The danger in limiting the definitions in this way is that the conception of the development of the meanings of the verbs is oversimplified; the gradual accrual of meanings to the verbs and their gradual organization is instead reduced to an all-or-none phenomenon.

What of the meanings of the verbs ascribed by observational researchers? Shatz, Wellman and Silber (1983) identified seven functional categories for the early use of mental verbs as a group: reference to mental state, modulation of assertion, directing the interaction, clarification, expression of desire, action-memory, and the fixed phrase, "I don't know". The adult meanings of the verbs are not given; the question of how these categories relate to adult definitions is not addressed. Whether or not children differentiate between the verbs in some way is also not addressed: the assumption seems to be, that if the verbs share common communicative functions, then their meanings as well are shared. Similarly, Furrow, Moore, Davidge, and Chiasson (1992) coded for five functions: mental state reference, modulation of assertion, directing the interaction,

directing reflection, and other. However, unlike Shatz et al., they reported on specific form-function tendencies: both mothers and children predominantly used think to direct the interaction. Know was used by both mothers and children more to direct reflection than to direct the interaction. Again, it is not clear how these functional categories relate to fully-fledged adult differentiated definitions of the terms. While an argument could be made that children first learn to use the words as conversational devices, it is less plausible to maintain that the definitions remain solely this way for adults (not that I doubt that these observationalists might agree with this assessment.)

Bartsch and Wellman (1995) dispense with a large proportion of uses by considering only "genuine mental references", thus limiting the possible range of definitions. Within this limit, however, they do include several types of uses: for think, they identified three kinds of references to mental state: thought-as-belief, thought-as-imagination, and thought-as-activity. Here I report their categories (p.40):

1. Thought-as-belief: using think to refer to a propositional belief state, to attribute a propositional conviction.
2. Thought-as-imagination: referring to a mental state that is fictional or imaginary.
3. Thought-as-activity: referring to mental activity, to a mental process.

Their definition of know runs as follows: "Adults use know to refer to (1) a belief that is felt to be justified, (2) assumed to be true, or (3) that enjoys markedly higher conviction than one described by think" (p. 40, numeration added).

How do their definitions correspond to those of the American Heritage Dictionary? Think as thought-as-belief corresponds to dictionary definition 4: to believe

or suppose. Think as thought-as-imagination calls on definition 7, to visualize or imagine. Thought-as-activity is a catch-all category, for transitive dictionary definitions 2 through 10 include a variety of different mental processes. What of know? Their three definitions are covered by transitive dictionary definitions 1 and 2, dealing with justified perception and apprehension; and certainty.

Bartsch and Wellman's definitions thus stand between the very limited definitions offered by the experimentalists, and the inclusive radial category scheme. (Further comparisons of their coding scheme with the Nelson and Lucariello scheme are reported in the discussion chapter.)

Booth and Hall (1995) also present a view that reflects an allowance that each verb can have more than one meaning. For them, each verb can refer to more than one mental process. They provide what they call a "hierarchical", informational model of meaning - hierarchical in the sense of level of difficulty, not in the sense of subordination. They identify six general levels of mental process that account for differences in meaning and difficulty of acquisition. In order of difficulty from lowest to highest, these are (paraphrased from the original, p. 532):

1. perception: reporting the act of perception
2. recognition: acknowledging familiarity
3. recall: referring to remembered factual information
4. understanding: referring to a conceptual framework or reasoning
5. metacognition: focussing on discussing the awareness of mental acts
6. evaluation: referring to attitudes and beliefs about the truth of statements

Their model predicts that children will acquire the lower levels first because they are less abstract, less conceptually demanding.

While laudable in presenting a polysemous view of word meaning, their presentation of the six levels of meaning is insufficient to account for (1) word usages that are embedded in conversational procedures and do not necessarily refer to mental processes, (2) subtle meaning differences between and within the many mental verbs in the lexicon, (3) simultaneous and gradual acquisition of more than one of their informational levels, (4) knowledge of the cultural conventions governing the functions of the verbs within conversations, as well as conversations as a source of meaning acquisition. Indeed, one or more of these criticisms could be directed to each of the alternative accounts presented here. What Booth and Hall account for is not so much the development of word meanings per se, but the development of levels of cognitive knowledge that are intertwined with word meanings. Their model is most useful in that it provides testable predictions of order of acquisition of meaning groupings, along with a theoretical, developmental basis for these predictions. Their work is part of a series of studies [e.g., Hall, Nagy, and Linn (1984), Frank and Hall (1991), Booth and Hall, 1994a, 1994b, 1994c)] that has as one of its goals the refinement of the hierarchical model to accord more closely with data from multiple methods over a wide range of ages.

Wittgenstein's Language Games

In this analysis of the two-year-olds' uses of think and know, I use Wittgenstein's idea of language games to explore how the words are embedded in conversational routines. What is a language game? The answer to this question is not a straightforward one. Finch (1977) devotes an entire chapter to explaining the role of the language game

in Wittgenstein's later philosophy. Finch lays out the four meanings Wittgenstein offered for the language game in the *Philosophical Investigations*, Section 7:

(1) "I... will sometimes speak of a primitive language as a language game."

(2) "...those games by means of which children learn their native language. I will call these games 'language games'..."

(3) "And the processes of naming the stones and of repeating words after someone might also be called language games."

(4) "I shall also call the whole, consisting of language and the actions into which it is woven, the 'language-game'."

For Wittgenstein, a primitive language is a simplified language - one concerned with how words or sentences are used in a "clear and simple" way, such as the use of color terms and numbers in the activity of "shopping for five red apples". One way of interpreting these four meanings is that children learn a primitive version of language by learning how particular words are "woven" into activities. One example is laid out in meaning (3), the language game of naming an object and repeating a word after someone (This is part of Wittgenstein's builder's game in which a speaker calls out an order for a building material, and the other participant carries out the order by fetching it). Yet as Finch elaborates, the process of repeating a name is only one example of the myriad language games that Wittgenstein describes.

For Wittgenstein, a crucial reason for looking at language games was to establish philosophical clarity. He wanted to show that philosophical "puzzles" can be avoided by making evident dissimilarities in the functioning of language. Using the same word for different phenomena can mislead us into putting together phenomena that don't belong

together. Wittgenstein's practice of teasing apart the various functions - and thus meanings - subsumed by the same word can be applied to the cases of think and know. What appear to be two words each with one meaning, related to the other by one element should not be assumed. What needs to be done is to step back and look at actual uses, to see what functions they play in children's conversations. Only then can we discover what the words mean to the children.

What, then, are the language-games that think and know are part of? Where can we begin to look? Although Wittgenstein writes that there are countless language games (PI Section 23), with new ones all the time invented and others becoming obsolete, it would be advantageous to have a starting point, an idea of what kinds of language games there are that a child's words might belong in. Finch assists us by expanding upon a list Wittgenstein "carefully constructed" of "the very best examples" of language games he could find (PI Section 23). By primarily limiting ourselves to this list we can make an attempt to see if children's early uses of think and know are incorporated into the types of language games that Wittgenstein specifically described.

Here then, from PI Section 23, is Wittgenstein's list of language games (the numbering is added).

- (1) Giving orders, and obeying them. (Finch notes that this is related to guiding and being guided by)
- (2) Describing the appearance of an object, or giving its measurements
- (3) Constructing an object from a description (a drawing)
- (4) Reporting an event
- (5) Speculating about an event

- (6) Forming and testing a hypothesis
- (7) Presenting the results of an experiment in tables and diagrams
- (8) Making up a story; and reading it
- (9) Play-acting
- (10) Singing catches
- (11) Guessing riddles (Finch includes here other language games Wittgenstein identified involving guessing, such as guessing intentions or thoughts.)
- (12) Making a joke; telling it
- (13) Solving a problem in practical arithmetic
- (14) Translating from one language to another
- (15) Asking, thanking, cursing, greeting, praying

In Section 27, Wittgenstein also puts forth:

- (16) Asking something's name, with its correlate, ostensive definition
- (17) Inventing a name for something (as when children give names to their dolls and then talk about them and to them)

He goes on to emphasize, however, that it is not possible to define a thing ostensively without also specifying what place in language the name is meant to occupy. The definition must take place with respect to the word's overall role or use: red is a color, five is a number.

Some current theoretical approaches to lexical development

Some current theoretical approaches to children's early lexical development include the constraints/principles view, the social-pragmatic view, and the expressive view. Here I briefly summarize these three approaches.

Constraints and principles. Proponents of the constraints/principles view have been influenced by a problem described by Quine (1960): how does the language learner limit possible hypotheses regarding what the meaning of a new word may be? Their answer has been that children have, or construct, language-specific constraints or principles that help the child to limit the possibilities. In an article co-ordinating the work on principles proposed by several authors, Golinkoff, Mervis, and Hirsh-Pasek (1994) placed six principles into a two-tiered developmental framework. According to the authors, the principles of the first developmental tier help the child to enter into word learning. These first tier principles are that words refer: they map on to the child's concepts of objects, actions, and attributes; words are extendible beyond their original referents; and words label objects - whole objects, not their parts. The principles of the second tier are necessary for word learning to become quick and efficient. They are that words can be extended to other objects in the same basic level category; that new words map on to nameless categories; and that the conventional forms of words are preferred.

Soon afterwards, an attempt was made to extend these principles beyond words for objects to the acquisition of verbs [Golinkoff, Hirsh-Pasek, Mervis, Frawley, & Parillo (1995)]. They focus their discussion on action verbs. The principle of reference was transferred by saying that words can refer to actions or events just as they can refer

to objects. They can be extended as well to label instances other than the original action exemplar. What of the object scope principle, stating that children assume that words map on to objects, and that the objects are whole objects? The authors get around the hurdle of applying this principle to verbs by stating that indeed, a child will assume that a new word labels an object - children will only entertain the hypothesis that a new word refers to an action if the child already knows a label for the object undergoing the action. Also, children will assume that words for actions apply to larger rather than smaller actions.

To account for categorical scope, rather than posit a basic level for actions, the authors claim that children will extend words for actions to other actions that entail the same semantic components as the original referent. As for novel words naming nameless categories, this can work for verbs because a new label for an action will apply to a nameless action category. Labels are identified as referring to actions, by the use of syntactic cues. The principle of conventionality will motivate children to learn the conventional label for actions as well as objects. In the discussion I will examine how well these proposed principles hold up in the cases of think and know.

The social-pragmatic view. To illustrate the social-pragmatic view, I present some of the work of two of its proponents, Bruner and Tomasello. In contrast with constraints and principles, the social-pragmaticists argue that there is no need to posit language-specific limitations to the possibilities of word meanings. Instead, the learning of word meanings is possible both because the culture, in the guise of the adult partner, provides structure to conversational interaction, and because the child comes to the

interaction equipped with the social skills to interpret the meanings of adults within the structured interaction.

Bruner (1983) was successful at incorporating Wittgenstein's later work into the area of early language development. Rejecting both strict empiricist and nativist positions, he argues for a middle ground in which both biological endowment and environmental support are necessary to the child's language development. To counter nativist Chomsky's inborn modular Language Acquisition Device (given the homunculus-reminiscent acronym LAD), Bruner presents the social/cultural Language Acquisition Support System (the LASS). Bruner's goal is then to describe the LASS.

In order to describe the LASS, Bruner first lays out the cognitive endowments that the infant brings to the task of acquiring culture through language. Infant cognitive processing supports goal-directed activity; even before language, the infant's activity is social and communicative; infant activity shows much order and systematicity, taking place in familiar situations; and much of the systematicity is abstract. Although language does not grow out of these cognitive endowments, they do enable language acquisition.

Bruner's emphasis in language acquisition itself is on the development of pragmatics (in contrast with syntax or semantics). Calling on the Speech Act theory of Austin (1962), Bruner argues that pragmatics leads the way into the acquisition of language. The child's entry into discourse requires the participants to interactively interpret each other's communicative intent. The adult is seen as a communicative partner who negotiates the communication of the expression of intent with the child. Parents "fine tune" their speech to the level of the child's understanding in a way that promotes the child's increased regulation of language use. The child is an active

participant as well, striving to master the cultural conventions of language in order to make her communicative intentions clear.

The Language Acquisition Support System provided by the adult communicative partner consists of formats: highly routinized and familiar settings in which the child can interpret language use and learn the conventional signaling of intentions. Here is where Wittgenstein comes in. Bruner applies Wittgenstein's language games almost literally: for Bruner the routine formats in which language is encountered and interpreted are the games of childhood: peekaboo, object exchange, hide-and-seek. Game formats such as peekaboo provide the structure of self-contained, ordered sequences of events involving language. As the child becomes familiar with the structure of the game she gradually takes over control of both the game and the performative language that can both accompany and constitute the components of the game.

Having established the importance of the structure of games in providing the context for the production and interpretation of language, Bruner goes on to show how formats can become independent from the specific settings in which they were acquired, and furthermore can be incorporated into more complex discourse, evolving into Austinian speech acts. Bruner's analysis, however, concentrates on the transition from prelinguistic to linguistic communication. It remains to be demonstrated how more abstract words learned after this early transitional period are learned as part of routine formats, and if so what sort of formats these might be.

Tomasello is another proponent of the social-pragmatic view. In a major diary study of his daughter (Tomasello 1992) as well as in laboratory and observational studies [Tomasello and Kruger (1992), Tomasello and Barton (1994), Tomasello (1995)],

Tomasello has studied one- and two-year-olds' acquisition of verbs. He argues for the importance of explaining the acquisition of verbs for any successful theory of children's language acquisition for several reasons: they require a richer characterization of children's cognitive processes than one based solely on children's understanding of the perceptual and functional features of objects; they necessitate a fuller characterization of the social-cognitive processes involved in word learning rather than one based on joint attention on objects; and because of their role in relating lexical items with one another, verbs play a crucial role in the child's transition to grammar (Tomasello, 1995).

In Tomasello's description of the social-pragmatic view, language, like other mental processes, depends on both the culture's structuring of routine activities, and the individual child's social cognitive skills, such as intersubjectivity and perspective taking, that allow the child to enter as participants into the culturally structured activities. The child is able to assign meanings to the words she hears only in situations when she can interpret the intentions of the other activity participant/speaker. The culture's structuring and the child's skills together make this possible. The child's nonsocial cognitive skills are by no means left out of the process either: Tomasello explores the representational structures underlying children's early action and change of state verb meanings.

In his diary study of the uses of verbs by his daughter Travis from her first to second birthdays, Tomasello's goals were to describe the cognitive structures underlying her early use of verbs and the social-pragmatic contexts in which they were learned. He also found support for the "Verb Island" hypothesis: that in the beginning syntactic devices are lexically specific; in other words, that each verb appears in its own sentence frames that are not shared with other related verbs. This is to say that early on, children

do not have a syntactic category of "verb" that allows them to interchange verbs in syntactic frames in a grammatical rule-governed way.

For the most part, the verbs that Travis produced during the period of study were words for activities and changes of state. The activities are subdivided into activities involving objects and those that do not. Under the latter are included several internal state activities: sorry, try, hungry, listen, feel, remember. In contrast with the in-depth child-centered semantic analysis he provides for change of state verbs, Tomasello does not offer an analysis for the semantic content of internal state verbs.

Tomasello describes four main pragmatic contexts for early verb learning: a parent comments on the child's activity or state while the child is engaged in it; or comments on a state or activity of another person or object; the parent asks the child about the child's intentions or desires; or the parent requests the child or another person to do something. The first two contexts he compares to the ostensive learning situation; the second two are nonostensive learning contexts. Tomasello showed that all four types of pragmatic contexts served as parental models for Travis' acquisition of verbs prior to 18 months of age. Tomasello concludes that verbs can be and are learned in nonostensive contexts; he argues that the assumption that children's early words are object labels learned in ostensive contexts needs to be adjusted.

The expressive view. Bloom (1993, 1994) argues against the instrumental-function view of language held by social-pragmaticists. She places emphasis on the individual side of the individual/social equation: children are motivated to learn language in order to express their individual thoughts. With cognitive development, as their thoughts become increasingly discrepant from perceptual data, the acquisition of

language becomes necessary in order to share their thoughts with other people. As well, increases in cognitive development leads to more elaborated contents of thought, and thus the need of more elaborate language to express those thoughts. Bloom argues for a bottom-up approach to meaning, saying that "complex sentences connect the structures underlying simple sentences, and the meanings of early complex sentences are acquired sequentially; they are also semantically cumulative." [Bloom (1994), p. 217]. In other words, the meanings of sentences are the additions of the meanings of the individual words.

While Bloom's bottom-up account of meaning may be applicable to much of children's earliest word meanings and their acquisition, it is less applicable to the explanation of why and how children learn words for abstract concepts that are tied up with cultural practices and institutions, and are not individually constructed (she points out herself that "words like citizen, honor, and trust are learned indirectly, through the words a child already knows" [Bloom (1994), p. 221], as well as how it is possible for early sentences to mean something other than the sum of their cumulative parts.

If we take the meanings of mental words such as know and think to have meanings restricted each to one or two mental states or processes, it is plausible that the child could map the words onto pre-constructed concepts for these meanings; but if we take the view that the child must construct a more complex conventional system of intra- and inter-word meaning relations and how the words fit into larger speech activities, then experience with the many ways of using the words within different contexts becomes crucial to the construction of meaning. I believe a top-down approach to word and sentence meaning is also necessary: children often learn larger units of speech wherein

sentence meanings are tied to activities, and only later analyze the sentences into their component parts.

Experimental Studies

Here I summarize experimental studies that have been carried out on children's understanding of mental verbs, all of which include either the term know or think, or both. While they differ in the details of their procedures, all of the researchers make the assumption that the meanings of the verbs differ by single semantic features; all find age-related differences in the ability to contrast related verbs.

Johnson and Maratsos (1977) found differences between 3- and 4- year-olds on an experimental task designed to investigate children's understanding of the presuppositions of the terms think and know. In this task, the participants were presented a brief story about how one person (the Hider) tricks another person (the Seeker) by hiding the Seeker's toy in one location (under Box A) and telling the Seeker it's in a different location (under Box B). The children were asked whether the Seeker and Hider think it's under Box B, and whether they know it's under Box A. Then they were asked to choose whether the Hider and Seeker think or know that the object is under Box A or B, respectively.

Six of the 16 4-year-olds answered all four questions perfectly, while none of the 16 3-year-olds did. Looking at the answers to individual questions, the 3-year-olds tended to answer indiscriminately that yes, the Seeker thinks the toy is under Box B (correct) AND that the Seeker knows the toy is under Box A (incorrect), logically incompatible responses. On the other hand, the 4 year olds tended to answer correctly to both questions: the Seeker thinks the toy is under Box B, he doesn't know it's under Box

B. This pattern of indiscriminate "yes's" by the 3-year-olds for questions about the Seeker was only somewhat improved for questions about the Hider. While the 4-year-olds tended to respond that yes, the Hider knows the object is under Box A, and no, he doesn't think it's under Box B, both correct responses, the 3-year-olds answered correctly that the Hider knows the toy is under Box A, but then answered at close to chance level - 44% saying no - when asked if the Hider thinks the toy is under Box B. On the forced choice questions, most of the 4-year-olds answered correctly both that the Hider knows the object is under Box A and that the Seeker thinks the toy is under Box B. The 3-year-olds answered at close to chance levels both that the Seeker thinks it's under Box B (36%) and that the Hider knows it's under Box A (65%). Many of the 3-year-olds (6 and 5 of the 16, respectively) could not even comprehend these questions sufficiently to give responses. Johnson and Maratsos conclude that "4-year-olds understand that thinking may be false and that knowing must be true," while 3-year-olds do not.

Miscione, Marvin, O'Brien, and Greenberg (1978) asked 48 preschool children in three age groups (3;6 to 4;5, 4;6 to 5;5, and 5;6 to 6;5) to report on their own internal states of knowing or guessing during an object location guessing game. In the guessing game, the object was hidden in one of three boxes, which unbeknownst to the children could be manipulated by the researcher to make the object disappear. In this way the researcher was able to control whether or not the child's choice of location was correct or not, one of the experimental variables. Another variable was whether or not the child saw the object being hidden. Finally, there were two points in the sequence of the game at which the child's knowledge state report could be gathered: either before or after the outcome of the choice of location was revealed to be correct or incorrect. Combining

these three variables, there were five conditions (the possible condition of the child being shown where the object was hidden but then having their choice turn out to be incorrect was not attempted!). Each child was tested on five trials for each of the five conditions, for a total of 25 trials each, and were given a point for each trial for which they said know having watched the researcher hide the object, or guess having not watched the researcher.

The researchers found that there were four general patterns of responses, which they labeled Undifferentiated, Outcome, Transitional, and Adult. The Undifferentiated pattern occurred when a child said either know or guess under all conditions, or answered in a random pattern. The Outcome pattern consisted of saying know for both those trials in which information was given beforehand and those in which the child guessed correctly despite not having seen the object hidden, and guess for those trials in which the choice was incorrect. The Transitional children answered all conditions correctly except for correct outcome without having seen the object hidden, for which they answered randomly. The Adult pattern consisted of answering know and guess correctly under all conditions.

A significant relation was found between age and pattern, with most children under four displaying an Undifferentiated response, most children over 5;5 falling into the Adult pattern, and the Outcome and Transitional patterns occurring from the ages of 4;0 up to the age of 6;5. The authors argue that these results suggest that children giving undifferentiated responses - those under age four - have not acquired "any of the adult semantic knowledge for these words" (p.1112). Children in the Outcome classification were using the incorrect semantic criterion - correct or incorrect outcome - as the basis

for distinguishing between the meanings of these words, rather than the adult basis, which they define as encoding whether the decision from a process of transforming or operating on information is (know) or is not (guess) logically necessary (p.1108). Furthermore, they suggest that the pattern displayed may be dependent on the child's cognitive stage, in the Piagetian sense: the Outcome children may be in the preoperational stage, attuned to the external, perceptible, surface aspects of phenomena, while those answering in the Adult pattern may be in the concrete operational stage, able to think about phenomena in a more abstract, conceptual manner.

Johnson and Wellman (1980) investigated children's understanding of the terms remember, know, and guess. Again, they assumed that these words differ in meaning from each other by single features: remember is a special case of knowing based on prior apprehension; knowing can be based on memory, but also on present apprehension, inference, or deduction; guess contrasts with know and remember in that there is an absence of a knowledge base. The participants in this study were 4 and 5 year-olds, and first graders (ages six and seven) and third graders (ages eight, nine, and ten), who were tested on a series of hidden-object tasks. The conditions of the tasks varied as to 1) whether the child had prior knowledge of the object's location (whether or not they were shown where the object was hidden), 2) whether the child had present knowledge of the object's location (opaque and clear boxes were used for this condition) and 3) whether there was correct performance, and the child found the object (the researcher used trick boxes to manipulate the outcome of the child's performances). For each task, the researcher asked three questions varying only the target mental verbs to probe for the child's understanding of the words: "Do you [know/remember/guess] it's there?".

The four year olds tended to answer "yes" that they remembered, knew, and guessed under all conditions. The exception to this consistency was in the "guess wrong" condition, in which no prior knowledge was given of the opaque boxes' contents, and by using the trick boxes the researcher ensured that the child's performance on guessing which box the object was hidden in was incorrect. For this task, the 4 year olds answered at close to chance levels for remember (40% said yes) and guess (47%) while 27% said (incorrectly) that they knew. Johnson and Wellman interpret these results as showing that 4-year-olds "remain largely oblivious to conceptual differences between mental states". The major difference between the 4 and 5 year olds was that more of the 5 year olds said that they guessed under the guess wrong condition. Otherwise the 5 year old performed much like the 4 year olds, saying indiscriminately that they remembered, knew, and guessed in all the experimental conditions. The first and third graders performed in a much more adult-like fashion.

In their study Abbeduto and Rosenberg (1985) investigated children's understanding of five cognitive verbs (know, forget, remember, think, believe), using three different tasks. Their goal was to find out when children understand the presuppositions associated with each verb, and when children differentiate between the verbs on the basis of these presuppositions. The participants were 3, 4, and 7 years old. The tasks included a comprehension task, a verb-choice task, and a definition task. In the comprehension task, the children were presented sentences containing that-object complements and each of the verbs (e.g., "Mary forgets that the cat is slow.") . For each sentence, the children were asked a question about whether or not the complement is true (e.g., for the sample sentence given above, "Is the cat slow?"). In the verb-choice task, the

children were presented with stories about characters who observed events either under favorable or unfavorable perceptual conditions. For each story the children were asked to choose between two verbs expressing the character's cognitive state (think, know, and believe were the only possible choices). In the definition task, two questions about each of the five verbs were asked. The first question was, "What does it mean to (verb)?" For the second question, the verb was embedded in a sentence, and the child was asked to explain the meaning of the entire sentence.

On the comprehension task, the 7-year-olds performed significantly better than the 3-year-olds (with no significant differences between the 4-year-olds and other age groups). There was also a significant verb x age interaction, with 3-year-olds performing better on forget, remember, and know than on think or believe; the 4-year-olds doing worse on believe than on the other four verbs, and better on remember than think, and the 7-year-olds like the fours doing worse on believe than all four other verbs, but also worse on think than on all three factives (know, remember, forget). The authors suggest, however, that the 3-year-olds' success on the factive verbs may be a fortuitous result of responding to all the verbs as if they were factives; thus they displayed no differentiated understanding between the verbs.

On the verb-choice task, the 7-year-olds performed better than both the 3- and 4-year-olds. Very few 3- or 4-year-olds answered correctly on any verb for all stories having the particular verb as one of the choices, while many of the 7-year-olds did. On the definition task, very few of the children at any age spontaneously mentioned any presupposition for any of the verbs. The children were better at stating, either directly or indirectly, the presuppositions in response to question two, which asked for the meanings

of sample sentences containing the verbs, especially for forget, remember, and know, but there were no significant age differences.

Moore, Bryant and Furrow (1989) point out that much of the experimental research that had been done on children's understanding of mental state verbs had investigated children's knowledge of the presuppositions of the verbs - whether or not the complement of the verb is true. For example, in "John knows that it's raining", "it's raining" is presupposed to be true - while in "John thinks that it's raining", "it's raining" may or may not be true. Verbs like know which presuppose the truth of their complement are called factives, while verbs like think or guess that don't presuppose the truth of their complements are nonfactives. Thus in Johnson and Wellman (1980), the conditions of the tasks were manipulated to change the presuppositions - whether or not prior information was given about whether the object was in the box - to see if children are sensitive to the effects of these conditions on the meanings of the words. Other studies identified by Moore et al. (1989) which investigated children's understanding of the presuppositions of mental verbs are Abbeduto and Rosenberg (1985), Bassano (1985), Johnson and Maratsos (1977), Miscione et al. (1978) and Wellman and Johnson (1979). Moore, Bryant, and Furrow extend these works by investigating another aspect of the acquisition of these terms: how they are used to signal the certainty with which a statement is made. Moore et al. call these usages pragmatic, in contrast to what they say is the semantic differences of the factive-nonfactive distinction (whether or not differences in certainty are just another type of semantic difference is a point not worth arguing here; however the recognition that the previous studies were concerned with but a limited aspect of meaning is laudable).

In Moore, Bryant and Furrow's study, 3-, 4-, 5-, 6- and 8- year-olds were given a series of tasks of choosing in which of two boxes an object was hidden. They were given verbal clues as to which one to choose by two puppets manipulated by the researcher. For each trial, each of the two puppets indicated a different location and used a different verb, saying "I [know/think/guess] it's in the [blue/red] box." The three possible combinations of two of these verbs were presented in each set of trials. They found that for the know-think and know-guess contrasts, the 3 and 4 year olds performed worse than older children at choosing the box indicated by the more certain statement (know). The 4 year olds did better than the 3 year olds, however. Moore et al. interpret these findings as indicating that by 4 years of age, children are starting to differentiate between know and think, and know and guess, and that this pragmatic understanding of the certainty implied by each term is complete by 5 years.

In a study similar to Moore, Bryant and Furrow (1989), using the same methodology, Moore and Davidge (1989) set out to see whether children's understanding of certainty (again called pragmatic understanding) is differentiated from their understanding of the factive - non-factive distinction (deemed a semantic understanding). Were children using the pragmatic or semantic distinction to differentiate cognitive verbs? In order to investigate this, three cognitive verbs were contrasted: know, think, and sure. (Know is a factive implying certainty, think a non-factive which doesn't imply certainty, while sure is a non-factive which does imply certainty.) They found that 3-year-olds performed poorly on all distinctions. Four, 5, and 6 year olds differentiated between know and think, and sure and think, but not between know and sure. They

conclude that these older children were using the pragmatic basis, certainty, to differentiate between the terms, and not the semantic basis, factivity.

To summarize, in the experimental work on children's understanding of the verbs know and think, the researchers have assumed that the verbs differ from each other only by single semantic features. While their results all show age differences between younger and older children, it is not possible to tell from this approach what the source of the age differences is, what the actual meanings of the verbs are for the children at different ages, and what developmental processes lead to more mature understanding and use. The attainment of more basic levels of meaning is not addressed.

Observational Studies

We move now from the experimental work to a summary of observational studies that have been carried out on children's acquisition of mental state terms.

Shatz, Wellman, and Silber (1983), in setting out to study two-year-olds' uses of mental state verbs, were concerned that children may be able to use these verbs conversationally without actually making reference to mental states. They point out that in adults the verbs can be used for example to fill pauses ("you know") or mitigate a demand ("I think I want a cookie"). These conversational uses in the adult presuppose the verbs' reference to mental state, but Shatz et al. wanted to be careful not to count such productions by the child as instances of reference to mental state, since the child could produce such utterances without understanding or awareness of the presupposition of mental state associated with these words. Thus in their conservative coding scheme, the functions of the utterances were classified, using contextual cues, into one category for

reference to mental state, and several others for utterances which did not provide strong evidence for their explicitly referring to mental state. These latter categories included, for example, 'modulation of assertion' (e.g., "I think this is a lamb"), and 'directing the interaction' (e.g., "Remember where the dirt is?"). In addition, those utterances classified as referring to mental state were further examined to see whether they served to point out a contrast between mental state and reality. According to Shatz et al., these 'contrastive' uses are especially informative not only because they provide good evidence for understanding of mental phenomena, but also because they indicate that the child's understanding is similar at least in this way to adults' understanding - it is claimed that among adults "making the difference explicit seems to be a prime motivation for expressing mental state" (p.304). The children's contrastive utterances, then, are taken as paradigmatic examples of expressions of mental state.

Their results are based on two studies of spontaneous speech in young children: the first followed one child (Abe) intensively, using speech samples collected twice weekly from age 2 years;4 months to 4;0. In the second study speech samples were collected by audiotape from 30 children on 4 occasions at 2 month intervals during their third year.

Abe used the verbs know and think most frequently of the 17 mental verbs reported. The earliest age at which he used a mental verb to refer to a mental state according to their conservative classification was at age 2;8 - the verb think. Most (13) of the verbs were used over the course of the study for both mental state reference and "nonmental" uses. Eight of these 13 verbs were used in nonmental ways at earlier ages than mental uses. The modal function of these verbs changed over the course of the

study from using the phrase "I don't know" (65%) at 2;4-2;8, to expressing mental state at 3;7-3;11 (43%). By 2;9-2;11, nearly a quarter (23%) of his mental verbs were used to refer to mental states, and 20% of the utterances coded as mental state references were used contrastively to differentiate mental states from reality. Results from the second study are comparable to and corroborate those obtained in the first study from Abe's earliest productions (age 2;4-2;8) and are not summarized here.

In a study of mothers and their toddlers videotaped longitudinally in a variety of contexts, Beeghly, Bretherton, and Mervis (1986) found that the mothers' internal state language to their toddlers changed over time, increasing with the increasing age of their 13-, 20-, and 28- month-old children both in frequency and variety. At 13 months, mothers attributed internal states primarily to the child; by 28 months, the mother was attributing them to other people as well. The category of internal state talked about also changed with the age of the child: at 13 months, the mothers talked most about perception, and volition/ability, while at 28 months they were also using words for cognition, moral judgment/obligation, and physiology. Measures of the frequency and variety of maternal internal state language at each age of the child were correlated with maternal report of their children's ability to use internal state words and other measures of the children's production and comprehension of these words at 28 months. The frequency of use of internal state words by the mothers differed by social context at 28 months: more during the snack and book reading situations than during free play. While the overall variety of internal state words produced was highest during the snack context, the category of internal state words most often used differed by the three contexts.

In conjunction with another study reported in their paper which showed that mothers use less internal state language with toddlers who have Down's Syndrome, the authors interpreted the results as suggesting that mothers fine-tune their internal state language according to their beliefs about their children's development. In turn, amount of exposure to internal state language seemed to influence their children's acquisition of this vocabulary. An important finding for the present study is that the category of internal state language used differed by social context (fairly broadly defined), leaving open the possibility that children use differing cues present in the differing contexts to interpret the meanings of the words. How internal state language is parceled out over more finely cut divisions of context was not addressed in the Beeghly et al. study.

Hall, Scholnick and Hughes (1987) observed the cognitive state word usage of somewhat older children, aged 4 1/2 to 5 years. The children in this study differed by race (black or white) and socioeconomic class of their parents (working or professional). All children were audiotaped during three settings: free play at school, teaching time at school, and dinner at home. The speech of the adults interacting with them in these settings was also recorded, and usage of cognitive state words noted. Besides the frequency and variety of words used by the children and adults, the usages were classified according to a scheme that categorized them into six progressively more advanced levels, based on depth of processing and abstractness: Perception, Recognition, Recall, Understanding, Metacognition, and Evaluation (see Hall, Scholnick and Hughes, 1987, p.294-295 for level descriptions; see also Booth and Hall, 1995, for a refinement of this scheme.) These levels are based on the content of the mental verb - for example, for Perception, the speaker reports the act of perception, "I heard your story"; for Recall, the

speaker refers to factual information that he or she remembers: "I know his phone number"; for Metacognition, the speaker discusses awareness of a mental act: "Pretending can be fun". These researchers support an information processing view of the development of meaning; according to their interpretation, the lower levels are acquired first because they are closer to the perceptions of the child-observer, while the higher levels are acquired later because they require more processing of perceptual input. (Because these levels are based on an information processing model, they are difficult to compare to the levels in Nelson and Lucariello's scheme which assumes that meanings are formulated by the child in relation to event representations, and that words eventually become related to each other in a lexical system; see next section, Reconciliation.)

Because they are of the most relevance to this project, I will focus here on differences by setting contexts and meaning level. Because the focus for the authors was instead on social class and race differences, significant differences by setting are not always reported. In these cases I rely on inspection of their data for comparisons. Also, the length of time to which their data correspond was not reported, so the frequency values in their tables are difficult to interpret, and are not recounted here.

The children used significantly more cognitive state words (tokens) at home than in either school setting. Level 1 meanings (Perception) were the most frequent at both home and school; Levels 3 (Recall) and 5 (Metacognition) were more frequent than Levels 4 (Understanding) and 6 (Evaluation). Significance tests on the frequencies by setting were not reported for the adults, but inspection of the frequencies presented suggests that the adults at home used cognitive state words more frequently than the adults at school.

The white working class, white professional class, and black professional class children produced a greater variety of different types of cognitive state words at home than at school; the black working class children produced as varied speech at school as at home. The black working class children produced the least varied speech at home, when compared to the three other groups of children.

The variety of cognitive state words in speech directed to the children in the different settings differed by the socioeconomic level of the children. The children of professional parents heard more varied speech at home than at school; however the working class children heard an equal variety of cognitive state words at home as in the directed school activity (but more in both situations than in free play). The overall variety of cognitive state words heard by the children was significantly correlated with the variety in their production.

The level of meaning used also differed by setting. The proportion of the child's internal state lexicon devoted to each of the three most advanced meaning levels was highest at home. There was a correlation between the proportion of internal state words devoted to the three higher levels directed to the child and that produced by the child.

The tentative conclusions to be drawn from these results are that setting makes a difference to the use of internal state words, but it may affect different groups of people in different ways; and that adult ways of using internal state words may influence how they are used by children. What this study didn't address is what aspects of the situation call forth the different patterns of usage, and whether different sets of words might be used more often or with particular meanings in particular contexts. As well, their account of meaning development tells us little about how word meanings come to be related to

each other in a lexical system, or how children manage to move from lower levels of abstraction to higher.

Bloom, Rispoli, Gartner, and Hafitz (1989) approaching the problem from a linguistic-structural rather than a functional perspective, looked at a large subset of children's uses of think and know, complementation: their uses in complex sentences having two verbs, expressing two propositions, in which one proposition serves as an argument within another proposition, as in their example, "I think I can put him in a house". Four children were studied longitudinally in naturalistic contexts from two to three years of age. Aside from short routine phrases (such as "I don't know" and "Think so?"), know and think were used mostly as complement-taking verbs.

They found that children's complement-taking uses of think and know had a high degree of contextual contingency - that is, the complement and/or complement-taking verb were previously introduced into the discourse by the adult speaker.

Bloom et al. distinguished two types of sentences with complementation: sentential complements (s-complements) and wh-complements. Think appeared only with s-complements (e.g., "I think I can put him in a house") while know appeared predominantly with wh-complements ("You know what's in this bag?"). The complementizer connectives what, where, and how were used by the children with know but not with think. That was rarely used as a complementizer connective. The participants of the subordinate verbs varied much more than those of the mental state verbs: think occurred mostly with I as a participant; know appeared with both I and you, but the order of acquisition varied by child. Little morphological marking was used with

the mental state verbs. The subordinate verbs used with think often appeared with a modal such as should (as in, "I think we should put this in a house.").

Bloom et al. use these findings to support their proposal that children use think and know to express uncertainty and certainty, even before the "truly cognitive meanings" of the terms are acquired. They emphasize that even at this early age, these and other complementizing verbs (see, look) are used with differentiation and specificity. These findings call out for the examination of mother-child conversation. Where do the lexical and semantic differentiations reported for the verbs at ages two and three come from? How closely do children's uses match those of their discourse partners?

Furrow, Moore, Davidge, and Chiasson (1992) investigated the relations between mothers' and children's uses of mental terms. They looked at 19 mother-child dyads; when the children were 2;0 years and again when they were 3;0. They measured the functions of the usages: true mental state reference, modulation of assertion, directing the interaction, directing reflection. These categories were an improvement based on Shatz et al.'s (1983) scheme - an improvement because Furrow et al.'s descriptions of the coding categories provide clearer criteria for an utterance's category assignment.

Because I base these coding categories on their work, here I briefly summarize the category descriptions and examples presented by Furrow et al. (pp. 621-622).

Mental state reference. The utterance's topic was the mental state of a person, as in "Think about it in your head".

Modulation of assertion. Marking of the certainty of a statement, recasting the speaker's own previous utterance, as in "Did you chew that or did Liam chew that? I think you chewed that."

Directing the interaction. An utterance that gave information or specified an action which might be carried out, as in "Do you think that's a garage?"

Directing reflection. An utterance made reference to information or an action but did not specify it directly, instead using a wh-word, as in "Do you know where that goes?"

Furrow et al. provide an important and arduous-to-obtain statistic: the percentage of all mental term utterances of the total number of utterances in the samples: 3.93% and 8.32% for mothers of 2;0 and 3;0 year old; and 0.40% and 3.82% for the children aged 2;0 and 3;0. These were significant differences for both speaker and age. (A count of the total number of utterances made by the speakers in the current study, no matter how desirable, was not attempted.)

Think and know were the two most common mental terms used by both mothers and children at both ages. Utterances containing these two terms, like the total of all mental terms, showed increases from age 2;0 to 3;0 for both children and mothers. The most common function for mental term use by mothers and children at 3;0 was directing the interaction. There was a difference between terms, however: mothers and children used think more often to direct interaction, while mothers used know to direct reflection. The children used know both to direct reflection and in the phrase "I don't know".

Correlations were performed for proportions of total utterances containing mental terms, and for the functions of the mental terms, with all the mental terms grouped together. Although it is understandable that they view the mothers' overall use of mental terms as contributing to the children's global understanding of mental phenomena, given their findings that the different mental terms had different functions, their results would

have been clearer for unraveling the development of word use if they had reported on each term as well as grouping them together.

They found significant positive correlations between the mothers' and children's proportion of use of mental terms at age 2;0 and children's use at 3;0. As for the functions of the mental state terms, mothers' use at 2;0 of mental terms to make utterances actually about mental states and to direct reflection were both significantly correlated with children's total use of mental state terms at 3;0.

Despite their focus on language, Furrow et al. speculate that the mother's use of mental state language contributes to the child's theory of mind by overtly focussing the child's attention on mental processes; using utterances which "direct reflection", in particular, would ask children to reflect on their own mental states.

In research focussed on the influence of conversational partners, Brown, Donelan-McCall, and Dunn (1996), studied a relatively large group (38) of 47-month-old, second-born children with three different conversational partners: the mother, the older sibling, and a friend. Audiotape recordings were made under naturalistic conditions, in the target children's homes. For the mother and sibling observations, the family's daily routine was recorded in the presence of the researcher. For the observations with the friend, the target child and friend were provided with a set of dress-up clothes and other toys and were left to play on their own. As well, the target children were tested for false belief understanding at 40 and 47 months. It is not clear from Brown et al.'s description of the observational method as to how much direction was given to the mothers and siblings to focus their attention on the younger child; the participants were free to move from room to room and to engage in their "daily routine".

Brown et al. did not focus on mothers' or children's differential uses of different mental state terms; rather, all mental state terms were grouped together and reported on globally. This is because they were concentrating on differences in mental state talk in general in different relationships- Dunn, the third author, has in her work consistently been interested in the family, especially sibling relationships - and not on the development of word meaning. Their work is nevertheless based to a large extent on uses of know (47% of mental state turns) and think (14%), and thus their findings bear direct importance to the study reported on in this dissertation.

Brown et al. found that the children used mental state talk much more with their friends than with their mothers or siblings. For all speakers, the conversational function of the mental state term was most likely for referring to mental states themselves; but the children also often used mental terms to direct the interaction with their friends. The children referred to shared mental states more often with their friends than with their mothers or siblings. Much of the child-friend mental state term use occurred during pretend play. Mental state talk was positively correlated with cooperative (as opposed to conflictual) play between friends and siblings, and more with girl friends than with boy friends. The strength of the friendship (measured in length in time of the friendship and frequency per week in playing together) was also positively correlated with amount of mental state talk. Positive correlations were also found between false belief task measures and use of mental state terms with siblings and friends as measured by total mental state turns, use of terms to modulate assertions and direct the interaction, to make contrastives, and to talk about shared mental experiences.

Brown et al. argue that among 4-year-olds who have clearly demonstrated an understanding of mental representation, it is overly conservative to assign "conversational" uses of mental state terms to a simple rote, non-mental status. They point to the important pragmatic role such utterances take in collaborative pretend play, and suggest that "the activity of creating fantasy worlds and sustaining interactive games with other children must surely provide multiple opportunities for the fledgling theorists to appreciate the workings of the mind" (p.847). These authors acknowledge that they have studied these children at a relatively late age, when use of mental state terms is fairly well established; they recommend the study of naturalistic mother-child interaction for the investigation of the development of these abilities. They recommend also that attention should be focussed on the type of play conditions under which mental state terms are used and learned.

While the observational work demonstrates the early competence of young children in using mental state terms, including think and know, there are important issues that it skirts. The development of the meanings of individual words is largely bypassed: mental state terms are grouped together, their differing meanings and functions often undistinguished. The relations between words, emphasized in the experimental literature, are largely ignored in observational studies. One significant exception to these generalizations is Bloom et al.'s study; however, they look only at complement-taking uses. And while mother-child interaction is emphasized in the observational work, how conversation leads to the development of individual word meaning and meaning relations is not.

A Reconciliation between Experimental and Observational Studies:

Development of Meaning

The apparently contradictory results offered by the observational and experimental work summarized above showing that children under 3 years of age use mental state terms appropriately under naturalistic conditions, but fail on experimental tests of their discrimination between cognitive terms, may be reconciled by placing them into a broader perspective provided by Nelson and Lucariello's (1985) classification of theories of early word meaning, and their developmental solution to the inadequacies of these theories. Here I will briefly describe their classification framework and their proposed solution, and then show how the mental state term work fits into their classification scheme. Then I will show that their developmental perspective on early word meanings provides a satisfactory explanation for the differences in findings between the observational and experimental studies on internal state terms. Continuing on to Nelson and her colleagues' work on the relation between generalized event representations and early language acquisition (1986) will set up a springboard for proposing a new study on the acquisition of the two mental state terms, think and know.

Following Lyons' (1977) description of three aspects of adult word meaning, Nelson and Lucariello divided theories of early word meaning into three groups: referential/perceptual, denotational/conceptual, and sense/semantic theories. Referential/perceptual theories are those which propose that children use perceptual cues as a basis by which to form meanings of words. Acquisition consists of learning what labels stand for which things in the world (usually objects), using perception as a guide. Extension precedes intension - children learn what words refer to what things without

previously having a concept on which to map the word. As Nelson and Lucariello point out, there are drawbacks to referential/perceptual theories: for one, many words do not have clear real world referents, such as abstract, or relational terms.

Denotational/conceptual theories of early word meaning propose that children map words onto their previously existing concepts. Intension precedes extension - children form concepts based on their experience in the world and only then pair words and objects. Word meaning is based on the child's experientially derived concepts.

Sense/semantic theories, rather than positing that children base early meanings on perception or prior concepts, claim that children early on have available linguistic primitives or semantic features. Working out the relations between words within various domains in terms of their contrasting features is seen as the way children accrue meaning to words. A problem with these theories as applied to internal states, as with other domains, is that it is not clear that young children recognize from the start that there are linguistic (or real-world) domains of emotion, cognition, or physiological states, etc., which they proceed to differentiate.

Nelson and Lucariello argue that all three types of theory are flawed in that each presents a limited view of what word meaning consists of: the referential theories don't take into account denotation and sense, the denotational theories don't address reference and sense, and the sense theories ignore reference and denotation. An adequate theory of the development of words meaning must take into account all three aspects of word meaning, since all will eventually be present in the adult system. At the same time, an adequate theory must account for the changes in the child's ability to mean; rather than claiming that all three aspects are available from the start, Nelson and Lucariello propose

that there is a developmental progression proceeding from the ability to refer, to denotation, to making sense (in the technical sense of the word).

To accommodate all three aspects of meaning in a way that accords with the evidence from studies of the meanings of children's early words, Nelson and her colleagues (1985) have proposed a model of meaning development which revolves around generalized event representations. Generalized event representations are, as their label implies, internal representations of familiar events in the child's everyday life. Much effort has gone into demonstrating that these representations are general - representations of the way events usually go - and not simply memories of specific, individual events. GER's are the cognitive counterparts to the routinized formats of Bruner's (1983) formulation, the point being that the children's representations may differ from the formats of the actual events, and once established can be manipulated independently of the events themselves. From an early age, young children represent events in a holistic manner, without conceptually distinguishing the parts (actors, actions, objects) which make up the event. During the first half of the child's second year, many of the children's words are prelexical - they don't refer to particulars within the event, as the event has not yet been analyzed into its component parts. Instead they have a more event-bound, performative quality, inseparable from the situations in which they occur. Some words at this age do seem to refer - the naming of pictures in books, the naming of objects in specific situations - but the meanings of these words are solely referential, lacking a conceptual basis. During the second half of the child's second year, children start to analyze their event representations, developing independently manipulable concepts for the parts of the event: objects, actors, actions. At the end of the child's third

year, words not only refer, they also denote, as word meanings are now based on concepts of these parts of events. However, sense meaning is still not present. Only with further differentiation and integration of the conceptual system and linguistic experience, occurring through the preschool years, does a semantic (sense) system come into being. It is only then that the relations between the meanings of words - relations of contrast, of similarity, of hierarchy - become established.

In this dissertation, I will use the terms conversationally embedded (rather than referential/perceptual), denotation (rather than denotational/conceptual), and sense (rather than sense/semantic) to refer to the levels of word meaning for think and know attained by children. I use conversationally embedded instead of referential/perceptual because children's first meanings for abstract words such as think and know do not refer to any particular object or concept or perceptual phenomenon; they are inseparable from the types of conversations in which they are used. I use denotation and sense because I want to emphasize linguistic development, and the first term in each pair speaks to word more than thought.

Since 1985, Nelson and Lucariello have toned down their strong claim that initial words are non-conceptual and dependent for their meaning on their undifferentiated embeddedness in general representations of familiar events (Nelson, personal communication). This change was prompted by research carried out by Lucariello (1987) which demonstrated that even infants in the beginning of word acquisition (under 50 words in their vocabularies, in the middle of their second year) were able to form concepts of and learn words for experimental objects. These words were also generalized by the infants to novel exemplars of the categories of objects signified by the new words.

Rather than learning ungeneralizable words for objects, embedded in event schemas, as the theory predicted, even these beginning learners seemed to base their learning of words for objects on object concepts.

Nelson has further suggested (1990) that the single-word period may consist of three distinct phases: first a "holistic" phase, in which words are embedded in unanalyzed event schemas; secondly an "exemplar" phase, in which word meanings are beginning to depend on object and action concepts, but these concepts are holistic, based on single exemplars; and third a "conceptual" phase, in which words are extended on the bases of analyzed features (labels for phases, in quotes, are mine). In her 1988 paper ("Constraints on Word Learning?") Nelson provides an overview of three periods of word learning which correspond to those of the Nelson and Lucariello 1985 paper but which rely less heavily on the disembedding of words and concepts from generalized event representations. In the 1988 scheme, in the first period, the child faces the problem of what words do and how they refer. Word production is marked by over- and under-extension, complexive uses, idiosyncraticity of meaning. The second period begins when the child has about 30 words in his productive vocabulary, and "seems to have achieved the realization that words name categories of objects and events" (p. 89). During this period word meaning are based on conceptual categories which are in turn based on the child's experiences. It is not until the third period when the relations between words begin to be worked out, and the child forms a lexical system through the reorganization of the conceptually-based words acquired during the second period.

These tentative modifications of their theory do not appear to affect its application to the acquisition of mental state words. These changes are meant to address new

research on the early, one-word phase, especially as it relates to the learning of object words. Children are well past the one-word phase of development when they begin to use words for mental state. Their description of word meaning development may be an even more useful guide to how children acquire the meanings of more abstract words such as mental state terms, which cannot be taught by simple ostension or be based simply on readily available perceptual cues.

Using this framework, we can now return to the issue of the apparent contradiction between the experimental and observational findings on children's mental state terms. Now we can see that the contradiction is indeed only apparent. The experimentalists have focussed on the development of sense meanings - whether or not children differentiate between the features of related words in a particular lexical domain, cognitive terms. Studying 3-, 4-, and 5- year- olds, they have mostly found 3- and 4 year- olds' knowledge to be deficient. It would be acceptable if the researchers acknowledged that what they were studying is only one, later-developing aspect of word meaning - sense - which develops through the preschool years and beyond. But instead these researchers tend to claim that 3- and 4- year- olds lack the conceptual basis for these words. This makes it seem as if they were saying that these words mean nothing to pre-schoolers. Yet the observational data make it clear that 2- and 3- year- olds can use mental state terms appropriately, when supported by the appropriate context. It may be suggested then that the meanings of two- and three- year- old children's mental state terms might have a conceptual basis; perhaps at two they start to be differentiated within the holistic event and at three they can be manipulated independently of the event itself -

but as the experimental evidence shows, at three years the words do not seem to have been located in an abstract lexical system complete with sense contrasts.

Observational Data for Theory of Mind Purposes:

The Research of Bartsch and Wellman

In service of their goal of describing the state of young children's knowledge about the mind, Bartsch and Wellman, in their 1995 book, Children Talk About the Mind, present an analysis of children's uses of mental state terms - but only those that fall under the category of "genuine psychological reference". Bartsch and Wellman present a strong argument in favor of their "theory theory". They describe children's understanding of the mind as the development of different theories as to how the mind works.

Children's understandings can be described as theories, in their view, because they explain and predict people's behavior and actions. The constructs involved in the theories - beliefs, desires, actions, etc. - are related to each other in important ways which serve to explain and predict. Bartsch and Wellman describe three phases in the child's developing knowledge about people's minds: an early desire phase, in which people's behavior is understood in terms of their wants (desire psychology); a second phase in which children begin to talk about people's beliefs and thoughts, but do not consistently relate them to people's actions - their explanations for people's actions still rely on desires (desire-belief psychology); and a third phase, in which people's beliefs and thoughts are increasingly used to explain behavior (belief-desire psychology).

Rather than collect original transcripts, Bartsch and Wellman have used previously collected transcripts from other longitudinal studies of individual children - 10

children in all- which had already been entered into CHILDES , the Child Language Data Exchange System (MacWhinney & Snow, 1985, 1990). The children included in the study were Adam, Eve, and Sarah (Brown, 1973); Abe (Kuczaj & Maratsos, 1975); Ross and Mark (contributed by Brian MacWhinney); Allison (Bloom, 1973); Peter (Bloom, 1970); Nathaniel (contributed by Catherine Snow) ; and Naomi (Sachs, 1983). They searched the records for uses of a short list of target mental terms, including think and know. They also studied desire terms, such as want and like, but because they relate more directly to this research, I present here a summary only of some of their findings on children's use of mental terms. Verbs included in their analysis were think, know, wonder, dream, believe, and expect, but 96% of the uses were of think or know.

According to Bartsh and Wellman, the children began to refer to thoughts and beliefs just before age 3; by age 4, 25% of their uses of the terms were genuine psychological references. Their uses included two different types of contrastives: those in which the child contrasted thoughts and reality, and those in which they contrasted the thoughts of two different individuals. Only a small percentage (less than 4% at its highest point for thought-reality contrastives) of mental term uses were contrastives, but Bartsch and Wellman argue that the demonstrated ability to make these kinds of contrasts, beginning about age 3, are significant because they provide insight about the child's early conceptions of thoughts and beliefs. To this end, they analyzed the children's contrastives further. The children's individual contrastives not only juxtaposed two differing mental states, they were differing states about the same object or contents. This indicated that children understand the subjective quality of mental states - that different people can simultaneously have different thoughts about the same object. As well,

beginning at age 3, the children in their thought-reality contrastives demonstrated their knowledge that thoughts can reflect the real world - be epistemic - and not only about fictional imaginings. The children also, from age 3, produced false belief contrastives: statements contrasting false representations of the world with true real world content - demonstrating their understanding that thoughts are representations of reality, which can match (or not) the state of affairs in the world. The emphasis here is on their grasp of the representational quality of mental events - that they are representations of, and not mere connections to, external events. From age 3, the children also asked questions about, and made assertions about sources of knowledge - such as seeing or hearing, or being told by another person. Bartsch and Wellman report that the children used think and know differentially; their genuine psychological references using think referred to the contents of thought, while they used know to talk about ignorance of true things. (Perplexingly, they provide only examples of differential use, and no data to back up their statement.)

Bartsch and Wellman also looked at children's references to the self's and others' thoughts and beliefs (again, data are provided only for "true psychological references", not all uses of the mental terms). While references to the self's thoughts and beliefs predominated, the delay between first referring to the self's and first referring to another's thoughts was not long, on average only one month. Bartsch and Wellman conclude that the predominant reference to the self's thoughts stemmed from the child's general tendency to talk about the self, and not from the absence of a conception of thought in other people.

While providing us with a useful, if overgenerous, description of young children's knowledge of people's mental states, their approach and method give us little

idea of how this knowledge originates and develops. They dispense with a bulk of useful information: the uses of mental state terms which were judged not to be genuine psychological references.

I challenge the notion that mere "conversational" uses of mental terms (as if the other uses were not made during conversation!) are unrelated to the development of genuine psychological ones. There is a reason why common phrases are used in conversation the way they are, having to do with their relation to the more core meanings represented by the words. Take two common conversational uses of know: "You know what?" and "I don't know". "You know what?" is used in conversation to gain attention and introduce new information. Literally, though, the phrase questions the listener as to whether or not the listener possesses the new information to be given by the speaker. "I don't know", in conversation, is an answer given by a listener when the speaker asks whether or not the listener possesses a piece of information - new or otherwise- and the listener does not possess that information. Queries and answers about the possession of information can be interpreted as references to mental state. Admittedly, these are the literal interpretations of these phrases; the child does not need to understand these literal meanings in order to participate in conversations containing them; they can use them simply by rote. Yet the potential is there for a deeper analysis of the repeated conversational contexts in which they occur. These, in conjunction with hearing more "advanced", more obviously mental uses, can contribute to the child's interpretation of the meaning of mental terms. The argument is that it a mistake to disregard conversational uses of mental terms as irrelevant to the disentangling of meaning of the terms by the child; on the contrary, the stable conversational contexts in which they occur can aid the

child. To rephrase the argument in terms of Nelson and Lucariello's theory, the children might first be using the word such that it is embedded in the conversational events - but with repeated use in a number of different contexts, the child disembeds the term from the conversational events, arriving at a concept of what the term denotes. The use of mental terms in "conversational" ways with adults is part of how children gather the evidence which they later use in the disembedding process.

As I read their book, I attempted to clarify how the categories they coded would have been placed in this study's coding scheme. The differences in emphasis are a good example of how the same data can be coded differently to serve the purposes of two very different theories with diverging goals. Bartsch and Wellman's conversational uses, rejected by them as not genuine mental references, become conversationally embedded uses, tied to the here and now, in the word meaning level coding scheme. Bartsch and Wellman's contrastives- except those that contrast two mental terms - become Nelson and Lucariello's denotational uses, as they indicate that the child has disembedded concepts corresponding to the terms. (In the word meaning scheme, references to the past, future, and generalizations are also included as denotational references.) The contrasting of two mental terms - not specifically coded for by Bartsch and Wellman but overlapping in part with their contrastives - those that use two related verbs for mental state - are included in the sense meaning category of the word meaning level scheme, along with assertions about sources, described as mention of presupposition in the meaning level scheme. Questions about sources alone in the Bartsch and Wellman scheme were not included as sense meanings in the word meaning scheme because their form - consistently appearing in the frame, "How do you know?" - led me to think that the question can be understood

as functioning as a fixed mode of additional information acquisition in a given context, and not necessarily as a true inquiry about source. Further, many of Bartsch and Wellman's codings are generous in ascribing children with knowledge about mental states from rather bare conversational evidence. Until they gain a more fluid flexibility in using the terms in more varied lexical and situational contexts, it is presumptuous to claim they are using an organized theory of mind when the children could simply be starting to use phrases which they have heard more advanced speakers using in similar contexts.

General Event Representations and Language

I move on now to a selected review of literature which supports the view that language in general and word meanings in particular are acquired in the context of adult-child interaction.

Lucariello, Kyratzis, and Engel (1986) present three studies which explore the relation between event representations and language. (The first two will be discussed here; the third is omitted because it deals with the influence of maternal language on event knowledge acquisition, rather than on language acquisition, the focus here.) In the first, mother-child language in Event Contexts, situations in which mother and child share event knowledge, was compared with their language in non-Events, for which the dyad did not share such knowledge. The authors predicted that language in the Event Context would be facilitated for three reasons: (1) mother and child share knowledge about the situation, and this in itself should promote discourse; (2) mothers may promote their children's speech to a greater extent during the routines played out in Event

Contexts; and (3) child speech may be facilitated in Event Contexts because there is less of a processing demand on the child in a more familiar situation, leaving more processing capacity to be devoted to language.

In this first study, ten mother-child dyads were audio- and video-taped in their homes. The children ranged in age from 2;0 to 2;5. Three contexts were studied: an Event Context situation which varied by dyad but was always familiar and routine to the particular dyad (e.g., lunch or getting dressed); and two non-Event situations: a Novel context consisting of play with an unfamiliar castle toy set; and a Free Play situation in which the dyad played with an unfamiliar set of unrelated toys. Transcripts of the sessions were examined for variation in language use. In general, their predictions were supported. Among the results supporting the prediction that the Event Context would support language use were that the children were better at answering questions during the Event Context than during the two non-Event contexts; the semantic breadth - number of different topics discussed per conversation - was greater during the Event Context; and more conversations about non-present activities - either in the past or in the future - took place during the Event Contexts.

A second study described by Lucariello, Kyratzis, and Engel and reported on more completely in Nelson, Engel, and Kyratzis (1985) examined the decontextualization of early object word use within an Event Context. Decontextualization was defined as the acquisition of pragmatic functions increasingly distant from the action: requesting, initiating, narrating, planning, invoking. The invoking function is seen as the "culmination of the decontextualization process": words can be used conceptually to refer to particular aspects of an object or to further a conversational topic. For this study, one

dyad was audiotaped once a week for 8 months, starting when the child was 16 months old. The Event Context studied was the morning routine of getting dressed and having breakfast. In Nelson, Engel, and Kyratzis (1985), the development of four words were traced: book, shoes, juice, and Daddy (concrete nouns all). Through relevant examples, the authors present the increasingly decontextualized manner in which both the mother and child used the words. At first, the child's uses were embedded within the action of the Event, and didn't appear to have any meaning which was independent of the Event. Then, within the Event Context, in later sessions the child was able to accomplish more complex functions: requesting, initiating. Finally, the child was able to anticipate and plan using the words: for example, while getting dressed, she was asked what she was going to have for breakfast, and she replied, "Toast. Milk. Juice!" The authors suggest that the shared event knowledge between mother and child permitted the mother to interpret the meanings of her child's words and for the child to acquire the meanings presented by the mother.

These findings support the view that dialogue within familiar, routine contexts facilitates word learning, although word meaning may be disembedded from the representations of the events earlier than was previously assumed, during the "exemplar" phase as presented above in the discussion of Nelson (1990). It may be that the learning of object words presents a special case in the relation between words and concepts; children may disembed words for objects from event representations earlier than other types of words because object concepts may be easier for the child to form than other types of concepts (Gentner, 1982). The evidence that Lucariello (1987) put forth prompting the revision that children do base their early word meanings on concepts was

solely based on object words, and might not generalize to other types of words and concepts. [See arguments below supporting this view in the summary of Nelson, Hampson, and Kessler Shaw (1991)].

Nelson, Hampson, and Kessler Shaw (1991) argue against the claims that 1) children in their earliest word learning first learn object names, identify these as belonging to the word class of nouns, and later extend the word class to include other types of nouns (semantic bootstrapping) and 2) children in the earliest period of language learning are constrained to think that words are the names of whole objects. Not all children learn nouns in preference to other types of words, and even when nouns are learned, they are not necessarily basic level objects, as the two above claims would imply. Instead, they suggest that object names may be relatively easier to learn not because of innate constraints, but due to other factors working together: the child's general interest in and experience with objects, resulting in prelinguistic object concepts to which object names can be readily mapped; the perceptual coherence of whole objects, made even more salient through pictures which can be pointed at, or otherwise displayed as a single entity; and the format of the "Naming Game", a familiar frame within which object names can be introduced by the mother or (later) provided by the child. In contrast to these supportive conditions for the acquisition of object names, how young children can learn other words, including non-object nouns (or mental state verbs) is not as evident.

In a longitudinal investigation of how mothers and children up to the age of 20 months use non-object nouns in natural discourse contexts, Nelson et al. identified a number of regularities which may support acquisition of these words. Each tended to be

used in specific pragmatic and sentential contexts: both particular pragmatic contexts centered on the child's activities, and sentential contexts involving frequently used lexical phrases containing the word. They suggest that children use these cues toward meaning in conjunction with their prelinguistic concepts of activities, events and other non-object phenomena, and also begin to form new concepts based on the way these words are used in the language. (The latter may be especially true of words for cultural constructs, such as money). Children too may use such words in appropriate contexts before they know what the words mean; by using the words and attending to their use by others, children can gradually work out their meanings.

In this project I propose to extend the work of Nelson, Hampson, and Kessler Shaw by looking at two verbs commonly acquired by young children that are much more abstract than object names: think and know. Unlike objects, these mental states cannot be bumped into or picked up or pointed at. They are more like actions and events in that they are experienced. Unlike actions and events, however, the mental states of other people are not so easily observed. Because of their very internality, it may be more difficult for adults and young children to achieve joint attention on mental states. How then, is learning of these words accomplished? How can the child know when an adult is referring to a mental state?

Montgomery: Wittgenstein's Private Language Argument

Montgomery's (1997) statement in his theoretical article on Wittgenstein's private language argument, as applied to a critique of theories of the child's theory of mind, fits

in well with the view presented here that developments in word meaning account for discrepancies between observational and experimental data. Here I will summarize his statement, compare it with Nelson and Lucariello's view of word meaning development, and discuss how it relates to the research conducted in this dissertation.

Montgomery contrasts three views of how children might come to understand other minds: the simulation view, the theory view, and Wittgenstein's criteriological view (which he supports). In the simulation view, the child first experiences the self's own internal states, and then by analogy imputes the same internal states in others; the child works from the inside, out. In the theory view, the child acquires a set of theory-like principles that interrelate mental states with each other and with behavior; it is a coherent conceptual system that allows the child to infer the presence of mental states in other people. Bartsch and Wellman support this view.

According to Wittgenstein, introspection, as used in the simulation view, is an inadequate method for acquiring knowledge of mental state terms, because the child could not be certain when the private language created for the self should be applied to others. For justification of the appropriateness of using a word, external input is necessary. The child must learn which terms apply to which publicly observable, overt cues. These criteria are the public, outward rules of a "language game" which children learn by participating in the language game with more experienced "players" (such as parents). The rules of the language game provide criteria by which a speaker knows when a word is applicable and when it is not. For Wittgenstein, a word has meaning only when it has rules governing its applicability.

Montgomery uses Wittgenstein's criteriological view as applied to research evidence to criticize the theory view. According to his reading of evidence from research on children's understanding of the mind, children's initial state of understanding is more criteriological than theory-like: they appear to be more influenced by external criteriological features than by interdependent mental constructs. To use one of Montgomery's examples, Lillard (1993) presented four and five-year-old children with a story in which a person who had never seen or heard of a kangaroo was hopping up and down. The preschoolers said that the person in the story was pretending to be a kangaroo - they used overt behavior (hopping) to establish pretense rather than the possession of pertinent knowledge (the related theoretical construct). Similarly, he argues, the evidence shows that young preschoolers use correct outcome to behavior (an overt cue) more reliably than perceptual access (a related conceptual assumption) to attribute knowledge to another person. He summarizes that only gradually do preschoolers acquire an interrelating of concepts that indicate a theory of mind; the experimental evidence points to their early reliance on overt criteria to establish the presence or absence of mental states.

Montgomery suggests that children's understanding of the mind may follow a developmental sequence wherein at first understanding is criteriological, as early word meanings are established, and later may be more theory-like, when the meanings of words are placed in relation to each other. A criteriological view is an inadequate description of adult understanding of the mind; overt behavior may differ from mental states. Montgomery further suggests that the child's observations of discrepancies between outward behavior and mental states necessitate rule clarification and may be

what drives the child's development to a more mature, theory-like understanding of the mind.

How does Montgomery's description of the development of word meaning compare to Nelson and Lucariello's? Simplifying for comparison, Montgomery described only two stages of development: a criteriological stage, in which overt cues are used by the child to decide when a word can be appropriately used, and a theoretical stage, in which word meanings are interrelated and incorporated into a coherent set of principles. Nelson and Lucariello described three stages: reference, in which word meanings are undifferentiated from the event representations in which they occur; denotation, in which words have been differentiated from the events in which they occur, and the child has a concept for the word independent of the events in which they occur; and sense, in which word meanings have been placed in a system of relations with each other.

Montgomery's theoretical stage and Nelson and Lucariello's sense stage correspond to each other fairly readily, if the emphasis is placed on the establishment of a system of word meaning interrelations and not on whether or not the child has a theory-like understanding of other people's minds. How the criteria stage and embedded use and denotation fit together is not as apparent, and requires some stretching beyond these authors' work. Perhaps initially, when the overt criteria and their correspondences to mental terms are being established, and must be present for the child to use the appropriate term, the child is establishing embedded use. Later, when these correspondences have been established so that the child can use the terms even in the

physical absence of the criteria, but has not yet interrelated the meanings of the terms, the child has achieved denotation.

Montgomery focuses on how the child learns which mental state corresponds with which mental term: for him, the child's most important step in entering the language game consists of learning correspondences. What he doesn't address is the complicating factor of the multitude of functions that mental terms such as think and know play in actual conversations. Children also must learn the recurring persons, topics, times, grammatical forms, and lexical patterns (including frozen idioms) in which these terms are embedded. The acquisition of word-concept correspondences alone is inadequate for the acquisition of competence in a language, just as the memorization of long vocabulary list translations by a junior high school student does not produce a fluent speaker of a second language. Non-object words especially are not learned or used in isolation but in sentential groupings, in appropriate contexts. Bloom et al. (1989) have shown that think and know have their own differentiated sentence patterns from their earliest uses, at least for uses with complementation.

The research in this study is designed to examine this aspect of the child's entry into using mental terms - for both reference to mental states and other functions. This is not to deny the validity of Montgomery's argument that the child must learn the public criteria for applying words to concepts. I am extending his argument to say that the child must attend to other aspects of the conversation beyond overt behavior. The emphasis here is on the child's achievement of competence as a speaker, not simply as a gatherer of isolated word meanings.

Chapter 2: Pilot Study

As a preliminary investigation into the patterns of use of think and know by mothers and children in naturalistic conversations, transcripts of mothers talking with their 13-20 month-old children were analyzed. The main purpose of this investigation was to gain a picture of how these words are used by mothers in an everyday context, and to find out what cues are provided by the mother in conversation as to the meanings of the words. The types of cues looked at were the general activity context; the time reference of the conversation; the person to whom the mental state was attributed; whether or not the word actually referred to a mental state at all or had some other purpose within the conversation; informational cues in which fairly explicit details were provided regarding the meaning of the word; and lexical frames, phrases within which the word frequently appeared.

It was predicted that the words know and think would each have its own individual pattern of frequently recurring cues, providing a rich predictable backdrop by which children can work out the individual meanings of each word.

Method

Transcripts

Pre-existing transcripts of 12 mothers and their 13-20 month-old children interacting in their homes were utilized in this analysis. These transcripts were originally created by Hampson (1989) as part of a dissertation on children's' and mothers' referential and expressive language styles. She videotaped the children at 13, 16, 18, and 20 months of age with their mothers in three situations: during play with toys provided by the

researcher, a meal or snack, and a frequent activity context chosen by the mother, varying by dyad (often picture book reading). Fifteen minutes of each of three contexts at each age were transcribed, along with a running commentary on the actions performed by mother and child in relation to their utterances. However, because of a subsequent reanalysis of the transcripts (to be described), not all fifteen minutes of each context was available for this study.

In the second analysis of the Hampson transcripts, Nelson, Hampson, and Kessler Shaw (1991) searched the transcripts for all segments of conversation containing a predetermined list of non-object nouns. These segments were then entered with identifying headings into a word processor. An estimated one-half of the original transcripts were entered. It is these latter segmented transcripts, readily accessible to manipulation via the word processor, which were used in the current study of know and think. Since there is little reason to surmise that the frequencies or types of non-object nouns and these mental state words covary, it can be tentatively assumed that the filtering of the transcripts through the non-object editing had little or no selective effect on obtaining a representative sample of conversations including know and think. However, it does mean that the precise lengths of the transcripts from which these samples were obtained are not available. As a consequence, it is not possible to compare, for example, the frequencies of uses of a particular word by play or meal context; one can only achieve a more global picture. For this reason, context comparisons, while of importance, cannot be regarded as reliable in this preliminary study. (The use of original videotapes for transcription in the main work of this dissertation will eliminate this weakness.) For this

study, the segments of transcripts from the non-object noun study were rearranged according to their inclusion of the two target words.

Coding

Context. Transcript segments were given one of three context codes according to the general activity engaged in by the dyad:

<u>Code</u>	<u>Context</u>
P	play: play, with or without toys provided by the researcher
F	food: during meal or snack
B	book: during picture-book reading

Time. The time classification code designated when in time the target word referred. Conversational and situational cues as well as grammatical tense were used to determine the time reference. One example is the idiomatic use of the phrase "I thought so", which while couched in the past tense usually was used to refer to current situations, and was thus coded as referring to the present.

<u>Code</u>	<u>Time reference</u>
B	before (past)
P	present
F	future
G	timeless generalizations
Y	fantasy play

Person. The person code was assigned according to the person in the utterance to whom the mental state word was attributed.

<u>Code</u>	<u>Person</u>
M	the mother in the dyad
C	the child in the dyad
O	other person or object
MC	both mother and child

Mental verb code. The main purpose of the mental verb code was to report whether or not the use of the word referred to an actual internal state on this occasion of use. Shatz et al. (1983) have reported on the different types of uses of mental state verbs, both to refer to mental states and other, non-mental uses. As they have stressed, mental state verbs may be used for a variety of conversational purposes which do not refer to mental states. Here the mental state verbs know and think are classified using the Shatz et al. scheme.

Mental verb codes. The following classifications and their abbreviated explanations are borrowed directly from Shatz et al., 1983, p. 307-308 (see their article for further details). Note that in the main study reported in this dissertation, a modified coding scheme based on Furrow et al., 1992 is used.

<u>Code</u>	<u>Classification</u>
IS+	Mental state: an utterance is classified as mental state only if the mental term is judged, with regard to its context, to refer to the thoughts, memories, or knowledge of the speaker, listener, or a third person.
MOD	Modulation of assertion: these utterances mark the degree of certainty with which a speaker makes an assertion.
DIR	Directing the interaction: utterances in this category focus the conversations or are used in a general way to aid interaction.
CLAR	(Clarification: omitted because it was not applicable to the words in this study.)
DES	(Expression of desire: omitted.)

- ACT (Action-memory: omitted.)
- IDK I don't know: The phrase "I don't know", without a predicate complement.

Another type of use of the word think was discerned, and was added to its coding in this study:

- OP Opinion: An utterance which expressed, attributed, or asked for a subjective opinion.

Sense meanings. The purpose of the sense meaning classification was to look for explicit clues as to meaning provided by the mother in conversation.

<u>Code</u>	<u>Classification</u>
C	Contrast: the mother makes a contrast or differentiates between the mental state and another, related mental state.
PS	Presupposition: the mother mentions a presupposition of the verb.

Lexical frame. These were repeated phrases within which the mental verbs frequently occurred. Frequently occurring morphological markers and irregular verb tenses are also reported under this classification.

Results

Table 1 presents the total number of uses, and the frequencies of the context of use, time reference, and person reference for the mothers' uses of know and think with their 13-20 month-old children. Data on know used to refer to an internal state (IS+) are presented after its totals.

Context, Time, and Person. Both of the words occurred in both the play and food contexts, without one context or the other predominating. Know and think were used most often in conversations about the present. The mother assigned think most often to herself, while know was attributed to both mother and child.

Mental verb code. The percentages of maternal uses which utilized the words to refer to internal states, along with other non-mental uses, are presented in Table 2. Know("Do you want to know what you can do with these blocks?") and think("I think you've had enough lunch for today.") were used to direct the interaction each about 40% of the time. They were also often used to modify statements ("We'll take out some of the chicken and carrots, which I know you'll only pick out." "We can't see it from here. I think it's someplace else.") Think was rarely used in an unequivocally internal way (9%; "You don't believe me. You think I have another bag hidden somewhere."). Instead it was used in conversational ways.

Sense meaning. Table 2 also presents the percentages of sense meanings used by the mothers. The mothers did differentiate the verbs from other related verbs (16 for know, 7 for think) and mentioned presuppositions for know (11 total) but not think (only once).

Lexical frames. Table 3 presents the percentages of common lexical frames, phrases within which the words were often used. The two verbs were used in different lexical frames, with the most common "I think X" (39% of uses of think).

Summary

These preliminary findings show that the words know and think are used differentially but in predictable ways by mothers in conversation with their toddlers.

They demonstrated that mothers were using the target verbs with children even this young, and that this coding scheme is a fruitful way of describing their uses.

Chapter 3:Method

The two major goals of the main study presented here were (1) to see how mother-child conversations contribute to the child's acquisition of two mental state verbs, think and know and (2) to investigate the development of meaning of the child's uses of think and know, using Nelson and Lucariello's (1985) description of the development of word meaning as a model. Pursuit of these goals is important for several reasons: it can contribute to our understanding of how lexical acquisition in naturalistic contexts proceeds; it can elucidate the Nelson and Lucariello model, which while consonant with previous research on lexical development, has had little research addressed to it directly; and it can provide evidence relevant to the proposed explanation for why the apparently contradictory experimental and observational findings on children's internal state words are actually compatible.

In designing the study, it was thought essential to study children longitudinally from the time of early use of internal state words (roughly two and a half years) to the age of most interest to the experimentalists (four years). This age span should correspond to the time of greatest change in developing word meanings, according to the Nelson and Lucariello model. In practice, a more convenient design was used: two groups of children, ages two-and-a-half and three-and-a-half at the beginning of the study, were each visited four times over a span of six months. I predicted that by 30-32 months first uses of think and know would be established, as the evidence from the observational

studies suggested; when the children would provide evidence that they had achieved denotation and sense was open to investigation.

I thought it important to observe the mother-child dyads in a variety of contexts, differing in familiarity and activity. This would both provide the dyads with a wider opportunity to display usage of the target words, and provide the researcher with the opportunity to investigate whether the individual words were used differentially in different contexts.

Participants

Twenty-three children and their mothers (one father) participated in the study. Most were recruited through word of mouth. Five dyads were friends of families already participating in the study. One child was recruited through a nursery school. Twelve of the children were two-and-a-half years old (ranging from 2;3 to 2;8) at the time of the first visit, and eleven children were three-and-a-half years old (ranging from 3;4 to 3;7) at the first visit. Each child was visited in their home four times over the course of 6 months: Visits 2, 3, and 4 took place one, two, and six months after the first visit, respectively. Thus by the end of the study the 2-1/2-year-olds were approximately 3 years old (2;10 -3;3) while the 3-1/2-year-olds were approximately 4 years old (3;10 - 4;1).

There were seven girls and five boys in the 2-1/2-year group, and five girls and six boys in the 3-1/2-year group. There was much variety in the birth order of the children. Five of the 2-1/2-year-olds were only children, and seven were second-born; one of the second-born children had a younger sibling, and one was a non-identical twin.

Six of the 3-1/2-year-olds were only children; one was a first-born, three were second children, and one was a third child.

The majority of the children came from white, professional class families with two parents. There were one African-American and one Latin-American 2-1/2-year-old. There were two African-American 3-1/2-year-olds, and one with a white mother and African-American father. Two 3-1/2-year-old children lived in single parent homes (both mothers); all of the 2-1/2-year-olds lived with both parents. Five of the 2-1/2-year-olds' mothers, and 5 of the 3-1/2-year-olds' mothers, worked full time outside the home. Only one child (a 3-1/2-year-old) had parents who were psychologists (in this case, both parents). Mothers participated in the study with their children, except for one father of a 3-1/2-year-old boy whose mother was ill. Other family members were discouraged from participating but were not completely excluded, as when a younger sibling had no other childcare, a father joined in for a meal, or a jealous older sibling would not be ignored.

Parents of potential participants were called on the telephone. The parent was told that the study was about children's word meaning development, but that the words being examined would not be divulged to the parent until the end of the study. They were told that this was because knowing what the words were could change the way the parents or children used them. The parents were not told until the end of the final visit that they were being studied as well as their children. During this first telephone call the home visitation schedule was explained. They were told that their child would be videotaped for approximately one hour in the presence of the mother, in four contexts of 15 minutes each: Play, where mother and child chose an activity they enjoyed; Meal - a time of day would be chosen when the child normally ate; and two activities with

materials brought by the researcher: a Hide and Find game with cups and Doll House play. The home visits were to last approximately 1-1/2 to 2 hours and would be conducted by the researcher.

The parents were offered copies of the videotaped sessions if they provided blank tapes for this purpose to the researcher. Then the parent was asked if they wanted to participate, and if they did a first home visit was scheduled.

The participation rate of invited families was encouragingly high (23 out of 31 families). This was probably due to the method of finding families to participate, word of mouth through the researcher's friends and participants' friends, perhaps facilitated by the researcher's self-description as a heavily pregnant young graduate student, a suitably non-threatening figure. All 23 families remained in the study for its duration. Only 3 of the 92 scheduled home visits (all Visit #3) did not take place, all due to the upcoming childbirth of the researcher. I was accompanied on most of the fourth home visits by my young infant daughter and either my mother or husband to care for the baby during videotaping. Bringing my own family along, far from interfering with the visits, enhanced the experimental process for everyone. Being welcomed and pampered in the homes of so many families during my late pregnancy and early motherhood was an extraordinary experience. And bringing my own family to meet theirs broke down some of the formality and inequality inherent in the researcher-participant relationship.

Apparatus

Hide and Find Context. For the Hide and Find Context, originally 3 "magic boxes" were provided for use by the mothers and children, with two small toys to hide in them (a miniature brown, hard plastic violin, and a miniature gray, rubbery plastic wild

pig), and a cardboard screen. The magic boxes, procured at a magicians' shop, measured 5" x 2" x 1/2". Each had a pull-out drawer and an inner compartment in which objects could be secretly hidden by tilting the box to one side with the drawer closed. The boxes were painted blue, red, or yellow. The use of these boxes was discontinued after three sessions in total, as they were found to be too complicated for use by even the mothers, and too fragile for use by the children.

To replace the magic boxes, three simpler containers were provided at subsequent sessions. These were cups with lids. The inverted cone-shaped lids were easily removed and replaced by the children. The cups each had one handle. There were one blue, one red, and one yellow cup. Holes in the lids (one per lid) at the apex of the inverted cone meant for drinking straws were taped over on the inside with black masking tape so that the participants could not look through them. The same two toys for hiding in the cups were presented as with the magic boxes: a violin and wild pig. The cardboard screen was provided as well.

Participants sometimes included their own materials in the hide and find game, such as extra containers or objects to hide. This inclusion was taken as a sign of enthusiasm for the task and was not discouraged by the researcher.

Doll House Context. For the Doll House context, a plastic Playmobil 1-2-3 doll house (20 inches long with the downstairs walls folded down flat, 9 1/2 inches wide, and 5 1/2 inches high) with furniture and dolls were provided. The doll house had an upstairs and downstairs, with no enclosed side walls or roof on the upstairs. The rear wall had two windows downstairs, and one window upstairs. The downstairs interior had a partition to divide the house into two rooms. On the front wall was a door. The two

downstairs side walls folded down flat on the ground to provide access to the downstairs rooms and extra floor space. The floors of the house had a network of square grooves which allowed the furniture to be affixed to it, Lego building-block style.

The furniture provided included: 3 beds, a cradle, and a changing table; a bathtub, sink, and toilet; a couch, two armchairs, a rocking chair, a bookcase, a clock, a fireplace, and a coffee table; a dining table with three chairs and a highchair; a stove, sink, and refrigerator. The furniture was arranged in the same way before each doll house session by the researcher to resemble a bedroom and bathroom upstairs, and a living room and kitchen downstairs. A set of removable stairs connected upstairs to downstairs. The participants sometimes moved the furniture around or even removed it entirely. This was not remarked upon by the researcher.

Five Playmobil 1-2-3 dolls were included: a mother, a father, a child (a girl doll for girl subjects, a boy doll for boy subjects), a baby, and a cat. The tallest doll was three inches high. The dolls could turn their heads and bend at the waist, except for the permanently seated baby, and the featureless, unarticulated cat.

The doll house was well liked by most of the children regardless of age or gender. Occasionally a participant would introduce an appropriate outside object into the doll house play - for example, a terrorizing toy dinosaur, a tennis ball representing the moon, a toy horse to give the dolls rides. This was not discouraged or otherwise commented upon by the researcher.

Recording and Transcription Equipment. All home visits were videotaped using an 8mm Ricoh R-861 video camera recorder. The recorder was powered by a small battery pack which allowed freedom of movement during recording. After recording, the

8mm tapes were copied onto VHS tape for transcription. The VHS tapes were transcribed using a JVC HR-D960U stereo video cassette recorder, with headphones (SONY MDR CD350).

Procedure

Home Visits. After initial equipment setup and greeting, the mothers were reminded of the four videotaping contexts to be recorded. At the initial visit, the parent signed a permission form for the child's participation in the study. A sequence was decided upon for the four contexts: usually Play, Meal, Hide and Find, and Doll House, but this order could be modified at the discretion of the parent, usually due to the hunger or lack thereof of the child. For the Play context, mothers and children were asked to choose an activity that they enjoyed doing together. Activities chosen included play with dolls, puzzles, art projects, construction toys, board games, reading books, fantasy play. For all contexts, the mothers were told that I was interested in recording everyday talk, and they were encouraged to engage their children in conversation.

Each context was videotaped for a maximum of 15 minutes. Taping of a context also stopped if the child lost interest in the activity. In general, the Play and Doll House contexts lasted the full 15 minutes, while the Meal and Hide and Find contexts did not (although there were exceptions). Sometimes breaks occurred in the middle of a context for the participants' unrelated activities, such as a trip to the bathroom, a telephone call, retrieval of an object from a different room, the occasional temper tantrum or scolding. In these cases the videocamera was turned off, and turned back on when on-task activity resumed. A running clock on the videocamera showing hour, minute, and second was superimposed onto each recording.

At each visit, an appointment was made for the next visit. These appointments were confirmed by telephone and if necessary modified, on the day before the appointment. At the end of the final visit, the parents were debriefed as to the focus of the study. They were told that I was studying children's acquisition of the meaning of mental state words, and I was looking to see what clues the mothers gave the children as to the words' meanings. While some parents expressed surprise that I was studying them as well as the children, none objected. Blank tapes were collected from those parents who wanted copies of their child's videotapes. Copies were made and mailed to the parents within a few weeks.

Transcription. Each videotape was viewed at least twice. At the first viewing, the time of each utterance of the words think and know by either the mother or child was noted. At the second viewing, transcripts were made of the conversations in which the target words occurred. An attempt was made to include all preceding and following utterances for as long as the conversation remained on the same topic as the utterance which contained the target word.

Coding.

Context. Transcript segments were given one of four context codes according to the activity engaged in by the dyad:

<u>Code</u>	<u>Context</u>
P	play: an activity chosen by the dyad
M	meal: during meal or snack
HF	hide and find: the dyad engaged in hide and find task with materials provided by the researcher

DH doll house: the dyad engaged in play with doll house materials
provided by the researcher

Time. The time classification code designated when in time the target word referred. Conversational and situational cues as well as grammatical tense were used to determine the time reference.

<u>Code</u>	<u>Time reference</u>
B	before (past)
P	present
F	future
G	timeless generalizations
Y	fantasy play

Person. The person code was assigned according to the person in the utterance to whom thinking or knowing was attributed.

<u>Code</u>	<u>Person</u>
M	the mother in the dyad
C	the child in the dyad
O	other person or object
MC	both mother and child

Mental verb code. The main purpose of the mental verb code was to report whether or not think or know referred to an actual mental state on this occasion of use. Shatz et al. (1983) have reported on the different types of uses of mental state verbs, both to refer to mental states and other, non-mental uses. As they have stressed, mental state

DIR-R Directing Reflection: these utterances made reference to information or an action but did not specify it directly. Instead, a wh-word was used, in the form of wh-questions or wh-complementation.

RW, 31 months, Visit 2, Doll House, 13:03

M: Why is she going in the window instead of the door?/ doll

R: You know where she going?/

M: Where?/

R: She going on the table/

M: On the table/

R: Yeah/

IDK I don't know: The phrase "I don't know", without a predicate complement.

MD, 38 months, Visit 4, Doll House, 11:11

Md: I'm taking the ladder away!/
M: Taking the ladder away?/

M: How are they gonna get downstairs?/

Md: I don't know/

M: I hope they have a phone up there/

M: They're gonna have to call for help/

Lexical frame. These were repeated phrases within which the target word frequently occurred. These categories were determined after transcription, by examination of the mothers' and children's usages.

Think.

<u>Code</u>	<u>Lexical Frame</u>
1	"I think (that) X"
2	"I don't think (that) X"
3	(Do) you think X?"

4	I/You (don't) think so."
5	How/What/Where/Which/Who/Why do think (X)?"
0	Other frame

Know

<u>Code</u>	<u>Lexical Frame</u>
1	"I don't know"
2	"I don't know (if) X"
3	"(Do) you know how/what/when/where/which/who/why X?"
4	"I know X" or "X, I know"
5	"X, you know" or "You know, X"
6	"(Do) you know X?" or "X, do you know?"
7	"I know"
8	"(Do) (you) know what?"
0	Other frame

Meaning Level. This was an attempt to categorize each usage of think or know according to the level of meaning it displays according to the Nelson and Lucariello theory of how meaning levels develop, in regards to conversationally embedded use, denotation, and sense. The operationalization is an interpretation based on their description, as their work is based on usages of object terms and needed to be extended here to abstract terms. Again, the examples are taken from my study, and the coded utterance is underlined.

<u>Meaning level</u>	<u>Code</u>	<u>Description and Example</u>
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Con conversationally Embedded Use	C	<p>Speaker uses word in the here and now situation, with use tied to the immediate context.</p> <p>RW, 31 months, Visit 2, Doll House, 14:03</p> <p><u>R: Who do you think this is?/</u> doll</p> <p>M: I don't know/ M: Who do you think that is?/ R: That's the Mommy - baby/</p>
Denotation	D	<p>Speaker uses word to refer outside of the here and now, to a past or future occasion, to make a generalization, or to make a contrast between a mental state and reality.</p> <p><u>Past</u></p> <p>KP, 42 months, Visit 2, Play, 39:15</p> <p><u>K: You know what we put it on top of our Christmas tree?/</u></p> <p>M: Yeah/ K: An angel/ M: Oh, okay/</p> <p><u>Future</u></p> <p>SL, 44 months, Visit 2, Play, 58:21</p> <p>M: Oh, you're just making that food for me/ M: Are you gonna get mad if I don't eat it?/ <u>S: I think you're gonna get, really tummyache/</u></p> <p><u>Generalization</u></p>

DV, 38 months, Visit 4, Play, 29:10

D: This is our chimney/

M: That's our chimney?/

M: What comes out of it?/

D: Smoke/

M: Yeah, you're right/

D: I know - I know my words/

M: Yes, you do know your words/

Contrast Mental State with Reality

AF, 41 months, Visit 3, Meal, 06:21

A: There was a pre - there was a pretend, um, ghost/

M: You were not afraid?/

A: Nn-nn/

A: I thought it was a real ghost, but it wasn't/

A: It was a -/

A: A pretend ghost/

Sense

S

Speaker makes a contrast between two related mental states, or mentions a presupposition of a mental verb.

Contrasts Two Mental States

ERo, 44 months, Visit 3, Meal, 3:08

M: Who ate the other half?/ pizza slice

E: Laurie's babysitter/

M: Oh, good/

E: I think but not - I don't know/

Mentions Presupposition.

ERo, 44 months, Visit 3, Meal, 06:47

M: Where's his busy balls?/ cat

E: I don't know/

E: I don't - I don't see them/

M: He must have hidden them away/

Reliability. Variables for ten percent of the utterances for each of think and know were recoded by a developmental psychology graduate student. The variables recoded were time reference, person reference, mental verb code, meaning level, and lexical frame. For know, the percentages of interrater agreement were 90% for time reference, 100% for person reference, 89% for mental verb code, 83% for meaning level, and 96% for lexical frame. For think, the percentages of interrater agreement were 79% for time reference, 100% for person reference, 84% for mental verb code, 91% for meaning level, and 90% for lexical frame.

Two-year-olds' language games. I attempted to categorize each two-year-old child use of think or know into one of Wittgenstein's language games, from the list of 17 as given in the introduction. I was assisted in this task by Finch's interpretive descriptions of the first 15 language games, and his pointers as to where in the text Wittgenstein expanded upon each of the games. Once the game categorization was done, I attempted to identify the roles played by the two words in each of the language games. As will become clearer when they are reported on in the results section, roles were defined by the lexical frames in which the words occurred, the utterances' relations to adjacent utterances, and the functions the utterances held within the conversation.

The four language games that both think and know most often appeared in were guessing, play-acting, ostensive naming, and guiding. (See Table 29). Know and think were used in each of these language games at least six times (with a maximum of 33, for know in play-acting). The occurrence of the guessing and play-acting conversational activities came as no surprise; they are intrinsic to the Hide and Find, and Doll House

contexts that the dyads were provided with. However, these were not the only conversational activities to occur in these contexts; Hide and Find also gave rise for example to naming the toys and the colors of the cups, and negotiating turn-taking; the Doll House activity also included naming the pieces of furniture in the house, inventing names for the dolls, relating the activities of the dolls to real-life situations, as well as others.

To show how language games were identified, here I give, where available, Finch's interpretive descriptions of these four language games, remarks provided in Philosophical Investigations (abbreviated PI) by Wittgenstein, as well as additional information about the children's uses that led to the assignation to these language game categories.

Guiding and being guided by. "Giving and obeying orders is related to guiding and being guided by, which can be involved in a great number of language-games..." Here Finch directs us to PI 172. What does Wittgenstein say about the game of guiding and being guided by?

"Let us consider the experience of being guided, and ask ourselves: what does this experience consist in when for instance our *course* is guided? - Imagine the following cases:

You are in a playing field with your eyes bandaged, and someone leads you by the hand, sometimes left, sometimes right; you have constantly to be ready for the tug of his hand, and must also take care not to stumble when he gives an unexpected tug.

Or again: someone leads you by the hand where you are unwilling to go, by force.

Or: you are guided by a partner in a dance; you make yourself as receptive as possible, in order to guess his intention and obey the slightest pressure.

Or: someone take you for a walk; you are having a conversation; you go wherever he does.

Or: you walk along a field-track, simply following it.

All these situations are similar to one another; but what is common to all the experiences?"

PI 172

Let's turn now to the children's uses that were categorized as guiding. Unlike Wittgenstein's examples concerning the guidance of a course, the data here involved the guidance of other types of action, including where to place an object, making a choice of objects or activities, deciding who will engage in an activity, choosing whether or not to participate in an activity at all. The cases were considered as examples of guiding rather than giving orders or obeying them because the language used to convey the direction was indirect: in most of these cases, the child's utterance with think or know was preceded by an indirect request by the mother, as in, "You don't want to eat the stem, right?"; "Want to try to make it work?"; "Shall we see if I can make it disappear again?"; "What Bible verse would you give? Remember the one about Jesus?". In other cases, the child used the target word in guiding her own activity, sometimes taking control of the action away from the mother, as in, "I know how it goes" while putting a doll in a train, or, "I'm taking this one, I think", while choosing a strawberry. As Wittgenstein showed, guiding can include varying levels of coercion: a child wanting to spread cream cheese on his bread without assistance from his mother insists, "I know how to!"; in contrast,

another child half-jokingly answers her mother's question about what to feed their non-present snake, "I think it should eat this hard corn."

In the guiding language game, then, think or know is involved in the conversational negotiation of the activity of guiding (or being guided by) the child or the mother.

Naming. "Asking something's name...we might say, [is] a language game on its own. That is really to say: we are brought up, trained, to ask: 'What is that called?' - upon which the name is given." Wittgenstein, PI 27. Children's uses of think and know were assigned to the naming language game if the target word was used in either asking or giving the name of an object or entity.

Guessing. Finch points out that "There are many language-games involving guessing: as, for example, guessing the meaning of definitions (PI 32), what time it is (PI 266, 607), what a person means (PI 210), what a person is pointing to (PI 33), intentions or thoughts (PI pp.222-3). (We cannot, however, guess how a word functions (PI 340).)" Wittgenstein (PI pp.223) gave several variants of the game of 'guessing thoughts'. "A variant of it would be this: I tell A something in a language that B does not understand. B is supposed to guess the meaning of what I say. - Another variant: I write down a sentence which the other person cannot see. He has to guess the words or their sense. - Yet another: I am putting a jig-saw puzzle together; the other person cannot see me but from time to time guesses my thoughts and utters them. He says, for instance, 'Now where is this bit?' - 'Now I know how it fits!' - 'I have no idea what goes in here,' - 'The sky is always the hardest part' and so on - but *I* need not be talking to myself either out loud or silently at the time. All this would be guessing at thoughts; and the fact that it

does not actually happen does not make thought any more hidden than the unperceived physical proceedings." In this corpus much of the guessing occurred, as might be expected, in the Hide and Find context.

Play-acting. "This language-game is obviously related to pretending (PI 156) and simulating (PI 249-50), as well as to imitating (PI 285, 450). We might say that it is a full expression of these other games and also the first game which has the element of *play* in it. Pretense for entertainment or edification would have to be distinguished from pretense for deceit, which is another language-game." Finch, p. 85

Wittgenstein, in the sections cited by Finch, discusses not children's fantasy play but a beginning reader's pretending to read by guessing from the context or reciting memorized passages (PI 156); the inability of a dog to simulate pain, and the impossibility of teaching one to do so (250); imitating a face without seeing oneself in the mirror (285), and similarly, mimicking a facial expression without imagining it first (450).

Despite the absence of a clear playful element or the symbolic use of props in Wittgenstein's examples, the children's uses of think and know during fantasy play fit most clearly into this category - as Finch would call it, play involving pretense for entertainment.

Language Game Roles. Because the roles played by think and know within the language games were unknown before examining the transcripts, it was thought that the identifications and descriptions of the roles should be considered as results rather than preconceived coding categories. Their identities and descriptions, along with frequencies and examples, are thus reported in the results section.

Chapter 4: Results

Orientation

In this section I introduce the questions that will be addressed in the results chapter under the headings of Maternal Input, Children's First Uses, and Mother and Child Comparisons.

Maternal Input

Through examination of the maternal data, we can get an overall description of the ways mothers use the words think and know in conversations with their young children. While the child has other sources of input, in conversations with other people, such as siblings, friends, and other adults, and in other contexts, such as in daycare or other daily routines, I assume that the informal conversations like the ones examined here form the major source of input of the uses and meanings of these words for the child. It remains to be studied whether mothers' conversational uses differ in significant ways from other conversational partners', or whether uses in other everyday contexts differ from the ones examined here. (My guess is that they do not, but I remain open to other possibilities.) With these assumptions, using these data we can get an idea of what input the children are hearing: in what contexts, in what lexical frames, with what time and person references, with what conversational functions, with what meaning levels. Especially in early conversations, words are not isolated building blocks that are combined in infinite patterns; rather, they are used in a finite number of patterns for repeated functions. Identifying these patterns is a goal of this research. I also presume that children reiterate these patterns in their early uses, using them to get their feet in the

door for entrance into the more abstract meanings and flexible uses that their languages allow.

Verb Comparisons. In much previous research on mental verbs, uses of the different verbs were grouped together, with data provided for mental verbs as a whole. Partly this was done for practical reasons: children's early uses are so infrequent that the grouping of similar verbs can be required to assemble a large enough sample for statistical analysis to be possible.

Yet for the study of meaning this grouping is deleterious, as it obscures the differences in uses between the verbs. To the extent that the meanings of think and know differ, we would expect their uses to differ as well. And logically thinking, if they are used in too similar ways, how would the child ever differentiate their meanings? Yet because they belong to the same verb "family", we would expect their uses to be similar or to be explicitly contrasted in some way. This might be necessary if the child is to ever construct sense meanings for the words: to place them in a system in which their relation is understood. Luckily for the agenda of comparing uses of the verbs think and know, maternal uses in this corpus of data are copious.

Age comparisons. Comparisons of the uses of the two groups of mothers, those of two- year-olds and three- year-olds, can tell us both to what extent and how mothers tailor their uses to the age of the child, and how the input to children at the different ages differs. It's the same data seen from two perspectives: from the mother's perspective, changing her talk in response to the changing characteristics of her child, and from the child's perspective, hearing a changing input over time. We might expect that some aspects of verb use would remain constant to both age

groups (perhaps reflecting some invariant core to the language games roles in which they occur?) - while other variables might be more free to vary depending on the situation (perhaps reflecting differences in the understanding, participation, and types of conversations engaged in by the two age groups). Identifying the more and less invariant aspects of uses of think and know is possible through age by verb by variable (time reference, person reference, mental verb code, meaning level) comparisons.

Children's First Uses

The children's data can give us an overall view of how children initially use think and know: such as what functions they serve, what lexical frames they occur in, their time and person references. An examination of each child's attainment of meaning level (embedded use, denotation, sense) by visit and comparison of the two- and three-year-olds are tests of Nelson and Lucariello's developmental description of word meaning development. Does each child demonstrate the order predicted by the theory, with different aspects of meaning acquired over time, and do three-year-olds use more of the higher level meanings than two-year-olds? Or alternatively, is the learning of word meaning more of an all-or-none phenomenon, with labels quickly mapped on to previously existing concepts? If the latter is the case, children should be able to denote and use sense meanings from their first uses of think and know. Age comparisons of the other variables can tell us about additional aspects of meaning development: are uses among two-year-olds more restricted than those of the three-year-olds, with three-year-olds' uses showing more flexibility? If so, what variables gain in flexibility? Do all children begin using think and know in a similar manner, or is there individual variation? And is individual variation related to maternal use? Correlations between children's and mothers' uses can contribute to answering this question.

Questions about self and other can be examined using the person reference data. Do children refer to themselves with think and know before referring to others (perhaps implying self-knowledge before conceptualization of the knowledge states of others) or do they occur simultaneously within individuals?

Verb comparisons. Comparisons between the descriptions of how young children use the two verbs think and know can tell us to what extent they learn them as separate entities. We might expect verb by age differences as well, reflecting changes in verb differentiation with development.

Mother and Child Comparisons

Do children's initial uses depend heavily on the type of input they receive? If so, individual children's uses should closely resemble the uses of their particular mothers, and child-mother uses will be positively correlated. If word or child characteristics are more influential in determining initial child uses, then positive correlations would not be expected. Also, the variables studied may differ as to their dependence on the input, with some positively correlated with maternal uses and others not. Optimally, mother-child comparisons could show what aspects of use serve as clues to meaning, with higher uses of those variables correlated with higher overall rates of child use, higher meaning levels attained, and more flexible use, as measured in a greater variety of lexical frames.

Organization of Results

In this results chapter I will provide a description of the most important findings of this study. I have included here only the most important significant findings, and to increase readability I have placed a more detailed description of the overall statistical

analyses undertaken and their outcomes and significances in the appropriate appendices. Because there were a large number of analyses carried out on the same data sets, a strict alpha level of .01 was chosen as the cutoff point for significance. However, the exploratory nature of the study and low rate of child usage justify the report of some findings which met the .05 level criterion; these findings are considered strongly suggestive but not statistically significant. The reports and conclusions made on the basis of these differing criteria are clearly delineated below.

I provide here for the mothers general results, verb and age findings; for the children, general, verb, and age findings, and individual results for meaning levels, person references, and language game roles by two-year-olds; and mother and child correlations. Also included are three sections of a more descriptive nature, wherein I give examples of some of the acquisition processes that may be at work during the mother and child conversations.

Mothers

Before moving on to findings about verb and age differences, I start off with a brief summary of some general findings about how mothers used know and think. No significant differences were found between the mothers' total rate of use of know and think, nor were there significant verb by age of child differences. (*Table 4, Mother's total uses of think and know*). The child's gender did not seem to influence the frequency of the mothers' uses; there was no difference in total rate of use to boys and girls for either age or for either verb. (*Table 5, Mothers' uses of think and know by gender.*)

Similarly, there were no significant differences in rates between the four contexts. (*Table 6, Mothers' uses of think and know in 4 different contexts*)

The mothers' meaning levels came out as was expected: there was a significant difference in their uses of meaning level [$F(2,44) = 111.14, p < .001$]. They displayed conversationally embedded uses at a higher rate than denotation (post hoc $t = 11.48, p < .00001$), and embedded uses at a higher rate than sense (post hoc $t = 13.80, p < .001$). Denotation was used at a higher rate than sense (one-tailed paired sample $t = 2.57, p < .0085$) (*Table 7, Mothers' meaning levels for think and know*) These findings are expected because making conversation away from the here and now, as in denotation, and contrasting the verbs or talking about their presuppositions, as in sense, are more complex than talking about the here and now, and thus should not occur as frequently in conversations with young children. (See Phillips, 1973; Snow *et al.*, 1976.) As well, sense would be expected to be used less than denotation because the conversational circumstances for contrasting the verbs or making explicit their presuppositions would not be expected to occur as frequently as those for using them to talk about the child's past or future experiences. It should be noted that the mothers nonetheless did use these higher meaning levels, and so we can be certain that the children are being exposed to these higher levels: a lack of use of these higher levels by the children could not be attributed solely to their complete absence in the input.

Maternal Variable Differentiation. The mothers differentiated in their uses of the verbs think and know in their conversations with their children. So from the start, the children are hearing them used differently. The mothers' uses differed significantly as measured by four variables: person reference, time reference, lexical frames, and mental

verb code. There was a significant person reference by verb interaction, $F(1,21) = 34.0$, $p < .001$. The mothers used think more to refer to themselves than to their children [$F(1,22) = 212.5$, $p < .001$]; this difference did not occur with know. They referred to the children more with know than with think [$F(1,22) = 24.50$, $p < .001$], but to themselves more with think than with know [$F(1,22) = 10.53$, $p < .001$]. (*Table 8, Mothers' person references with think and know*) There was a significant time reference by verb interaction [$F(4,84) = 4.53$, $p < .01$]. The mothers made more generalizations with know than with think [$F(1,22) = 12.35$, $p < .002$]. Use of more fantasy talk with think than with know approached significance [$F(1,22) = 5.19$, $p < .033$]. (*Table 9, Mothers' time references with think and know*)

Lexical frame use also differed by verb. While a direct lexical frame by verb MANOVA was not possible because of the different sets of lexical frames the two verbs participate in, indirect comparisons can be made. For think, there was a significant difference in the rate of lexical frame use [$F(4,88) = 33.69$, $p < .001$]. "I think (that) X" was used at a higher rate than the other lexical frames (post hoc $t = 11.88$, $p < .00001$), and at a higher rate than the next most frequent frame, wh-questions (post hoc $t = 6.85$, $p < .00001$). Know also showed a significant difference in the rate of lexical frame use, $F(7,54) = 4.23$, $p < .001$. For know, however, wh-questions were the most frequently used frame (post hoc $t = 3.98$, $p < .001$). Note that about 75% of the mothers' uses are accounted for by the five frames identified for think and eight frames identified for know (listed in Table 10, *Mothers' lexical frames: rates per hour*).

The functions of the two verbs also differed. There was a significant mental verb code by verb interaction $F(2,44) = 10.50$, $p < .001$. The mothers directed the interaction

at a higher rate with think than with know [$F(1,22) = 29.44, p < .001$], but they directed reflection at a higher rate with know than with think [$F(1,22) = 8.41, p < .01$]. (*Table 10, Mothers' lexical frames with think and know*)

We get a general picture then that think is used more for a planning function, for the mother to express what she herself thinks, to suggest ideas for the ongoing direction of the activity. Know, on the other hand, is used more by the mothers to talk of generalizations, to direct reflection, by the use of wh-questions, to ask about what the child, rather than the mother, knows. These general pictures of course are only descriptive of the most common usages by the mothers; the actual uses by the mothers are more overlapping for the two verbs than these descriptions suggest. However, the evidence supports the view that the mothers use the verbs think and know not as nearly interchangeable units in identical types of utterances, but as carrying different functions in different types of utterances.

Age differences. Do mothers of two- and three-year-old children tailor their uses of think and know depending on the age of the child? There was not much quantitative evidence that they do: mothers' constitutive uses of think and know did not vary according to the age of the children. These negative findings are evidence for the stability of the mothers' uses over age: the constitutive measures of lexical frame, person reference, time reference, and meaning level, remained the same. This suggests that the utterances the verbs participate in do not vary according to child age, and that children hear similar versions of the verbs, that remain stable over the ages of the children sampled. In a later section, however, I suggest that mothers may fine tune their uses depending on the age of the child in other ways.

Children

For the children, after a presentation of general results, I move on to verb and age differentiation, including individual children's data on meaning level development, data on individual children's references to self and other, and two-year-old children's language game roles.

First I briefly present general data about totals, gender, context, person references, time references, and meaning levels. In total, the three-year-olds used the two verbs more than the two-year-olds; $F(1,21) = 13.66, p < .001$. The children used know more than think; $F(1,21) = 30.24, p < .001$. (*Table 12, Children's totals*) There were no differences between boys and girls in total uses of either verb in either age group. (*Table 13, Children's think and know by gender*) Neither were there significant results for differential use in the four contexts. (*Table 14, Children's think and know in four contexts*) The children used the verbs to refer to themselves more than to their mothers [$F(1,21) = 3.87, p < .001$]. (*Table 15, Children's person references with think and know*) In the section below on individual children's person references, I expand on this finding to show as well that most children refer to themselves at an earlier visit than they refer to their mothers.

There were significant differences in their reference to different times with the two verbs [$F(3,66) = 33.19, p < .001$]: they referred to the present more than they referred to an average of fantasy, the past, and generalizations ($t = 6.32, p < .001$), and they used fantasy talk more than an average of referring to the past and making generalizations ($t = 6.35, p < .001$). There were no differences between referring to the present and fantasy

talk, nor referring to the past and making generalizations. (*See Table 20 , Children's time references*) Like the mothers, the children used the verbs more in embedded ways than in denotation [there was a significant main effect for meaning level, $F(1,21) = 78.23$, $p < .001$]. (*See Tables 17 and 18, Children's meaning levels*).

Verb differentiation. In the section above on the mothers' verb differentiation, I demonstrated that at the level of the utterance, mothers use the verbs think and know with their young children in different ways. Do the children also use these verbs in different ways, from their first uses, as measured by these utterance-level variables?

In contrast with the mothers, who differentiated between their uses of think and know in a variety of ways, the children's uses were not as clearly differentiated. Other than differences in total uses (know was used more by the children than think), (*See table 12*) significant results were found only between the children's mental verb codes for the two verbs [$F(1,21) = 3.87$, $p < .001$ for the mental verb code by verb interaction]. Directing the interaction was done more with think than with know [$F(1,22) = 13.17$, $p < .001$]. (*Table 16, Children's mental verb codes with think and know*)

The children, from the start, then, differentiate the functions of the verbs even when they haven't differentiated person references and time references, and lexical frame domination is unclear (*See Table 19, Children's lexical frames*). Their grasp of how the verbs differ constitutively is thus most advanced in terms of the action (function) of the verbs, and is less advanced in terms of personnel, time, and space.

Age differences. What age changes, or developments, take place over the course of the ages of the children studied? The uses of think and know by the two-year-olds and three-year-olds were compared to examine this question. Other than total uses,

significant differences at the .01 level were not found for any of the variables tested (gender, context, person references, time references, mental verb code, meaning level).

Individual Children's Meaning Levels: Conversationally Embedded Use Before Denotation. An examination of the patterns of individual uses supports Nelson and Lucariello's theory. Tables 21 through 24 present what are some of the most important findings of this study: they report on the individual children's meaning levels over the four visits. In brief, they demonstrate that children do not use think and know with denotational meanings (or sense, although the evidence, as shall be seen, is weaker) without using conversationally embedded meanings first.

Table 21 shows the two-year-olds' meaning levels with know over the four visits. Five of the twelve children show the predicted pattern: they displayed conversationally embedded use at an earlier visit than denotation or sense (CB, DV, IK, LB, RW). Five other children demonstrated embedded use only (EM, JA, SM, WH, LV). This finding is also consistent with the prediction of conversationally embedded meanings first. Two children (CF and MD) displayed embedded uses and sense together at the same visit. Perhaps these two children were early embedded users; CF used know these ways at her first visit, and MD at her second.

Since seven of the two-year-olds used know with higher level meanings by their fourth visit, it is not surprising that many of the three-year-olds, on average six months older at their first visit than the two-year-olds at their final visit, demonstrated both conversationally embedded and higher level meanings from their first visit. (*See Table 22, Three-year-old children's meaning levels with know over 4 visits*) This was true for five of the children (AF, BE, ERo, KP, and NP). Three others fit the predicted pattern of

embedded use first, higher level meanings later (LS, NR, and SL). Two demonstrated embedded uses of know only (BC and PD). One child showed embedded and denotational uses of know from Visit 2 (ERi). None of the children's patterns of onset of usage violated the predicted one, by the use of denotation or sense without embedded uses first (or at the same early visit).

Lower total uses of think make the argument less forceful regarding order of acquisition, but the data are still consistent with predictions. Table 23 (*Two-year-olds' meaning levels of think over 4 visits*) shows that four two-year-old children followed the predicted pattern of conversationally embedded uses at an earlier visit, and higher levels later (CF, IK, LB, and WH). Of the other two-year-olds, four used think only embedded in conversation (DV, LV, MD, RW); three didn't use think at all (EM, JA, and SM); and one child's usage (CB) violated the prediction: at Visit 4 she used denotation, without ever displaying embedded use. None of the children used denotation or sense initially with conversationally embedded use at the same visit.

While all eleven three-year-old children used think at least once during the course of the study (*Table 24, three-year-olds' meaning levels with think over 4 visits*), seven of them showed embedded use only (BC, BE, ERi, KP, LS, NP, and PD). Two followed the "ideal" pattern of embedded use at an earlier visit before higher levels (AF and SL); and two showed both embedded use and higher levels at the same visit (ERo and NR). There were no outright violations of the predicted pattern. Indeed out of the 46 total cases of child by word (23 children x 2 words), there was only one case of violation, CB's use of think with denotation without embedded use. Thus the evidence is in favor of the proposal that children use think and know embedded in conversation before using it

denotationally. The evidence also is somewhat supportive of the proposal that they use denotation before sense, but this rests on the absence of sense meaning display: 13 of the 23 children used know with denotation but never used sense; and 7 of the 23 children used think with denotation but not sense. The absence of sense demonstrations is not due to their total absence in the speech of their mothers: almost all of the children were exposed to examples of sense meanings with both think and know during the course of the study.

Even the oldest children in the study do not seem to have placed the two verbs into relation with each other. This has strong implications for experimental studies in which a researcher insists that children choose between think and know: three and even young four-year-old children haven't yet worked out how the two verbs compare and thus have great difficulty with these questions. Would older children than the ones in this study use sense meanings with think and know? This possibility remains open for further exploration.

The children's uses of think and know did not change in many respects over the age range in the study. Their patterns of use do not match those of the mothers, either, as will be demonstrated further in the section below on mother-child correlations. This suggests that they have still more to learn about how the verbs are used in everyday speech, and even at age four they have not completed their acquisition of conversational patterns.

Individual Children's References to Self and Other. Tables 25 through 28 provide data on individual children's person references over the four visits. These are of interest because they can help address the question of whether children simultaneously have an

idea that both other people and themselves have mental states, or they first have knowledge of their own mental states, that they then ascribe to other people. Table 25 shows the two-year-old children's person references with think for the four visits. Small numbers here make reporting sketchy at best. Only three children referred to the mother or another person at all (CB during Visit 4, RW at Visit 2, and WH at Visit 4). CB did not refer to the self using think although she did with know at an earlier time, Visit 3. RW referred to the self at an earlier visit before referring to the mother, as did WH. Six two-year-olds referred only to the self.

Table 26 shows individual three-year-old children's person references with think over the four visits. Of the eleven three-year-olds, only two (ERi Visit 4, KP Visit 1) referred to the mother using think at a visit before (or without ever) referring to the self. However, ERi referred to himself using know at Visit 2, as did KP at Visit 1. The other nine children referred to the self at a visit prior to referring to the mother (SL, NP) or other (BE), or else didn't refer to the mother or other person at all.

The two-year-old children's person references with know over four visits are shown in Table 27, and the three-year-old children's in Table 28. Although all twelve two-year-old children produced the word know over the course of the study, only eight used it to refer to someone other than the self. Of these eight, all but one (DV) referred to the self either at a previous session (CB, EM, IK, JA), or at the same session (CF, LB, MD, RW). DV referred to the mother at Visit 1, and didn't refer to herself until Visit 2. Four three-year-old children (AF, ERi, LS, PD) produced know for the self at a visit before using it to refer to the mother or another person. Five three-year-olds (BE, ERo, KP, NP, NR) used know to refer to both self and mother and/or other from Visit 1. One

three-year-old (BC) never referred to the mother or other with know, and her first self reference was at Visit 4. One three-year-old (SL, Visit 1) referred to the mother and another person before referring to the self; she did use think to refer to herself at this initial visit.

In summary, the children in general used think and know to refer to themselves before using them to refer to other people. Although this is not the main focus of this study, these data can be used to support the argument that children first conceive of, and refer to mental states in themselves before they do for other people. It's important to keep in mind when thinking about these results, however, that most of the children's uses of think and know are not for actual reference to mental states (See Table 16, Children's Mental Verb Codes).

Two-year-olds' language games and roles. As shown in Table 29, most of the two-year-old uses of think (80%) and know (72%) occurred in four language games: guiding, naming, guessing, and play-acting. The roles that think and know occurred in were determined by looking for regularities in lexical frames, conversational functions, and relations with adjacent utterances. Table 30 shows that for think, one (guiding, naming, guessing), or two (play-acting) roles accounted for most of the uses within each language game; these five roles accounted for 73% of the uses of think that occurred in these four language games. There were more roles for know (See Table 31); but two (guiding, naming, guessing) or three (play-acting) roles accounted for most of the uses within each game; the nine roles accounted for 80% of the uses of know in the four language games.

Guiding. There were 9 cases of two-year-old use of think in the guiding language game. In 6 of these cases, the child accompanied a choice (where to put an object, what object to take) with "I think" + the choice. In four of the six examples, the child's choice was preceded by a question asking the child to make a choice.

IK V4 Doll House 46:37

I: Where's this go?/

M: What?/

M: Where do you want to put it?/

I: I think - right here I'll put it/

There were 19 two-year-old uses of know in guiding. In one role (9 cases), either the mother or child first makes a suggestion about an action, and the child either takes control of performing the activity or gives it to the mother by saying, "I/You (don't) know how [+ X]".

Abate V1 Meal 11:38

J spreading cream
cheese on bread

M: Can I hold your hand?/

J: No, I'll do it, I'll do it/

M: Okay/

J: I know how to/

Flanagan V4 Play 31:56

Drawing pictures on chalk
board

M: Want me to do it, or you want to try?/

C: Um, you know how do it/

In the second role of know in the guiding activity (5 cases), "I/you know [+X]" was used in either giving, accepting, or rejecting guidance.

Davis V4 Play 55:57

M: Her ear is very delicate/

M: Why don't you give it to Lily on the side, here,
where it's nice and fleshy/

a pretend vaccination

Md: I know, I have to do it/

Davis V2 Play 13:26

G: You have it go around and around and
around/

building with
construction toy

G: You know you have to hold this part right here/

Of the five remaining cases of know in the guiding game, 2 were unclear, 1 was a direct repetition of the mother's preceding utterance, and 2 were a response of "I don't know" to a mother's what-question.

The two words' roles in the guiding language game differed. Think was used mainly to announce the child's own choice; know on the other hand was used in negotiating control over who would perform an activity, or in initiating or acknowledging a specific suggestion.

Naming. Think was used by two-year-old children in giving a name; but in doing so it was used when contradicting or making a contrast with either the self or mother. This was the case in five of the six cases of the two-year-olds' uses of think in naming.

IK V3 Play 43:21

M: That's a sheep/

I: Cow/

M: Cow?/

I: I think, two cows/

WH V4 Play 04:17

W picks up hammer

W: I think this is a axe/

Know, on the other hand, played two roles in the naming game: in answering "I don't know" to a mother's "What's that?" question (6 of the 15 uses of know in the naming game); and in asking the mother what something is, with a what-question (4 of the 15 uses. The contrastive role played by think is not present in either of these roles of know.

In this example, the child replies "I don't know" to the mother's "What's that?":

MD V3 Play 13:16

Md: What is it?/

alphabet puzzle piece

M: What's that?/

Md: I don't know/

M: C/

Here the child asks and then provides the mother with a name:

IK V4 Meal 06:22

I: You know what this called?/

I points to
book

M: What?/

I: Frog/

Guessing. In most, but not all, of the guessing situations in which think or know was used, the guessing was of location in the Hide and Find situation. Other guessing occurred, however, such as the meaning of words ("cats oh nine nine"; "hussy"), and what a child had in mind (sipping from a spoon, nail polish).

Think was used in 5 of 7 cases of its uses by two-year-olds in guessing, to answer the mother's where-location question with "I think" [+ location]. The location could be either verbalized or implied through action.

RW V4 Hide and Find 40:32, 40:33

M: Okay, without touching, can you guess?/

M: Where do you think the violin is?/

R: I think it's in that one/

M: Which one?/

R: That one/

R points to red cup

Two roles used three times each were identified for know in guessing situations.

Know was used in 3 of its 9 uses by two-year-olds to initiate guessing (about location, the child's sipping action, nail polish) with the question, "You know what [+X]?"

CF V3 Play 01:24

C: You know what I can do?/

C sips tea from spoon

Another role for know was to answer "I don't know" to the mother's location question.

EM V4 Hide and Find 26:28

M: So where are they?/

E: I don't know/

Again we see here think and know used in different roles in similar language games: think to make a guess, know to initiate guessing or say "I don't know" when invited to guess.

Playacting. Think was used to set up pretend situations in two ways: to pretend about what a doll wants, and to set up larger pretend contexts such as an "earthshake" or it being "hot outside".

Think was used in the role "I think s/he wants" + [what the doll wants], to express pretending about a doll's desire. This role for think occurred 5 out of the 11 total play-acting uses.

WH V4 Doll House 48:56

M: Waah, waah, waah/ baby doll
 W: No, don't cry/
 M: Waah, waah, waah/
 W: I - I think he wants - a baba/ baba = bottle
 M: Okay/
 M: Here, give him a baba/

Another role was used in 4 of the 11 play-acting uses of think: the child said "I think" + [pretend state of affairs] to create a pretend situation for dolls. The four situations thus created were an "earthshake", a broken house, it's hot outside, and a baby that can't sleep.

WH V4 Play 11:14

W: What's that?/ playing with dinosaur toys
 W: I think there's a earthshake/
 M: Earthshake?!/
 W: Let's get out of here/

Know was also used in introducing pretend activities, but in a different way: first the child used know in a wh-question, then the mother would optionally restate the wh-word, and finally the child would introduce the pretend situation:

C: (Do) (you) know wh- (X)?
 (M: Wh-?)
 C: [Pretend situation]

Know was used in introducing pretend situations in this way in 11 of its 33 play-acting uses. The pretend situations introduced were "She going on the table" "He look right in the mirror", "The little baby going in the bath", "The clock is tick tocking", "I'm going to turn off the clock", "The kittycat got to go run down the stairs", "Emily gonna give me a present", and "Time to take a bath now". (Two situations were repeats of these; one was not stated by the child because the mother changed the topic.)

RW V2 Doll House 13:03

R: You know where she going?/

M: Where?/

R: She going on the table/

Another role for know in the play-acting game was in saying that a doll "(doesn't) know(s) how" [+ activity]. This was used 8 of the 33 total times know was used in play-acting.

DV V2 Play 24:37

D (to Lea): Her Mommy is jumping/

doll

Lea: Mm-hm/

D: Cause she doesn't know how to walk/

A third role for know in the play-acting game (used in 9 cases of the total of 33) was for the child to respond "I don't know" to the mother's wh-question about a doll's activity or other pretend activity. (In one case, the child answered her own wh-question, "Where is him?" with "I don't know":) Here are the mother's wh-questions in pretend play contexts that received the response of "I don't know": "What are you gonna make for them for breakfast?", "Whose birthday was it at Grandma's house?", "What are they going to do next?", "What are we having for lunch?", "How are they gonna get downstairs?", "But who's gonna bring it there?", "Where are your friends?", and "You know how to get to Ebony's grandma house?"

Individual two-year-old children's language games and roles. How do two-year-old children first using think and know get their feet in the door of appropriate usage, if the uses they hear are varied? I hypothesized that each child may latch on to a particular role within a particular language game for each word, a game closely tied to the ongoing

conversational activity that may be practiced and mastered before additional games for that word are tried. The hypothesized roles chosen could differ by the individual, or could be held in common by a number of children; these possibilities were open to investigation.

Does each child produce a limited number of games and roles in his/her initial uses, perhaps starting out with just one role in one language game? Tables 32 and 33 present the individual two-year-old children's uses of think and know over the four visits. Although small numbers of uses make our comments speculative, the patterns of use for the individual children look like the group data: for the most part we do not see each child limited to use in just one particular language game or role; but within each language game, the roles are limited to one or two.

The trajectory of acquisition seems to differ by individual. Just as important to conclude, however, were the limited number of roles the two-year-olds acquired for each verb, how readily definable the categories were, and how easily categorizable each utterance was. For the two-year-old, think and know are not, on the one hand, terms that are used only to describe people's mental states; but nor are they, on the other hand, the flexible terms accorded the full variety of meanings as presented in a standard adult dictionary. Note also that the roles that the two verbs participate in are virtually mutually exclusive. When actual uses are examined, we see that these are not terms that share meaning but for one differing element (such as factivity or degree of certainty). Rather, they are independent words, learned independently with different roles tied to particular language games.

Mother and Child Correlations

It was predicted that the mothers' and children's specific categories within variables would be positively correlated in a fairly straightforward manner. Thus for example, mothers' using a particular lexical frame would be associated with the children's using the same lexical frame within the same age group. With some exceptions, the prediction of large numbers of positive correlations between corresponding variable categories for mothers and their children was not substantiated. The total number of Spearman rank-order correlations performed was 271; the number of significant correlations was 22; this is 8% of the total number run. A report on the correlational analyses performed and their results is given in Appendix 3.

Chapter 5: Processes

Language game role processes. In this section I give some examples of individual children's uses of the different roles that think and know play in the language games of guessing and play-acting. For each game/role combination, if possible a previous maternal demonstration of the use is given. These examples were chosen because they lend support to the suggestion that a child can use the words correctly in conversation by using a rote-learned lexical frame to carry out a fixed function in limited contexts. Without the recognition that this is what the child is doing, their uses can appear fairly sophisticated, inviting overinterpretation of the child's word meaning by both parent and investigators. However, I don't wish to downplay the child's accomplishment; the child is adept at interpreting the social situation and figuring out the roles that words play in conversational situations. Each example is preceded by an identifying header: [child's initials, age in months, visit (V) number, context, and time(s) on videotape of think or know in minutes:seconds].

Think: Playacting. In this series, WH experiments with the procedure of pretending that a doll has internal states. He begins his use of this game by pretending, like his mother, that dolls are sleepy. Later he moves on to play-act about other doll desires: wanting to go home, to have a bottle, etc.

First WH's mother uses think to suggest that a doll "wants to take a nap":

WH, 32 months, V1, Doll House, 10:31

M: Who's that?/

doll

W: Ashley/

M: She fell down/

M: Do you think she wants to take a little nap?/

W: Mommy, let me see outside/

Soon afterward, like his mother, WH uses think to suggest that a different doll

"wants to take a nap":

WH, 32 months, V1, Doll House, 11:53

W: Let the kitty see something/

cat doll

W: I think he wants to take a nap/

M: He's tired?/

M: Where's the kitty's bed?/

At his next visit, he uses think only once:

WH, 33 months, V2, Play, 24:22, 24:50

W: I think Mickey wants to go home/

M: He does?/

M: How's he going to get home?/

W: Cause he wants to go home/

W: Where's the house?/

M: Oh, the house went away/

WH again has a small doll in his hand, and remembers the (as yet absent) doll house from the previous visit ("Where's the house?"). This seems to call up the lexical frame, "I think X wants to Y", his only recorded usage of think thus far. The unanalyzed nature of the unit is revealed by his inappropriate response to his mother's question "How's he going to get home?" - he repeats himself, "wants to go home". By Visit 4, WH is using think in other roles in other language games, but in doll house play he twice returns to the original one, and it is the only one he uses in the doll house play-acting context:

WH, 37 months, V4, Doll House, 48:56

M: Waah, waah, waah/
 W: No, don't cry/
 M: Waah, waah, waah/
 W: I - I think he wants - a baba/ bottle
 M: Okay/
 M: Here, give him a baba/
 M: In the kitchen/
 W: He's drinking/
 M: Oh, he's very happy now/

Note WH's hesitation before he says "a baba". He more automatically says "I think he wants", but has to consider what would be an appropriate something for the baby to want.

WH, 37 months, V4, Doll House, 54:42

W: Does he turn his head?/ doll
 M: I don't know/
 M: Does he?/
 W: I think he wants to look at the cat's chair/

Here WH has thought of something appropriate for the baby to want to do (look at an object in another direction), now that he has found out that the baby can turn his head! Take a nap, go home, a baba, and look at a chair are different slotfilling activities WH has put into the frame "I think s/he wants to X", all appropriate to the doll house play-acting activity of attributing pretend desires to a doll.

Know: Play-acting. DV used know in the role, [A doll] "(doesn't) know(s) how" [+ action], to express the pretend competence of the doll, at two visits, the second and fourth. At Visit 2, she used it six times, all during Lego block play. The frame, and thus the word's, meaning does not show evidence of going beyond pretending about the doll's ability to perform the stated action.

DV, 33 months, V2, Play 23:44, 23:47, 23:49

D: (?) fits right in the seat/ doll
 M: That's right/
 D: It fits/
 M: It fits inside the truck/
 D: He doesn't know how/
 D: He doesn't know how/
 M: Can you help?/
 D: He does know how/
 D: There's a -/
 D: There's a duplo in his way/

We suspect that the DV is concerned with toy's physical performance rather than its mental processes because DV changes her mind about whether or not it "knows" when she discovers that there's a physical obstacle - a duplo - blocking its action. DV's frame is flexible enough that she can produce it in the question form, and with a real person instead of a doll:

DV, 33 months, V2, Play 24:37, 24:40

D (to L): Her Mommy is jumping/ doll
 L: Mm-hm/
 D: Cause she doesn't know how to walk/
 D: Does that Mommy know how to walk?/ D points to M
 M: (laughs)
 L: Uh-huh/
 M: Not the Duplo Mommy, right?/
 D: Yeah, she's a bigger one/

Here it is unclear whether "the red one" - a red doll - knows how to sit or drive:

DV, 33 months, V2, Play 25:11

D: He doesn't want to sit like that/ doll in toy car
 M: Doesn't he have to sit down, to drive?/
 D: No no, the red one knows how/ red doll

DV has learned, then, that know can be used in a particular frame to pretend about a doll's physical capability. Little further knowledge of word meaning needs to be imputed to explain the child's initial productions.

Think: Guessing. In these conversations, IK learns that statements about location of an unseen object can be preceded by "I think", when answering where-questions. However, she doesn't catch on that her mother uses "I think" only when a location is in dispute. This first excerpt shows that IK can answer "where" questions with a location. Her mother introduces "thought" to disagree with her child's negative answer.

IK, 29 months V2, Play 22:31

M: Where's your party shoes/

I: (?)

M: Oh, okay/

I: It's not on the table/

M: Oh, I thought they were/

When IK agrees to go to look for the shoes, her mother first gives her specific directions about a location to look (on the table in the hallway) and then uses the utterance "I think that's where they are". In saying "I think" the mother is emphasizing that the location contrasts with her daughter's previous denial.

IK, 29 months, V2, Play 23:24

I: I'll go look for them/

M: Go look on the table, in the hallway/

M: I think that's where they are, Izzy/ shoes

Here again, IK's mother again says "I think that's where they are" to talk about the location of unseen objects, to contrast with her daughter's denial of the correct location.

Argumentative IK demands, too late, that she doesn't want her mother to "put" them in the location her mother has put them already!

IK, 29 months, V2, Hide and Find 32:09

M: I'm gonna hide 'em/	
M: And then you try to guess, okay?/	M hides toys
M: Okay, ready?/	
M: Okay/	
M: Guess where the toys are/	
	I opens blue cup
M: No/	I opens yellow cup
I: No/	
M: No/	I opens red cup
M: I think that's where they are/	
I: Mommy, don't put it in there/	

At the next visit, IK can answer a where-question about the location of unseen objects with the frame, "I think" + the objects + location.

IK, 30 months, V3, Play 39:23

M: Um, where are all the rest of
the animals, Izzy?/
I: I think they're in my room/
M: They're in your room?/
M: Should I go get them for you?/
I: Yeah/

In the next example, IK inappropriately answers a why-question, rather than a where-question, with the "I think" + object + location frame. (Alternatively, she may just be ignoring her mother's why-question, and continuing on with location topic they were discussing previously):

IK, 30 months, V3, Doll House 58:00, 58:04

I: It's up there, look!/
 M: Yeah, it's right there/
 M: Why did this lamp fall all of a sudden?/
 I: I think it fell off of -/
 I: I think it fell off of here/
 M: Okay/
 M: The table by the bed?/

M puts lamp on

At the next visit, IK initiates a future-location conversation with a where-question, but her mother doesn't respond with a location, instead asking the question back of her daughter with "put". IK then combines "I think" with a location and "put". This harkens back to IK's consternation at Visit 2 about her mother's putting of objects in an undesirable location. Perhaps her mother is unwilling to supply an answer to her daughter's question about location because her daughter likes to be in control of "putting" decisions.

IK, 34 months, V4, Doll House 46:37

I: Where's this go?/
 M: What?/
 M: Where do you want to put it?/
 I: I think - right here I'll put it/
 M: Okay/

Moments later, IK answers her own where + put question, with the answer, "I think" + location. She does not wait for her mother to choose a location, but chooses an unsuitable place herself. Her mother doesn't let her choice stand, but suggests an alternative location.

IK, 34 months, V4, Doll House 46:57, 46:59

M: You got it/
 I: Now look/
 I: Now where should I put this guy?/

I: I think - it'll go right here/
 M: I don't think there's room right there/
 M: How 'bout next to the refrigerator?/

In these mother-child conversations about where objects are or should go, four disagreements take place. This element of disagreement between the participants is what necessitates the mother's preceding of location statements with "I think". However, IK uses "I think" in location statements even when there is no dispute. Here is indirect evidence that the child, while able to use the term correctly in conversation, has not taken into consideration the social presupposition - disagreement between conversants - of the term, at least as it is used in these cases by the mother.

Know: Guessing CF's mother demonstrates at two visits the use of "you know wh-" to invite guessing. In both cases, the mother supplies the answer to her wh-question:

CF, 33 months, V2, Hide and Find 23:52

M: Now, here's the - you know what this is?/
 M: You just had that before/
 M: That's a violin/
 M: A little bitty one/

CF, 34 months, V3, Play 55:58

M: Oh, you know what we need?/
 C: What?/
 M: Plates/
 M: For our tea cups/

Soon after her mother's demonstration at the third visit, CF uses know twice in inviting guessing. CF answers her own question either by physical demonstration (sipping tea) or verbally:

CF V3 Play 01:24

C: You know what I can do?/

M: Mm/

C sips tea from spoon
M drinks tea from cup

CF, 34 months, V3, Play 01:46

C: Lea, you know what I got on my fingers?/

L: What/

C: A pens/

L: Oh/

C: I got nail polish/

L: Oh/

In contrast with IK and her mother's use of think in a location - guessing game, know for CF appears in this limited corpus to be part of a general-purpose attention-securing device, perhaps related to Wittgenstein's description of the game of guessing the thoughts or intentions of another person.

Summary: Initial Language Game Roles. What can we say then, about the first language games roles in which children use think and know? In these limited examples of just two of the four most common language games, children used the verbs initially with fixed frames in procedures for attributing internal states or physical competence to dolls in play-acting, and to give location of nonpresent objects or to initiate guessing. These conversational routines are a far cry from Montgomery's claim that children in some way link mental verbs with their physical correlates. They have not much in common with the types of knowledge researchers probe for in theory of mind tasks. The child instead is learning what lexical frames are appropriate to what social, conversational situations. Their ideas do not remain fixed, but grow in response to their ongoing conversational experience. And they are not alone in their enterprise; their mothers provide assistance in

a variety of forms: entering into and encouraging pretend scenarios that expand the range of conversational topics, demonstrating new linguistic procedures.

Embedded Conversational Processes

In this section, examples of conversations between the two-year-olds and their mothers that contain think and know are provided. These are two-year-olds' embedded conversational uses. (More advanced uses by three-year-olds are examined in the following section.) The emphasis in their interpretation is on finding links between the mothers' uses and their children's subsequent uses. A variety of processes are identified that may support the children's initial uses of these words: direct repetition of the mothers' utterances; use tied to a particular event; using the same lexical frame with the same topic; role reversal, in this case in the telling of stories; the asking and answering of wh-questions; and contrasting related mental verbs. These processes are presented on a rough continuum from the more event-based to the more linguistically-based. The processes are reported in a speculative way, as the small number of examples of each present in the data prevented further quantification. Each example is preceded by an identifying header: [child's initials, age in months, visit (V) number, context, and time(s) on videotape of think or know in minutes:seconds].

Repetition. Repetition of a mother's previous utterance can support a child's beginning uses of a word:

RW, 32 months, V3, Doll House, 34:58, 35:04

R: There it is/

clock

M: Oh, good/

M: Why, does one of these dolls want to know the time?/

R: Yeah, this doll/

M: Oh/
R: Wanted to know - time -/

RW's faltering delivery may be due to his unfamiliarity with the vocabulary: perhaps he had never encountered the topic of time as something to know before.

Use tied to a particular event. CF, during her first visit, was asked by her mother with the phrase know how, to turn on a battery-operated train toy using a switch. (The train tracks were connected to a castle.)

CF, 32 months, V1, Play, 27:41, 27:49

M: Let's see what this thing does/
M: Sit over here/
C: Okay/
M: Do you know how to turn it on?/ castle & train

A little over a minute after this exchange, CF uses know how under similar circumstances, when

her mother asks her to turn on the train:

CF, 32 months, V1, Play, 28:54

M: Want to try to make it work?/ castle & train
M: With one of your little characters?/
C: Okay/
M: Oh/
C: I know how to work this/

Soon afterwards, CF uses know how to accompany another challenging aspect of playing with the castle and train toy, putting a figure into the train. Note that her mother has connected the two activities, making the train work and putting a character in, in the above example. CF connects the two activities too, extending her use of know how to cover putting the toy in the train as well:

CF, 32 months, V1, Play 32:12

C: This goes right here/
 M: Alright, we'll put it in/ figure in train
 C: I know how it goes/
 C: It goes in here/
 C: I can't do it/

Later in the Doll House context, CF's mother uses know what to talk (negatively) about the identity of a piece of furniture:

CF, 32 months, V1, Doll House, 25:00

C: What's this?/ cabinet
 M: Is that the television set?/
 M: Or-/
 M: Hm/
 M: What is that/
 M: I don't know what that is/

CF immediately uses know what, although in the positive, with the topic of identification:

CF, 32 months, V1, Doll House, 25:14

C: We need to watch the t.v./
 C: I know what it is/
 M: Maybe it's the refrigerator/
 C: Where?/
 M: No, there is a refrigerator/
 M: It's just one of the kitchen supplies/

In these examples, CF, while not mimicking her mother exactly, leans heavily on the context and her mother's previous utterances to produce her own utterances with know.

Same Topic, Same Lexical Frame, Different Event. In this example, CF extends a lexical frame to cover the topic of placement of an object, but during a different event. First she hears "I think the creamer goes here" while playing with a tea set:

CF, 34 months, V3, Play, 03:45

C: Pretend we put it, okay?/
 M: All right/
 C: Pretend/
 M: We'll pretend everything/
 M: You know, I think the creamer goes here/
 M: And - oops - the sugar goes here/
 M: Oh, here's - you're looking for a place for your cup?/

CF may be asking her mother for a frame to express putting: ("Pretend we put it, okay?")

Her mother provides her with one, and CF uses it later, but in the doll house context rather than the tea set context:

CF, 34 months, V3, Doll House, 40:05

M: Well who do you have now?/
 C: This one on here/
 C: I think this goes in here/
 C: And this - /
 C: And this lady goes here/
 C: Right here/

CF thus uses the frame "I think X goes here" to describe the action of putting an object in its place.

Role Reversal. At the beginning of the fourth visit, RW and his mother began their play session, that consisted of the building of a bridge with large blocks, by retelling the story of the building of the Brooklyn Bridge. This was a story that RW had heard before, and his mother encouraged him to participate in the retelling:

RW, 35 months, V4, Play, 18:55

M: That's right/
 M: She did build the Brooklyn Bridge/
 R: Why did Emily Roblin build the Brooklyn Bridge?/
 M: Do you remember?/
 R: Why?/
 M: Why?/

R: Why?/
 M: Do you remember why?/
 R: Why?/
 M: Because - do you remember what the man's name was,
 had the idea first to build the Brooklyn Bridge?/
 R: Who?/
 M: Was his name John Roblin?/
 R: Yeah/
 M: And what happened?/
 R: What?/
 M: You know/
 R: What?/
 M: Remember, he died/
 R: What?/
 M: And then his son took over/
 M: Remember his son's name?/
 R: And his son died, too/
 M: That's right/
 M: And then his son's wife, who was Emily Roblin, took over/
 M: And she was the one who really built the bridge/

Note how the mother uses know in this conversation, to encourage the child's provision of details for the story. What is to be known by the child is "what happened", and what happened was the next important event in the storyline - John Roblin died. The child, RW, has caught on to what is expected by his mother, as he demonstrates by giving the next important event in the story - that John Roblin's son died, too (ignoring his mother's request for the son's name however).

Later during this visit, during his meal, RW initiates another storytelling, this time with himself as the storyteller and the investigator as the listener (later his mother takes over the role of listener).

RW, 35 months, V4, Meal, 19:10

R (to Lea): Would you like me to tell you a story?/
 Lea: Yeah, would you tell me a story?/
 R: I only know the story about Cookie (?)/

Perhaps RW, after witnessing his mother's Brooklyn Bridge story told partly for the benefit of showing Lea that RW and his mother know a good story, has decided that Lea is in their home to hear their stories. He is cheerfully willing to tell the "only" story he knows for her.

RW, 35 months, V4, Meal, 21:53

M: Does it taste extra good when it goes through the bagel?/

R puts straw through bagel

R: Yeah, Mommy/

R: So you know what happened next to Big Bird and Cookie?/

Lea: No, what happened?/

RW uses know as his mother did earlier - with "what happened" - to draw the listener into the story. And later:

RW, 35 months, V4, Meal, 26:40

M: Reece, could you turn around so Lea could hear you better with her camera?/

M: Want to do that?/

R: So you know what happened then?/

RW then uses "you know" to encourage his mother's active participation in the telling of the story:

RW, 35 months, V4, Meal, 25:18, 25:20, 25:22, 25:26

R: And who else?/

M: Who else?/

M: I don't know/

M: Who else came?/

R: You know who else/

M: I don't know who else/

R: You know/

M: Who is Big Bird's big friend?/

R: Who?/

M: That big elephant guy/

In this conversation, RW tries to get his mother to give the details of the story, telling her that she knows, as his mother did with him in the Brooklyn Bridge story. Here he has access to his mother's input that "who else" is something that it is possible to know or not, and he is able to take the previously introduced utterances, "Who else" and "I don't know" and incorporate them into "You know who else". RW does not take into account his mother's lack of familiarity with the story he is telling - insisting that she knows "who else" even when she insists that she does not - perhaps revealing that even though he has grasped the conversational function of using "you know" to elicit the listener's participation in the storytelling, he does not grasp the basis for her knowing the details: remembering previously encountered information.

Wh-questions. A child can correctly begin using a mental verb by answering a mother's wh-question:

WH, 37 months, V4, Hide and Find, 17:17, 17:19

M: Okay, where do you think they are?/

W: I think they're right in here/(whispers)

W opens red cup

W: No/

Soon after answering a wh-question prompt that contains think, WH is able to answer a similar prompt that does not contain think with a similar response:

WH, 37 months, V4, Hide and Find, 20:12

M: Hey, where did it go?/

W: Hmp/

M: Hmp/

W shakes cups

W: Oh, I think - they're in here/

M: No/
 W: Yes it is/
 M: No it's not in there/
 W: Look and see/

W opens red cup

Similarly, IK answers her mother's questions about identity without, and then with think. Her mother first asks a wh-question with think and gets an appropriate response:

IK, 30 months, V3, Doll House, 58:42

I: What's this?/
 M: What is that?/
 M: What do you think it is?/
 I: This is a potty/
 M: Right/

Then IK identifies a related object, another piece of bathroom furniture, with think:

IK, 30 months, V3, Doll House, 59:54

M: And what's this called?/
 I: I think a shower or a bathtub/
 M: Bathtub, yeah/

IK has learned that you may preface an identifying name with "I think".

RW's mother often used know to direct reflection, asking wh-questions that encouraged RW to participate in the conversation, or if that attempt failed, to introduce new information herself that answered her own question, as in the following examples:

RW, 30 months, V2, Play, 10:43, 10:44, 10:49

M: Well you know, you know what you call this color?/
 R: Yeah/
 M: Not like yellow like Mr. Golden Sun, but -/
 M: You know what you call it?/
 M: You call it mustard color/

RW, 30 months, V2, Meal, 48:16, 48:21

M: Do you know what else Cathy made in it?/
 R: Yeah/
 M: She made almond butter/
 R: Yeah/
 M: You know what almonds are?/
 R: Yeah/
 M: They're another kind of nut/

RW's mother uses this function 11 times in Visit 2 before RW does, all with what as the wh-word. However when RW directs reflection, he uses where as the wh-word. RW has heard his mother use know where in this visit already, during the hide and find game:

RW, 30 months, V2, H & F, 21:25, 21:33

R: I'll put them in there/
 M: You'll put them in there?/
 M: Okay, but then I'll know where they are,
 right?/
 R: Yeah/
 M: Okay/
 M: So is that okay?/
 M: Should I guess where they are?/
 M: Or are they -/
 M: I know where they are/
 M: They're in the yellow cup/

In this example, several potential clues to meaning are presented together. The mother in protesting her son's placing the toy in the yellow cup while she was still looking, not only exposes him to the "know where" frame, but also indirectly gives him information about a presupposition of know - that if she sees, she will know. She also contrasts know with a related verb, guess. Finally she explicitly states what it is that she knows - that where the toys are is in the yellow cup. When RW uses "know where", it's with the directing reflection function:

RW, 30 months, V2, Doll House, 13:03

M: Why is she going in the window instead of
the door?/

R: You know where she going?/

M: Where?/

R: She going on the table/

Here's a sequence in which the child combines elements from her mother's previous utterances to produce the directing reflection function. In the first two excerpts, the mother uses "You know" to try to elicit a name of a character in a book:

IK, 34 months, V4, Meal, 56:47

M: Babar's Little Girl/

book's title

M: What's Babar's little girl's name?/

M: What is it?/

M: You know/

I: What is it Mom?/

M: What's Babar's little girl's name?/

I: (?)

M: It's Isabel!/
/

IK, 34 months, V4, Meal, 58:13

M: What was the baby's name?/

I: What?/

M: You know/

M: Isabel/

M: The baby was named Isabel/

Later the mother uses "You know what?" to introduce new information:

IK, 34 months, V4, Meal, 03:03

M: But you know what?/

I: (nods)

M: When Elvy gets here, you can go to the park/

M: By the fountain/

M: Would you like that?/

The mother introduces the word called to perform naming:

IK, 34 months, V4, Meal, 06:06

M reading book

M: And she didn't know it was time to go home/
 M: So she walked and walked 'til she got to the
 special place called The Blue Valley/

IK combines these elements in "You know what this called?".

IK, 34 months, V4, Meal, 06:22

M: What's that look like?/

M points to book

I drinking bottle

I: You know what this called?/

I points to book

M: What?/

I: Frog/

Here IK directs reflection for the purpose of establishing identity, during the same book reading session, using the lexical item called introduced by her mother. Her mother's use of called may have flagged a previously encountered utterance; IK has heard "You know what this is called" to identify objects at the previous session, although during the doll house play, not during book reading:

IK, 30 months, V3, Doll House, 59:31

M: And what's this called, Izzy?/

M: You know what this is called/

M: It's where you wash your hands?/

M: What's it called?/

I: Yeah/

In the following example, LB's mother provides an unexpected slotfiller for her daughter's answer to a wh-question with think; the child combines the response frame ("I think it should eat") with the object ("corn") to produce an appropriate (and humorous) answer:

LB, 39 months, V4, Play, 6:24, 17:08

M: You know I brought some big Indian corn back from

in Caanan, remember?/
 L: (?)
 L: Bleh, that's dusty/
 M: Do you think anyone can eat this?/
 L: Bleh/
 L: Pee yew/
 M: What do you think that snake should eat that we
 got - we found in Caanan?/
 L: The one that I (?)/
 M: No, the one that I have in a jar, that I gave to Hannah to
 take to show and tell/
 L: Oh/
 L: I think it should eat this hard corn/
 M: You think it should eat that hard corn?/
 L: Yeah, I think it likes hard corn/
 M: It doesn't have any teeth, though/

Contrasting two mental verbs. CB's mother, at the fourth visit, juxtaposed the mental verbs know and think. In the second example it is CB who supplies the second, contrasting utterance. In the first example, the mother establishes the pattern:

CB, 39 months, V4, Play, 09:37

M: We're so close, aren't we?/

C: Want to try this one?/

M: Hm?/

M: Ooh, okay/

M: I don't know that that has very good wheels/

M: What do you think?/

M: No/

M & C run cars
 down ramp
 C offers car

car falls

The mother has offered her opinion ("I don't know that..."), immediately asks for the child's ("What do you think?"), and gives an opinion when the child fails to supply one. In the next example, the mother expresses her doubt at finding seeds ("I don't know that..."), and CB supplies the opinion ("I think you can").

CB, 39 months, V4, Meal, 24:12, 24:32

M: Okay sweetie, we have to get some new dirt/

M: And a big pot/

M: And the seeds/

M: I don't know that I can find the old seeds/

C: I think you can/

C: Will you?/

M: I used to have them up there/

M points to shelf

M: And I don't see the package/

M: I might have them - I'll look under the sink/

M: I'll look there/

C: Okay/

The mother provides additional potential meaning clues, in her statements related to her not knowing where the seeds are: she doesn't see them in their old location, they might be under the sink, she'll look there. Note that in this example, reminiscent of a false belief task in that an item is hidden on a kitchen shelf but is no longer in the expected location, the participants do not contrast think and know regarding location of the missing item (as in, "I don't know where it is, but I think it's in here"); they contrast the finder's action, her ability to locate the package: ("I don't know that I can..." / "I think you can"). What is important to the participants is not so much where the object is, but whether it can be reobtained, for the social purpose of using it.

Processes Beyond the Here and Now: Three- Year-Olds' Uses of *Think* and *Know* to

Denote

Rather than look at three-year-old children's embedded conversational uses of think and know as I did for two-year-old children, I looked at the three-year-old child's attempts to use think and know in more advanced ways. These include using think and know in conversations about the past, the future, to make generalizations, to contrast thought and reality, and one girl's uses of verb contrasts. Conversations about the past entailed confusion, non sequiturs, argument, and negotiation. The absence of supporting details away from the here and now often necessitated the mother's questioning to figure out what the child intended to convey. The children themselves confused different events,

location in time, the general with the specific. However, the children were better at making generalizations. When possible, excerpts that contain parental demonstrations (one father was a main participant) of these advanced functions preceding children's uses are also presented. However, the three-year-olds' more advanced uses were not so tied to parental uses as the two-year-olds' embedded conversational uses were, and thus their relations to parental uses are more difficult to demonstrate. In addition, I identify parent-child processes which may assist the child in developing more advanced concepts of think and know, and in participating in the conversations with think and know in more advanced ways.

Each example is preceded by an identifying header: [child's initials, age in months, visit (V) number, context, and videotaped time of think or know in minutes:seconds].

Talking About the Past. When three-year-old children talked about the past, the absence of supporting details sometimes led to confusion. Even when the child managed to use know or think appropriately, she often left out the information necessary to get her complete message across. It then became the job of the adult to ask for further details, or to guess at the child's meaning. This process of questioning and correcting may contribute to the child's understanding of what is needed to talk about a past event, including how the use of think or know fits into these conversations.

In the first example, KP wants to tell her mother about another girl's toy rocket. But KP can't remember the girl's name, and she tries to ask her mother what it is. Her mother does not know who KP wants to talk about, and must elicit enough detail from KP to determine which girl it is. But the mother was not home for the event; "So how

would I know who this is?" And if the girl didn't bring the rocket, "How do you know she had a rocket?" KP's mother uses know in this excerpt to make explicit to KP some of the necessary information for relating an event about the past. KP is confused about why her mother can't name the girl she visualizes, as if her mother can visualize her as well as she can without any identifying clues - "Don't you remember her? You've seen her before." Her mother resorts to guessing: "Was it one of Jenny's friends?" "Was it Katie?"

KP, 42 months, V2, Meal, 11:53

K: You know what?/

M: What?/

(Pause)

K: You know something?/

M: What?/

(Pause)

K: Let me think/

(Pause)

K: What's her name again?/

M: What?/

K: What's her name again?/

M: Who?/

K: That girl/

M: Who?/

K: Don't you remember her?/

K: You've seen her before/

M: No/

K: Yes/

M: Where is she?/

K: I don't know/

M: Oh/

K: I don't know her name/

K: Somebody has a rocket/

K: That can turn into a big rocket/

M: Yeah?/

K: (nods)

M: Who is this person?/

K: I don't know her/

M: Where'd you meet her?/

K: At our house!/

M: At our house?/

M: Somebody with a rocket came to our house?/

K: Uh huh/
 M: Was I home for this?/
 K: (shakes head)
 M: No/
 M: So how would I know who this is?/
 M: Was it one of Jenny's friends?/
 K: (nods)
 M: Came to our house with a rocket/
 K: Right/
 M: Okay/
 K: Not with a rocket/
 M: Not with a rocket/
 K: She left it home/
 M: She left it home/
 K: Yeah/
 M: How do you know she had a rocket?/
 K: Cause she told us/
 M: Oh, okay/
 M: Was this Katie?/
 K: (nods)
 M: Oh, okay/
 M: Well why didn't you say so?/
 K: Cause/
 M: Because/

Having unearthed the name of the child, the dyad move on to the day of their meeting. In the ensuing humorous conversation, KP reveals her confusion about tomorrow and the days of the week, at the same time that she displays her exasperation ("Don't you know?") that her mother won't admit to comprehending the "obvious", that Katie came on a Sunday in the past, not in the future.

KP, 42 months, V2, Meal, 11:53, 12:04, 12:06, 12:23

M: When did Katie come over?/
 K: On Sunday/
 M: No, tomorrow's Sunday/
 K: Don't you know?/
 K: She came over to - mor - row!/
 M: She came over tomorrow?/
 K: (nods)
 M: No, I don't think so/
 K: (nods emphatically)

M: You know this, huh?/
 K: I know which day it is/
 M: You do?/
 M: Which day is it today?/
 K: Mm - Saturday/
 M: So when did Katie come over?/
 K: On Sunday/
 M: But Sunday is tomorrow/
 K: I know that/

KP faces a number of difficulties in sharing her memory of a specific event with her mother. 1) She doesn't seem to realize that her mother can't provide the name of the child she's thinking about without more explicit specification; 2) she needs to convey both past and general information - the girl came to the house at a specific time in the past, but has a rocket in general; 3) her time vocabulary - for days of the week, tomorrow versus yesterday - needs fine tuning. KP is able to use think and know and remember in appropriate conversational ways ("Let me think"; "You know something?"; "I don't know her name."; "Don't you remember her?"), but as her mother's probing demonstrates, there is more to using them to talk about the past than this.

Her mother helps KP out by:

1. Telling KP that she doesn't know who the child is because she wasn't there.

This gives KP information about an important source of knowledge: direct observation.

2. Summarizing the state of her understanding, she gives her daughter the opportunity to reject a statement confusing past and general:

M: Came to our house with a rocket/
 K: Not with a rocket/
 K: She left it home/

3. Steering the conversation to bring out and contrast different sources of

knowledge: (a) knowing by direct observation ("came to our house with a rocket"), and (b) knowing from social sources ("she told us").

4. Challenging her daughter's confusion over past and future vocabulary:

K: She came over to - mor - row!/
M: No, I don't think so/

Later in the visit KP more successfully uses know to talk about the past, but this time rather than relating a rather complicated event (what a friend told her at a visit to her home in the past), she conveys a simpler fact: what she put on top of her Christmas tree, an angel.

KP, 42 months, V2, Play, 39:15

K: You know what we put it on top of our Christmas tree?/
M: Yeah/
K: An angel/
M: Oh, okay/

Here's another case in which a mother has trouble understanding her daughter's statement about the past. First the mother and daughter discuss the habits of ghosts:

AF, 41 months, V3, Meal, 07:37

A: But he didn't ate us up/
M: Ghosts don't eat people up/
A: No/
M: What do they do to people?/
A: Um, they try to get them/
A: And they try to boil them and eat them up/
M: Really?/
M: I didn't know that/
M: I thought that ghosts- just scared people away/
M: From their house, because they want the house all for themselves/
A: (?)
A: They eat people up/
M: Yeah, it's true/
M: When I play ghost, I always pretend that I eat people up/
M: But I'm not a real ghost/

M: I don't know/
 M: I don't know what it means to be a ghost/
 M: Um yum yum/

The mother "didn't know that" ghosts try to boil people and eat them up. (Notice that she contrasts know with thought.) As well, AF's mother tells her daughter about a valid source of knowledge: she doesn't know "what it means to be a ghost" because she's not "a real ghost". Introspection, then, gives us self-knowledge, which differs by type of being. Do ghosts eat people up or merely scare people away from houses? She doesn't know because she's not herself a ghost. A ghost, presumably, would know.

Later in the visit AF inserts the phrase "I didn't know that" into a recount of that day's lunch at school, that gets confused with pickup time. Her use of this phrase doesn't fit smoothly into the conversation - what is it that she didn't know?

AF, 41 months, V3, Meal, 13:34

M: Do you remember what you had for lunch today?/
 M: I don't remember what I gave you for lunch/
 A: I don't know either/
 M: Hm?/
 A: I don't know either/
 M: You forgot?/
 A: Mm-hm/
 A: Forgot, I didn't see/
 A: We had it so fast/
 M: What-/
 A: I didn't even see/
 M: You ate it so fast, you didn't even see?/
 A: Nn-nn/
 M: Why do you eat fast?/
 A: No, you came right fast/
 A: I didn't know that/
 M: Oh, I came to pick you up fast?/
 M: Quick, I mean, early?/
 A: Mm-hm/
 M: Well, I came to pick you up after your nap/
 A: Oh, and um, what did I eat?/
 A: Do you remember?/

In the absence of perceptual evidence, disagreements about the past can arise, as in this argument between NR and his mother about where Cookie Monster doll was sitting:

NR, 42 months, V2, Meal, 15:50, 15:58, 16:12

M: It's like between the rocks, in your
bears at night/

N: Mommy I think this must be Cookie, this
must be me, this must be you/

Cookie
Monster doll

M: Really?/

M: See I thought, this was Cookie, this was
me, and this was you/

N: No because I was sitting in the middle/

N: I was sitting in the middle/

M: Oh, you were sitting in the middle/

N: Yeah/

M: I thought I was sitting in the middle/

NR resolves the conflict with think, proposing a third party as the one in the middle:

NR , 42 months, V2, Meal, 16:49, 16:53

M: So who was in the middle?/

N: I was!/

M: No, I think I was/

N: No, I was/

M: No/

N: I think Cookie was/

M: Mm/

N: Can I have a bite?/

Talk about the Future. The children's uses of think and know to talk about the future were rare. One child who did, at her mother's suggestion, SL, seemed caught up in the relation between what will happen and what usually happens. In this conversation, she discusses both a specific event in the future, a visit from her friend, and a generalization, how one plays tag:

SL, 44 months, V2, Meal, 36:53

M: So do you have any idea what we should do
with Lucy when she comes?/

M: Today?/

S: What?/

M: Do you have any ideas what games you want
to play with her?/

S: Mm - tag/

M: You want to play tag?/

S: Y'know what tag is?/

S: Somebody chases you then you chases them,
then you chase them, then you chase you,
then you chase you, then you chase them/

M: How do you decide who should do the chasing?/

S: Uh, I think Lucy should do the chasing/

M: Oh, and then when do you chase her?/

S: Uh, after I'm done/

S: And I say, Lucy, now can I chase you?/

S: And then she says, I can (?)/

Her mother wants to talk about what they will do that afternoon ("You want to play tag?") but SL switches to the general rules of tag ("Y'know what tag is?"). But when her mother switches to the general with her, ("How do you decide..."), SL returns to talking about the future ("I think Lucy should do the chasing.").

In another mother-initiated conversation about the future, SL again works back and forth between a specific event (eating this food will give you a tummyache) and the general (this food doesn't make tummyaches). Working out this contrast takes precedence for her over answering her mother's question ("Are you gonna get mad...?").

SL, 44 months, V2, Play, 58:21

S: This is where I live/

M: Oh, you're just making that food for me/

M: Are you gonna get mad if I don't eat it?/

S: I think you're gonna get, really tummyache/

S: Cause this stuff doesn't make you have
a tummyache/

S: But if you eat all the food it's gonna make
you have a tummyache/

Making Generalizations. Making generalizations with know and think seemed to be easier for the children than talking about specific events in the past or future, and their conversations about the general are less confusing for the listener. Three of the four children in the examples presented here use know to direct reflection, in wh-questions that introduce general topics. In the first example, after his father introduces the general topic, ERi asserts that his father doesn't know who is in the bathroom when he locks himself in, and he asks about the hypothetical situation of his father locking him in:

ERi, 43 months, V3, Doll House, 32:40

F: But in what room?/

E: In the bathroom/

F: Oh, in the bathroom/

F: You always lock that, don't you, when you're
in there/

F: You always lock me out/

E: Yeah/

E: But you don't know who's in there/

F: But I don't know who's in there/

F: But I usually assume it's you in there/

E: If you were out there you could lock me in?/

E: Couldn't you?/

F: I could lock you out/

ERi's father may not "know who's in" the bathroom, but he "usually assumes" it's his son, as his son "always lock[s]" the bathroom door. He may not have certain knowledge by direct observation - he cannot see his son - but he can make a good guess by deduction: inference by reasoning from the general to the specific.

ERi's father had already introduced know with a wh-question as a way of presenting

general information during the same visit, in the doll house context:

ERi, 43 months, V3, Doll House, 26:45

F: That cat needs a little nap?/

E: Mm-hm/

F: You know- you know where (Elaine?)
usually sleeps?/

F: Here/

F points to armchair

F: She usually sleeps here/

F: Maybe that cat could take a little nap/

E: Oh/

F: In the rocking chair/

Here ERi's father has made a suggestion about the specific (the doll cat can nap in the chair) using knowledge about the general (a real cat usually sleeps in a chair). In this way their doll house play can mimic reality.

BE is able to use know to initiate a general topic, what Natu drinks at school.

BE, 43 months, V1, Meal, 57:29

B: Know when we go to school?/

B: That's what kind -/

juice box

B: Natu gets stripes/

boy at school

B: But mine's not sweet, Momma/

M: Well Natu has to drink special kinds/

M: Because he has allergies/

He also uses know to introduce the topic of the location of a general event, where he eats lunch:

BE, 43 months, V1, Meal, 01:22

B: You know where I - where we eat?/

B: The children?/

B: We eat in the classroom/

B: Where we eat our lunch/

In contrast to her difficulty in talking about what's going to happen this afternoon, SL enjoys talking about the general game of tag, using know to introduce new details: running fast, winning and losing:

SL, 42 months, V2, Meal, 37:16, 37:30

M: Do you guys play tag at school?/

S: No no no no no no no/

M: No no no no?/

S: Know how fast you got to run?/

S: You gotta go dh-dh-dh-dh/

M: You've gotta go as fast as you can
go, right?/

S: So nobody can catch up with you/

M: Yeah, cause you don't want to be it, right?/

S: No/

M: You want to be able to run around/

S: But you know what?/

M: What?/

S: In that game, people are the winners
and sometimes people are the losers/

M: Really?/

M: What happens - why do people lose
sometimes?/

S: Cause sometimes, when they don't run that
fast, they're the loser and sometimes
when they run fast, they're the winners/

M: Oh/

KP, telling her mother about her gym class that morning, can switch between the past and the general. She uses know to provide more general detail for her mother when her mother doesn't understand her:

KP, 41 months, V1, Meal, 39:02

K: But the sliding part is fun, too/

M: Hm?/

K: The sliding part was - my funnest/

M: A sliding part?/

K: You know there's a slide on that you put -
jump on/

K: That I was kind of jumping on/
 K: That I had-ed to do all by myself/

ERo uses know in warning her mother about couches:

ERo, 49 months, V4, Play, 34:12

E: That's a couch - so it has -/
 E: You know couches have sharp things behind them?/
 M: Mm hm/
 E: Our couch?/
 M: Mm hm/

Contrasting Thought and Reality. Examples of this category of mental term use were rare, five in total for both think and know. I include these four examples to show that they did occur, however. (The remaining example is not included because it was partially inaudible.) In the first example, ERo provides a spontaneous demonstration of her understanding of her own false belief: she thought there was something in a manila envelope, but there isn't.

ERo, 43 months, V1, Hide and Find, 48:38

E: I want this/	E picks up envelope
M (to F): Go look in your box/	
F: Uh oh/	E tries to look in envelope
E: (?)/	F leaves room
M: Well that's - that's something Lea has to use for, you know, the other children/	
M: Cause some children aren't as good at keeping their eyes closed as you?/	E puts down envelope
E: Yeah?/	
M: And so, and then you have to put it up like this - so you can't see/	M demonstrates E looks at Lea
E: But what is in it?/	
M: I don't know/	
M: Why don't you look?/	M gives envelope to E

E: Okay/	E takes envelope
E: I'm going to look/	E looks at Lea
M: I know you like envelopes/	
E: Yeah/	E puts hand & arm in envelope, opens it, looks in
E: Nothing!/ M: Nothing/	E feels in bottom of envelope
E: I thought there was something in it, but -/	M shakes head
	E still looking & feeling in envelope
E: There isn't!/ L: No/	E turns suddenly to Lea, smiles
L: There's nothing in it/	E puts envelope down

AF also seems to have some grasp of her own false belief, at first thinking that a ghost in the house was real, then realizing that it wasn't:

AF, 43 months, V3, Meal, 06:21

M: So there was a ghost in the house/
A: Not you/
M: I wasn't a ghost, no/
A: No/
A: There was a pre - there was a pretend, um, ghost/
M: You were not afraid?/
A: Nn-nn/
A: I thought it was a real ghost, but it wasn't/
A: It was a -/
A: A pretend ghost/

In the following examples, LS contrasts his thoughts with reality in general: the Chinese restaurant serves chicken wings, chickens have muscles. He practices the lexical frame "I didn't know X", using it five times in three minutes.

LS, 49 months, V4, Meal, 09:00

L: I didn't know they had the wing/
M: You didn't know chickens had wings?/
M: Or you didn't know they gave it to you at that restaurant?/

L: I don't know if - if they had -/
 L: I didn't know that they wings/
 M: You didn't know chickens had wings?/
 L: No, I didn't - know - that - the Chinese
 place had chicken wings/
 M: Oh, oh/

LS, 49 months, V4, Meal, 11:50

M: Do you know what you're eating?/
 M: You're eating the chicken muscles/
 M: Is that a yucky thought?/
 L: What did you say?/
 M: You're eating the chicken's muscles/
 L: Oh!/
 L: I didn't know chicken had muscles/
 M: Yep/
 M: You have to have muscles to be able to walk/
 M: Your muscles help you walk/

Sense. The only three- year- old who gave some demonstration that she had placed think or know into a system with related verbs was ERo. In the first example, ERo's mother questions ERo about a recent visit to a pizzeria. ERo contrasts think and know in answer to her mother's question about who ate a pizza slice - she thinks but doesn't know that the babysitter did.

ERo, 44 months, V3, Meal, 03:06, 03:08

M: Who ate the other half?/ pizza slice
 E: Laurie's babysitter/
 M: Oh, good/
 E: I think but not - I don't know/
 M: Did you have anything else there?/
 M: Something to drink, or-/
 E: Yeah, I did/

In another example, ERo contrasts know and think in a similar way she did while discussing who ate the pizza - she is unable to provide a direct answer to a question about the past ("I don't know"), and she prefaces her tentative reply with "I think".

ERo, 44 months, V3, Play, 10:46, 10:48

E: That block was my favorite/

M: And it's got teeth marks on it/

L: Why was that one your favorite?/

E: I don't know/

E: I think maybe it was my favorite color/

ERo's ability to contrast think and know may have its origin in experiences of conversation such as one that she had with her mother at a previous visit. In this example, her mother refuses to provide an answer to her daughter's query about the identity of an object ("I don't know") instead asking twice that she guess ("What do you think it is?"). Her mother thus shows ERo that when she doesn't know what something is, she can say what she thinks it is.

ERo, 43 months, V1, Doll House, 53:17, 53:18, 53:20

E: What is this?/

M: I don't know/

M: What do you think it is?/

E: What is this?/

M: What do you think it is?/

E (to L): What is this?/

E: This/

E points

L: It's a wall/

Here's an example in which ERo mentions the presupposition of know - she doesn't know where her cat's toys are as she does not see them:

ERo, 44 months, V3, Meal, 06:47

M: Where's his busy balls?/

cat

E: I don't know/

E: I don't - I don't see them/

M: He must have hidden them away/

Again, ERo's mother has demonstrated the presupposition of know at a previous visit -

part of the example presented in the section above on contrasting thought and reality in which ERo looks in a manila envelope but finds nothing. In this excerpt, the mother provides an opportunity for her daughter to find out that looking (seeing) can lead to knowing:

ERo, 43 months, V1, Hide and Find, 48:09

E: But what is in it?/

M: I don't know/

manila
envelope

M: Why don't you look?/

M gives
envelope to E
E takes
envelope

E: Okay/

E: I'm going to look/

Summary: Parental input to children's advanced uses of *think* and *know*. From the above examples it is possible to identify a number of potential clues that parents provide their children as to the meanings of the words think and know. And yet to call them clues to individual word meaning is to diminish the task, that is also to learn the functions and roles that the words have in actual conversations. Among those observed in just the small number of examples presented here are the following:

1. Questioning for details to sort out what the child wants to tell about the past or future. This is necessary because away from the here and now, the child must learn what to present to the listener so that speaker and listener share enough background for the listener to understand the speaker's message.
2. Asking for or suggesting presuppositions of the mental verbs (as in, "How do you know she had a rocket?" and "Why don't you look?")
3. Introducing and extending discussions about the past, future, and general.
4. Contrasting related mental verbs.

5. Using relevant vocabulary, such as "usually", "always", "what happens" for generalizations, and past and future tenses.

6. Making logical statements and purpose explanations (as in, "You have to have muscles to be able to walk"; "Natu has to drink special kinds because he has allergies"; "I thought that ghosts - just scared people away because they want the house all for themselves"). Knowledge is not obtained merely through the senses, but is socially shared, scientific or otherwise cultural: muscles are needed for walking, Natu has allergies, ghosts' behavior is motivated by their wants, the game of tag has rules.

7. Discussing alternate sources of knowledge besides direct observation, such as introspection and deduction ("I don't know what it means to be a ghost"; "I usually assume it's you in there").

All of these types of information, and probably other ones as well, are needed for the child to participate fully in the conversations that include think and know, to use the words to denote, to place them in a system of related words. In focussing on one source of knowledge alone - vision - and in one task alone - location of objects - theory of mind experiments oversimplify both the meaning of words as they are used in actual conversations and the nature of human knowledge. There is much more to be known: procedures, names, what we had for lunch, chicken body parts, ghost motivation; and many sources of knowledge: to begin with, experience, hearsay, books, introspection, deduction, faith.

Learning about the myriad (and perhaps haphazard) categories of knowledge and the multiplicity of human sources of knowledge contributes to the child's concept of knowledge and thus to the meaning of the word know. An individual's language games

multiply and expand over the lifetime as new ways of using words, new understandings of the world, and new interconnections between word meanings are acquired through language participation and formed through the individual's reorganization of what is already known.

Chapter 6: Summary: Orientation Revisited

In the orientation, I asked a number of questions about mothers' and children's uses of think and know. In this section, I return to those questions to examine if and how they have been answered by this study. In doing so I will present a brief summary of the data in a way which allows us to keep in focus the main goals and findings of the study. As in the orientation, the headings will be Maternal Input, Children's First Uses, and Mother and Child Comparisons.

Maternal Input

Verb Comparisons

To what extent do maternal uses of think and know differ? Four variables revealed differences in usage between the two verbs: person reference, time reference, lexical frames, and mental verb code. The mothers used think to refer to themselves more than to their children, but this difference did not occur with know. The mothers made more generalizations with know than with think. "I think (that) X" was the most frequently used frame with think, while wh-questions were the most frequently used with know. The mothers directed the interaction more with think than with know, but directed reflection more with know than with think.

Are the two verbs used in completely different ways, or do their uses overlap? Despite the documented significant differences in frequencies of use described above, this type of analysis emphasizes the differences between verb usage. There is, of course, overlap in the categories: for example with mental verb code, both verbs were used for three functions in common: to refer to internal states, to direct the interaction, and to

direct reflection. Statistical analysis for differences emphasizes the differences between the verbs, obfuscating commonalities in usage. Similarities in use, beyond noting the common coding categories which the two verbs share with each other, are difficult to document using the methods of this study.

Are the verbs explicitly contrasted in some way, so that children can construct sense meanings for the words? Sense meanings in general, including explicit contrasts between related verbs and mentioning presuppositions, were provided by the mothers at rates ranging from 1.0 per hour with think by mothers of three-year-olds, to 1.9 per hour with know by mothers of three-year-olds, (with the rates per hour for mothers of two-year-olds for the two verbs falling in between). Thus children are being exposed to the explicit information needed which would allow them to construct sense meanings for themselves. It is not so mysterious then, the process by which children learn presuppositions and how verbs can be contrasted; this information is provided to them in everyday conversations.

Age Comparisons

How do mothers tailor their uses of think and know to the age of the child? Does it differ by verb or variable examined? No differences by age of child were found. Thus at a constitutive level the mothers did not appear to tailor their uses of think and know to the age of the child. These results argue for the stability of the constitutive contexts in which think and know participate in, which did not vary by child age.

It is unsatisfying to leave the matter of maternal input at a rest after finding no differences to two- and three-year-olds in these constitutive measures, however. The differences between the embedded-meaning conversations that two-year-olds engage in

with their mothers and away-from-the-here-and-now conversations that the older children participated in were both partially constituted by and furthered by differences in maternal conversational practices, as described in the process sections. For the two-year-olds, examples were found primarily of mothers demonstrating correct conversational use in here-and-now activities, as well as basic demonstrations of culturally important activities such as pretending about dolls and story-telling. Although related verbs are contrasted and knowledge sources are introduced, these tend to be done in an incidental, fleeting manner.

With the three-year-olds, knowledge sources are discussed explicitly and more in depth, including discussion of more advanced sources such as introspection and deduction. Incorporation of the verbs into conversations about the past, future and general is supported through maternal insistence on the provision of background information, and use of relevant time-marking vocabulary. More advanced explanations of culturally defined and scientific activities add to the child's knowledge of what is to be known.

Children's First Uses

Meaning Levels

Is Nelson and Lucariello's developmental theory supported by the data, or is the learning of word meaning an all-or none phenomenon, with labels quickly mapped on to previously existing concepts? Two sources of data were examined to answer this question: meaning levels demonstrated over the four visits by individual children, and a comparison of meaning level attainment by the two-year-olds and three-year-olds as groups. Does each child demonstrate the order of meaning level attainment predicted by

the theory? Although not all the children used denotation, the results in general support the prediction: the children for the most part either showed embedded use only or used denotation at a later visit than embedded use. Some of the children, especially the three-year-olds, displayed both embedded use and denotation at the same visit, but this does not violate the predicted pattern. Out of the 46 total cases of child by word (23 children x 2 words), there was only one case of violation, a two-year-old's use of denotation without embedded use. Do three-year-olds use more of the higher level meanings than two-year-olds? A significant age by meaning level interaction was not found, although the children in general showed embedded use more than denotation. (The interaction was significant only at the .04 level, and thus did not meet the study's more stringent .01 alpha requirement for significance.) Sense meanings were not in common evidence for either age group, suggesting that this level of word meaning development was not yet attained for the age studied (the three-year-olds had become young four year-olds by the final visit). Thus the individual trajectories, but not the age group comparisons, support the Nelson and Lucariello theory of word meaning development.

Other variables

What changes were documented between two- and three-year-olds?

Other than totals (the three-year-olds used both verbs more than the two-year-olds), significant age differences as measured by constitutive variables in the use of think and know were not found.

Is there individual variation in children's initial uses of think and know? The examination of a subset of the two-year-olds' initial language game roles with these verbs suggested that there is some individual variation: different children used

different subsets of the language game roles. The range of language game roles used as a whole by the group, however, was limited: nine language game roles were identified with know, and five roles with think, which accounted for the majority of the two-year-olds' uses.

Self and Other

Do children refer to themselves before they refer to others with think and know, or do the two types of reference occur simultaneously? The data reported here show that children use think and know to refer to themselves before they refer to other people such as the mother. Important to keep in mind, however, is that most of the children's uses of these verbs are not for actual references to internal states. Thus the argument that children develop concepts of their own mental states which they later extend to other people can be made only weakly from these data. A better test of this theory could be carried out looking at the individual initial uses of person references with only mental state utterances.

Verb comparisons

Are children's first uses of think and know constituted differently? While clear differences were found in a number of variables for the mothers' uses of the two verbs, the only variable which showed significant differences between the children's uses of the two verbs was mental verb code: directing the interaction was done more with think than with know. The description of the two-year-olds' children's language games, however, suggests that even from the beginning the two verbs take on different language game roles. No significant verb by age by variable differences were found.

Mother and Child Comparisons

Do children's initial uses depend on the type of input they receive?

Contrary to prediction, large numbers of straightforward correlations between mothers' uses and children's uses were not found. The acquisition of these verbs thus cannot be explained by a simple imitation model; a more complex model is required.

Processes

Straightforward mother-child correlations between constitutive variables were shown to be inadequate in accounting for child acquisition of the meanings of think and know. What processes then can be identified in mother-child interactions that account for the increasingly complex uses of think and know by young children? With the two-year-olds, a number of processes were identified which can contribute to young children's understanding and use of the verbs: repetition; use tied to a particular event; use with the same topic, and same lexical frame, but a different event than a previous use; role reversal; use with wh-questions; and maternal contrasting of two mental verbs. These processes were presented as existing on a continuum from more event-based to more language-based. In addition to these processes, the role of conversation in the acquisition of embedded uses was explored. The children's initial uses were seen to be tied to specific, limited conversational situations. Both think and know were most often used in the language games of guiding, naming, guessing, and play-acting. For each word between one and three roles (identified by lexical frame and conversational relation to adjacent utterances) for each language game accounted for the majority of uses. Each of the two words participated in its own set of roles that did not overlap with that of the other word.

I looked at the three-year-old child's first attempts to move beyond the here-and-now, to use think and know in conversations about the past, the future, to make generalizations, to contrast thought and reality, and beginning uses by one child of verb contrasts. The children appeared to have less trouble in making generalizations than in talking about the past and the future, to judge by the difficulty their mothers had in understanding their children's talk about the past and future, and the extra work mothers had to do during these conversations to establish this understanding. Help that mothers provided during these conversations took the forms of questioning for pertinent details, asking for or providing presuppositions, introducing and extending discussions away from the here and now, using time-related vocabulary and verb tenses; and providing logical statements and purpose explanations.

Chapter 7: Discussion

Beyond Point and Name: Differential language game roles and conversational complexity

In the opening literature review, I suggested that the processes of abstract word acquisition may differ from those for object words. For object words, ostension - pointing and naming - has been taken by many to be the predominant acquisition method. However, studies by Lucariello, Kyratzis, and Engel (1986) demonstrated that children were better at answering questions, discussed more topics, and had more conversations about non-present activities during familiar event contexts. Further, object word use became increasingly decontextualized (requesting, initiating, narrating, planning, evoking) within a familiar event context over time. This work indicates that the point and name paradigm oversimplifies the process of word learning, even for object names. Nelson, Hampson, and Kessler Shaw (1991) provided evidence that non-object nouns are used in regular, specific pragmatic and sentential contexts. These regularities can be used by the child to support their initial uses; as well encountering new words in regular contexts can contribute to the formation of new concepts.

On the basis of this groundwork, I set off to discover how think and know are regularly used by children and their adult conversational partners. As well, I looked for conversational processes which may support both initial uses and more advanced, non-present uses. I found that both mothers and children used think and know in regular, differentiated ways. The mothers differentiated the verbs by person reference, time reference, lexical frame, and mental verb code. Seventy-five percent of the mothers' uses

of think and know were accounted for by the five lexical frames identified for think and the eight lexical frames identified for know. The differentiation of the verbs can provide clues to the child as to how the meanings of these related verbs differ from each other; think was used more for a planning function, to express what the mother herself thinks, to suggest ideas for activity. In contrast, know was used to talk about generalizations, to direct reflection through wh-questions, to ask about what the child knows. In addition, the use of regular lexical frames can give the child an opportunity to learn how to use the terms appropriately in conversation. This finding of differentiation is an important contribution to the literature on early mental verb use, as most observational studies of these and related verbs have grouped the verbs together into one "mental verb" category. That method obscures the process by which the verbs are initially acquired, which is by individual verb.

Evidence that the children use and differentiate the verbs in ways similar to the mothers was not as abundant as predicted. The only significant difference between verbs was the function, as measured by mental verb code: directing the interaction was done more with think than with know. However, examination of the language game roles in which two-year-olds initially used the verbs generated a clearer picture of regularities of use: know was used predominantly in nine language game roles, whereas think was used in a different set of five. Children thus seem to be latching on to regularities in function and topic, to accomplish specific conversational purposes, before they produce more structural, constitutive regularities (such as person reference or lexical frames, as the mothers demonstrated).

As well as looking for statistical regularities and differentiation of use, I looked for conversational support for both initial and more advanced uses. Over the age range of the children in the study, from two-and-a-half to four years, I found a progression from simply directly repeating what the mother said and using the terms during events similar to the ones in which they were introduced, at the initial ages, to using the terms to make generalizations, discuss the past and future, to contrast thought and reality, and even one three-year-old child's contrasts of the terms themselves. Along the way, the two-year-olds progressed to using the verbs with the same topic and lexical frames but in different events; in storytelling role reversal; to first answer wh-questions appropriately, and then to introduce new information using wh-questions and statements.

The mothers provided a variety of types of conversational support for their children's increasingly complex uses, in addition to the regularities in their sentential structure. The mothers questioned and prompted their children for the information necessary to relate past events, in the face of the children's omission of relevant details; they asked for or provided presuppositions for mental state reference uses; they introduced and extended discussions about the past, future, and general; they contrasted related mental verbs; they used relevant time-related vocabulary and tenses; they provided logical statements and purpose explanations that went beyond simply stating what was known or thought; and they discussed alternate sources of knowledge besides direct observation, such as introspection and deduction. This last point is especially important to make in light of the emphasis in experimental research on direct observation and object location [e.g., Johnson and Maratsos (1977), Miscione et al. (1978), Johnson and Wellman (1980)]. Human beings use alternate sources of knowledge about a variety

of knowledge topic categories. Adult-child conversations using think and know even at these ages reflect this complexity, as these uses are part of the uses and thus meanings of the verbs.

Maternal support for the acquisition of these new abstract words thus goes well beyond establishing mere reference, as the point-and-name game can accomplish for object words. This is necessary, for the tasks facing the child - to learn appropriate contextual use; to use think and know to apply to situations outside of the here and now; and to learn what the relations between words are- go well beyond establishing reference. The words are learned as parts of conversational packages that also involve learning to engage in narratives away from the here-and-now. Regularly occurring uses also provide for the explicit demonstration of how words relate to each other, through the conversational contrast of the verbs, through the discussion of presuppositions, through the asking and answering of wh-questions. What is to be known or thought about include such mundane matters as object location and identity, but also more culturally- and child-relevant matters as exemplified here by discussions of ghost motivation , chicken anatomy, and who in the family generally locks himself in the bathroom. Sources of information are an important topic to be learned along with other meaning features of the mental verbs. As well as direct observation, these include hearsay, introspection, deduction, reading, and religious inspiration. Undoubtedly this list could be expanded by other sources of knowledge, both internal and external.

As far as I know, no other study has approached the problem of children's abstract word meaning acquisition at both of these levels, taking into account both the level of cultural and conversational meanings and functions, as well as the level of the more

minute details of lexical frame, person reference, and so on. The child must learn both; the point is that they are learned together in the process of participating in socially shared language games.

Reconciliation of Observational and Experimental Studies:

Con conversationally Embedded Uses, Denotation, and Sense

I began this dissertation with an examination of experimental and observational studies on mental state terms. While the observational studies found that two- and three-year-olds were able to use the terms appropriately in conversation [Shatz et al (1983), Bloom et al (1989), Furrow et al (1992), Brown et al 1996)], children of this age fail at experimental "theory of mind" tasks requiring them to have a grasp of the contrasting meanings of the terms [Johnson and Maratsos (1977), Miscione et al (1978), (Johnson and Wellman (1980), Abbeduto and Rosenberg (1985), Moore et al (1989), Moore and Davidge (1989)].

I proposed that this situation of competence in conversation and incompetence in experiments could be resolved and understood if children's word meaning development is viewed as the development of three aspects of meaning. To review, following Lyons (1977), Lucariello and Nelson (1985) classified early word meaning theories into three types: reference, denotation, and sense. Rather than choosing one aspect over another, they affirmed that all three are necessary to a fully developed lexical system. To simplify, children's first words are prelexical - they are bound up in their holistic event representations. First children learn to refer to objects within the events. As the event representations are further analyzed into their component parts, such as actor, object, and action, they develop concepts for parts of the event, and their terms denote the concepts.

However, sense meanings - parts of a lexical system with the relations between the meanings of words established - continue to develop through the preschool years and beyond, with further differentiation and integration of the conceptual system and linguistic experience. An expansion of their view was necessary to accommodate more abstract words and concepts such as mental state verbs that don't fit into the actor-object-action categories; I took children's usages of mental verbs in conversational contexts away from the here and now as evidence that children were developing concepts apart from uses embedded in the ongoing event. Adoption of the term "conversationally embedded" as a substitute for "reference" was necessary to avoid the idea that the word was referring to any "mental object", but instead to emphasize that the word had not been differentiated from the utterance. As well, I used Wittgenstein's notion of language games to explore how children's first usages are embedded in conversational events.

Returning to the original problem, we can see why children without a sense system in place would fail at the experimental tasks requiring knowledge of the relations between terms, and yet still be able to use the terms appropriately in naturalistic situations. In conversation, children can use their embedded and, later, denotational skills; however, these are inadequate when knowledge of contrasts is required.

The Nelson and Lucariello theory, while based on the previous work of many child language studies, had never had longitudinal research directed specifically to test its premises. For this it was necessary to follow children's word meaning development and to see if their uses followed the order of use predicted by the theory: first embedded use, then denotation, then sense. Since their theory and the data it was based on dealt primarily with object words, for this study with mental verbs the working definitions of

the meaning aspects had to be expanded. Conversationally embedded uses were defined as those where think or know were used in talking about some aspect of the here-and-now situation. Denotational uses were those that demonstrate that the child had a concept of think or know apart from the here-and-now: they could use the target verbs to discuss the past or future, make generalizations, or to contrast thought with reality. These accomplishments signal the child's ability to disembed meanings and concepts from the ongoing activity, and not merely an ability to talk about other time frames. This is rendered especially clear when the data are examined: children's early (two-year-old) uses were nearly all embedded in the ongoing activity; only later, the three-year-olds, with much assistance on the part of their mothers, began to use think and know to discuss other times. Sense meanings were demonstrated only when related verbs were contrasted, or the presuppositions, such as source of knowledge, were mentioned.

The data from this study supported the Nelson and Lucariello theory, and the reconciliation of the experimental/observational discrepancy based on that theory. An analysis of each child's uses showed that denotation is not attained without embedded use first: of the 46 total cases of child by word, there was only one case of violation of the predicted pattern; all other children demonstrated embedded use alone, embedded use before denotation or sense, or embedded use and denotation or sense at the same visit. Sense meaning demonstration was very rare, despite some exposure to these uses in the speech of their mothers.

While these data are in concordance with and supportive of their theory, they are far from a solid foundation for it. More observational work is needed with a greater variety of words (two mental state verbs, although a start, do not constitute a

representative sample of the lexicon!); with larger group sizes, and with older children as well, so that the progression to sense meanings can be better documented.

Although only the tip of the iceberg in relation to an overarching theory of word meaning development, these data present a stronger argument in the narrower field of the development of mental verb meaning. Children learn to use mental verbs in embedded ways, and then denotationally, before they can express sense meanings. Indeed, the older children in this study, most of whom attained their fourth birthdays by the final visit, for the most part did not display sense meanings at all. The observational/experimental discrepancy now becomes no discrepancy at all, but further support for the Nelson and Lucariello developmental sequence: younger children use mental terms appropriately in conversation, but display no sense meanings in tasks which specifically probe for them.

Can lexical principles account for mental verb acquisition?

Can the principles of early word learning as laid out by Golinkoff and colleagues (1994, 1995) account for the child's acquisition of the verbs think and know? Here I comment briefly on each of the principles. This is not at all a full-size critique of the principles/constraints paradigm, but simply an indication of some places in which the account falls short.

1. Reference. The two-year-olds' uses did not show evidence of referring to mental states or processes; they were instead embedded in conversational routines.

2. Extendibility: Little evidence was found that the two-year-olds' uses were flexible; indeed, without reference, it's difficult to pin down what would count as extension beyond the original "exemplar", unless it were extension beyond the original

conversational context. Each two-year-old's uses occurred in just a few roles in a small number of language games, in a small number of lexical frames.

3. Object labeling and the whole object assumption: If children used the verb-identifying syntactic cues with think and know to place them in the category of action words, they would be incorrect. There is no evidence to suggest that they do this, however; they do not use the verbs to refer to actions. As for labeling larger or smaller units of activity, since the uses are embedded in routines and have not yet been differentiated from those routines, it is not possible to speculate as to what size unit they refer.

4. Categorical scope: This principle fails because of its reliance on the componential view of word meaning. Even if children use semantic components in some cases to define some verbs, there is no evidence that children use them in the cases of think and know. The polysemic adult definitions of the verbs do not differ by single components, nor do the children's.

5. Novel words naming nameless categories: This would require that two-year-old children have available discrete conceptual categories of thinking and knowing to which the correct words would apply. At age two, the evidence from theory of mind research implies that this is not the case.

6. Conventional forms: This is the only principle to which I shall not provide any objection; children do learn to use the standard forms of think and know.

In summary then, the principles account is not applicable to children's early uses of think and know. Even if the principles view were correct for children's acquisition of

more concrete object and action labels, it does not explain how other types of words are acquired nor what their meanings are.

Methodological Issues: Observational Studies

Here I briefly point out some of the differences between this research and two other observational studies on mental verbs. I conclude that what looks like simple coding differences turns out to reflect differences in overall goals and theoretical approaches. I single out Shatz et al.'s (1983) work because it was a pioneering study on the development of mental verbs, and Bartsch and Wellman's (1995) because it is a recent, large-scale report on mental verbs. Both used the study of mental verbs in conversation to try to understand what children know about the mind. This is in contrast to this study, which focuses on the process of meaning acquisition.

Shatz, Wellman, and Silber's (1983) coding category of contrastives - "sentences which mark an understanding of a difference or discrepancy between some mental state and present or observable reality" - pools together what would be coded as both denotational and sense utterances in this study's coding scheme. Recall that denotational utterances in this scheme include those which make a contrast between thought and reality; in order to count as sense, the utterance had to either contrast with a related verb, or mention a presupposition.

Similarly, Bartsch and Wellman's thought-reality contrastives (Table 3.4, pages 52-53) divided into four contrastive types: fiction-reality, ignorance-fact, advance belief, and false belief, can be recoded in this study's coding scheme as examples of all three meaning levels: embedded use, denotation, or sense. Their five ignorance-fact and advance belief examples that involve thinking or not knowing about the current location

of objects would be coded as embedded use in this study's scheme. Most of their examples in this table were denotational usages: their fiction-reality contrastives were predominantly denotation about the past; advance belief is recoded as denotation about the future; and false belief as denotation with contrast between thought and reality. Only 2 of their 21 given examples of thought-reality contrastives would be coded as sense in this study's coding scheme. On the other hand, their 7 examples of "assertions about sources", from Table 3.8, would all be coded as sense, because they all mention the presupposition (source of knowledge) of the verb know. Only two of the seven examples of presupposition mention the senses (direct observation) as a source; three have social sources, one talks about the individual originator of an idea; another one talks about causality by constituency (Abe at age 3;9 asks, "Do you know this is wheat bread made from wheat?"). According to their Table 3.9, there were some scattered examples (6 in all) of mentioning knowledge source before age 3; at age 3 all 4 of their main children had mentioned knowledge source, with a range of individual (from 3 to 27). The other four children in their study provided hardly any knowledge source utterances - 5 in all.

The purpose in pointing out in such detail the alternate ways the same utterances can be coded is to show that in other coding schemes, it is not clear what overall meaning level a child has attained for particular words; the other schemes' categories conflate both basic and more advanced uses. By looking at conversational intent from an adult point of view, these researchers may be overattributing capabilities and intentions to the child which may be due to the child's initial attempts to produce more advanced uses. The extent to which the child is simply taking over conversational functions presented earlier by the mother is not addressed. Neither are the myriad adult contributions to the child's

understanding. Although these sources are mentioned briefly - Dunn's work on social origins is cited - Bartsch and Wellman's methods and conclusions leave little doubt that they believe it is the child's theories that are the causal factors at work in the production of more advanced utterances.

Bartsch and Wellman, with their goal of establishing the nature of the child's theory of mind, take the child's contrastive utterances and meanings at their face values - similar to what these phrases would mean if they were uttered by adults. For them, the source of the meanings of the utterances is the child's developing theory of mind. In their view, the concepts come first, and the utterances are mere reflections of, or windows into, the individual child's underlying conceptual schemes. However, learning to use think and know in these more advanced ways is part of a process of participating in language games with more competent speakers. It is through participation and experience with these games that children come to know their language group's way of parceling out meaning to related terms and to which situations they apply. Through further analysis, a system of inter-related concepts and meanings is built up over time. It is not an all-or-none phenomenon, but an extended process.

Methodological Issues: Experimental Studies

Many of the experimental studies included in the literature review either explicitly or indirectly ask children to contrast related mental verbs. As we have seen, however, children by their fourth birthdays, while able to use mental verbs appropriately in embedded and denotational ways, show very little evidence of being able to use the terms contrastively, or of knowing their presuppositions. This is possible because many of these verbs' language game roles do not require this level of knowledge.

Here I discuss one experiment in detail, Johnson and Maratsos' (1977) study. I concentrate on this one because the verbs they included, think and know, are the same ones as in this dissertation. [Wellman and Johnson (1979) followed a similar procedure for the verbs remember and forget]. To review in brief, in their study three and four year old children were told stories about hidiers hiding objects in one location, and then lying to a seeker, telling the seeker it was in a different location. The following questions containing think and know were then asked:

- 1) Does the seeker think it's under (wrong location)?
- 2) Does the seeker know it's under (correct location)?
- 3) Does the seeker think it's under (wrong location) or know it's under (wrong location)?

Let's take a look at what this task requires of the child, and how this experimental situation compares with what was seen in conversation. First of all, all three questions ask about the mental state of a non-present other. As we have seen, in conversation almost all utterances containing think and know by both mothers and children referred to either the mother or the child. The mental states of other people were rarely discussed. And although talking about the location of objects was one of the topics engaged in with the two verbs, it was not a predominant one. The hide and find context, included to elicit mental state verbs, actually yielded the lowest rates of the verbs of the four contexts, especially for know.

On at least two counts, then - talk about a nonpresent other and talk about location of hidden objects - this is an unusual conversation for young children. The third experimental question - asking the child to choose explicitly between think and know - is

not only an unusual question; the two verbs are not used interchangeably in everyday conversation; they are rarely directly contrasted, and even when they are, it is usually to negate know; but its correct response requires that children have constructed sense meanings of the verbs, how the verbs contrast with each other. And as we have seen, there is little evidence in the conversational data that children by their fourth birthdays have done so. (The four-year-old children in Johnson and Maratsos' study, with a mean age of 4 years, 5 months, performed well on these contrast questions, while the three-year-olds did not.)

It remains to be seen whether older four-year-olds use think and know with sense contrasts and presuppositions in conversation. Evidence from one precocious three-and-a-half-year-old (ERo) who did demonstrate sense meanings suggests that it may be possible to document this accomplishment conversationally at a slightly older age than this sample.

Johnson and Maratsos define the verbs in the following way: "In mature usage, the verb *think* means to hold a belief, whether correct or incorrect. *Know* in contrast refers to a belief which the speaker presumes to be true" (p. 1743). Their study investigated "that thinking can be false; that knowing presumes truth; that thinking is not equivalent to saying" (p 1743). The three-year-olds, in failing, showed "little evidence of differential comprehension of the terms" (p.1747). Their study is limited in what it can conclude because it starts with too narrow a range of definition of the verbs: mature usage in reality includes a variety of interrelated definitions; and also, as with the other experimental studies, because it ignores the socially dependent process of acquisition. There is no explanation in Johnson and Maratsos of how the child gets from confusion at

three years to competence at four years, other than an inborn maturational one: "This skill is remarkable given the abstract and complex implications of the verbs and the presumably short time these terms have been in the children's repertoire. If there is a period of systematic confusion in the developing comprehension of these mental verbs, it is apparently short" (p. 1747). As I have documented in the process chapters, there are a variety of ways mothers steer conversations with mental verbs that can contribute to the child's eventual more complex understanding of the verbs. Rather than simply establishing age differences, it is more elucidating to search for explanations for development.

A number of other studies, rather than present children with stories involving other people, provide children with a hidden-object-location experience, and then ask questions contrasting mental verbs based on this [These studies include Miscione et al (1978) on know and guess; Johnson and Wellman (1980) on remember, know, and guess; Moore and Davidge (1989) on know, think, and sure; and Moore, Bryant, and Furrow (1989) on know, think, and guess.]. While their procedures at least avoided the problem of asking children about absent-others- in- the- past, similar criticisms can be applied to their limited definitions of the verbs, their use of hidden object locations as the only context, and their questions asking for verb contrasts, an unfamiliar linguistic situation for a young child (One of Miscione et al.'s questions, for example, was "Did you know that the shape was in that box or were you guessing that the shape was in that box?"). All of these lead to the underrepresentation of the young child's capabilities, and mystification as to the process of development.

Miscione et al. (1978) offer a Piagetian interpretation of why children younger than four years were not able to differentiate between know and guess in a hidden object location task. The development of children's mental verb meanings is seen as based on specific cognitive capacities: whether or not children are able to attend to the abstract, conceptual aspects of events. Their interpretation of how children come to differentiate cognitive verbs will not go far towards the understanding of a more general lexical system because the relations between most words in the lexicon are not based on the concrete/abstract distinction or other logically based dimensions. Indeed, the nature of the differences in the way know and think are used in everyday conversations is difficult to pin down. Psychologists whose work is based on the logician's definitions of cognitive verbs, rather than the actual uses of the verbs, will not be able to trace the development of the child's meanings of the verbs because their view of the endpoint of development is too restricted.

Methodological Issues: Hide and Find

The original inspiration for including the hide and find context in these home visits to elicit mental state verbs came from Miscione et al.'s (1978) study of know and guess, in which the researcher used magic boxes with false bottoms to manipulate the outcome of a hide and find game played with the children. In this study's version, the mothers and children were to be provided with similar materials as a way of holding the dyad's interest and stimulating mental talk. In practice, however, the box mechanism proved to be too delicate to withstand the manipulation of two-year-old children. More child-compatible cups with lids were substituted, with satisfactory results.

Beyond its utility as a means of eliciting mental verb talk, the hide and find situation presents an opportunity to observe mothers and children in a hidden object-location task most similar to experimental tasks, but with a number of advantages:

1) Because the children were followed over the course of six months, progression in their understanding and participation in the task could be followed developmentally.

2) More importantly, we could see how mothers, and mother-child interaction, contribute to the children's growing understanding of what it means to hide an object, to guess its location, and just as revealing, to allow another person to guess. A preliminary review of these tapes suggests that it is this last aspect of the game that the two-year-olds find especially difficult. The two-year-old children did not always make certain that their mothers were not watching while placing the toy in a cup; refrain from telling their mothers where the object was hidden; place the lids on all three cups so that there were alternate possible hiding places; and allow their mothers to open the cups unaided.

A number of factors seemed to impede the children in carrying out this task successfully.

1. They had to make the connection between not seeing, not knowing, and guessing. This is the "presupposition" factor.

2. Then they had to monitor their mothers' eyes, to make sure they were shut before they hid. This is the "eyes closed - then hide" sequencing factor.

3. They had to remain quiet as to location. As Vygotsky (1978) has emphasized, young children verbalize their thoughts; they do it automatically. Speech accompanies action; they said, "I'm putting it in the red cup" as they performed that activity. Even if they understood that they shouldn't tell their mothers, which didn't seem the case, they

had to work against the impulse to verbalize their action. This is the "speech accompanies action" factor.

4. They had to realize that if not all the lids were replaced on the cups, there would not be a choice of location for the other person. Even if they knew this, they still had to remember to do it. The youngest children seemed focussed on where the object was - performing an action to create a negative location appeared difficult. This is the "focus on the positive" factor.

5. They had to allow unimpeded action by their mothers. This required not handling or opening the cups. It's difficult for a two-year-old to not touch toys, to allow another person to take control of the situation, to not show off knowledge. I call this the "Let me do it!" factor.

Many of the children in the older group showed increasing competence at this game, especially by the fourth visit. From two-and-a-half to four years seemed to be a transitional age for this activity. But as can see from the above analysis, it's not simply awareness of presuppositions of mental verbs that comes into play, but a conglomerate of cognitive, linguistic, and executive issues. The observation of children's experiences with such materials with a more expert other person can shed light on how children become more competent at social-cognitive games such as this. In what ways do children and parents work together to increase the child's awareness and control of the complexities of this task? I view children's progress at such cognitive games as amenable to the method of searching for mother-child conversational processes as was carried out here for the words think and know. How does performance on this more child-controlled

task correlate with more advanced mental verb usage, and other theory of mind tasks?

Answers to these important questions await further research.

Language Games: Publicly Observable Criteria or Embedded Roles?

In his (1997) paper on Wittgenstein's private language argument, Montgomery presents a strong case that children's mental state word meanings must be based on publicly shared rules and criteria, and not on introspection or independently constructed theories of mind. Thus far I concur. Where his statement and mine differ is on the types of criteria involved in the word learning. Montgomery argues, citing Wittgenstein, that "public observables", outward, perceptually available, non-verbal signs, natural expressions of internal states - such as groans and grimaces in the presence of pain - are used as criteria of correctness for the application of a word in learning situations. This is so even though the presence of the outward sign does not necessarily entail the term's correct application. There are cases of mismatch between outward sign and internal state, as when a person pretends to experience an internal state or tries to deceive another person as to their internal state. Despite these mismatches, outward criteria are necessary in order to initially establish equivalent meanings between self and other. But meanings are not the same as the outward criteria; as the child encounters mismatches word meanings must be adjusted to accommodate the differences.

This study's view of the word learning situation for mental state terms differs from this view in that I don't see establishing initial embedded use as learning which mental state term applies to what particular mental state, as identified by outward signs. The learning of words' roles in language games is more complicated than this. Language

game roles do not necessarily involve the explicitly mental meanings of the terms. The meanings of each of these abstract words is multifold; the task for the child is not simply to learn what term refers to what internal state, but how the term is used in here-and-now talk; in there-and-not-now, and general talk; how terms relate to one another. Learning the presuppositions of the verbs is a relatively late development which stands on the work of years of acquiring conversational procedures. Because these everyday conversational uses are consistent with and based (in the adult) on the more central mental meanings, repeated use in everyday conversational contexts contributes to the establishment of the core meanings. Outward criteria are not irrelevant to this process, but they are by no means the sole initial resource applied by the child in establishing multilevel abstract meanings.

This view is preferable to Montgomery's because it is applicable to a wide range of abstract terms, and not simply mental state terms. While not denying their importance in the lexicon, the range of abstract words in the language is far greater than the small mental state verb group. Any general theory of word meaning development must be able to account for the acquisition of this great variety. It would not be possible for children to acquire this great range of words if their focus was on external, observable nonlinguistic behavior. Many socially defined words are not definable outside of the roles in language games they participate in (see, for example, Nelson, 1996, for a discussion of the construction of culturally constituted concepts of time through language, p.288-291).

As well, this study's approach emphasizes the interrelated multidimensionality of meanings of particular terms, both with each other and related terms. Words do not mean

only what philosophers declare that they mean, although these meanings are legitimate; but they play other equally valid roles. Acknowledging the polysemy of words demystifies the process of acquisition, because it then no longer becomes necessary for the child to learn a difficult abstract term in an all-or-none fashion, or to have in place a complex theory of a domain before a term can be used appropriately. Word meaning instead is an incremental process, with various shades and aspects of meaning building upon each other.

Shore (1996) writes of the age-grading rites of the Murngin of Australia. Over the course of childhood and youth, young Murngin males (their ages are not specified) participate in three major rites, each of which is based on the Murngin creation myth. Each ceremony involves the acting out of aspects of the myth narrative, although the narrative is never actually delivered in spoken form to the novices. It is through the experiencing of the acting out of the myth itself over time that the narrative is gradually constructed by the individual, and aspects of the meanings of the symbolism of the rituals and the narrative itself are gradually transformed and re-understood.

Though *logically* the myth precedes the rites, in *experience* the rituals come first. The understanding made possible by such a myth-ritual complex is inevitably shaped by the dependence of the narrative on the ritual for its ongoing life and its regeneration as narrative. The difference, of course, is that ritual transmission is inevitably "embodied" to a much greater degree than any narrative transmission, with a significant effect on the quality of the resulting understanding.

Shore, 1996, p.256

In some significant way, the meanings of words too are embodied in the experience of learning them through conversation in context over a period of years; they are multi-leveled, with our understandings growing and changing as we participate in ever-more-sophisticated forms of life. And though logically the definition precedes usage, in experience the usage comes first.

Acquisitional processes

Levy and Nelson (1994), recognizing that previous proposals concerning the process of word learning based primarily on early acquisition of object names were inadequate for the explanation of the acquisition of the variety of types of words learned by young children, and the gradual accrual of word meaning over the lifespan, argued that instead a more general model of the process was needed. They proposed that meaning is derived from discourse context in a multi-step process via a dialectical exchange between the child and her social/linguistic environment. The child acquires new words based on broad discourse patterns and syntactic context, along with their distributional relations with other words. The child interprets discourse patterns on the basis of event representations. Use of new words may at first be limited to the particular activities in which they were first encountered. Levy and Nelson emphasize that the child's interpretation of the relevant event context may be different from the adult's interpretation. With further exposure to adult uses, the child can form an idea of how the word is to be used with particular topics and syntactic formats.

Levy and Nelson place special emphasis on how the child's own uses - especially in contrastive alternation with other related words - brings the target word into the

foreground, so that additional knowledge about the meaning implied by the word's uses by other speakers can be incorporated into the child's representation. The child also compares her own uses with those of other speakers, leading to a reorganization of the meaning of the word with other closely related words. At this point, although the child can use the word appropriately, experimental testing may reveal that the full acquisition of adult meaning is incomplete. Attainment of adult meaning may require further reorganization over a period of years after the word is first used.

What evidence is there in the data presented here on think and know that supports this view of the process of acquisition? The examples in the section on two-year-olds' embedded uses speak to this model. In the examples labeled repetition, use tied to a particular event, and use tied to a particular topic and lexical frame, are seen the borrowed uses of newly acquired words, tied closely to the broad discourse patterns and syntactic patterns as used by the adult conversational partner. The examples labeled role reversal give a good picture of a child who has formed "a discourse notion regarding the use of the form and subsequently use[s] it [him]self in [a] closely constrained syntactic 'format'.. and in the context of [a] specific topic" (Levy and Nelson, p. 385): he uses "you know what happened" to introduce more information into a storytelling, and "you know" to elicit details about the story from the listener.

The examples of three-year-olds' later uses provide a look at reorganization. Not only are there contrasts of the target verbs with each other and other related verbs, as Levy and Nelson describe, but other interactions are described that can assist in the children's use of the words away from restricted contexts (as in conversations about the past, future, and the general) and in working out semantic details: pointing out

presuppositions, and establishing the role of knowledge and thought in their larger cultural contexts. While we get glimpses of these processes at work here, more research is needed to provide quantitative data on the relation of these aspects of conversational experience to meaning acquisition.

Future research

The most important change that needs to be made in the field of research on the development of children's understanding of mental state terms, and their understanding of mental states in general, is a recognition of the complex interdependencies between the developing linguistic and conceptual systems. The field has been held back in its progress by its division between observational and experimental methodology and views of the problem. Children's behavior in response to language-laden theory of mind tasks may very well be a function of their level of lexical development; what is called a conceptual difference may be due to incomplete development of the lexical system. This is not to imply that one system necessarily precedes the other. As Nelson (1996) has argued, abstract, socially defined concepts must be learned through language and may be, at least at first, indefinable apart from it.

At the same time, observational measurement of linguistic levels of particular children would benefit from experimental probing of children's knowledge. Observation is a time-consuming, hit-or-miss procedure: it is all too possible to miss a child's most advanced uses because the child simply did not have occasion to use a relatively infrequently used variation of a term. Testing of individual children should thus include both a period of observation with a parent, [but see Brown et al. (1996) for an argument that a friend makes a better conversational partner for the elicitation of more complex

mental conversation], with attention to embedded, denotational, and sense levels of use; but also experimental probing for the more advanced levels, to see if the child can correctly contrast related terms and knows their presuppositions. Note too, how many theory of mind tasks ask children to answer questions about mental states which occurred in the past or to speculate about what someone might think in the future. I surmise that children's experiences with engaging in such conversational practices as observed in naturalistic contexts would correlate with their performance on theory of mind tasks which prerequisite ask them to answer questions about the past or future.

I further predict that a child's performance on theory of mind tasks in general will correlate with the lexical development of the interrelations of mental state terms. (Evidence for this has already been advanced by Moore, Pure, & Furrow, 1990, who found positive correlations between four-year-old children's ability to contrast between know and think in a hidden object task, and their performance on representational change, false belief, and appearance-reality tasks.) This is because the development of an understanding of the relations between people's states of mind is acquired only with an understanding of the relations between the terms themselves. Acquisition of the subtle intricacies in how a language community has decided to categorize and name mental phenomena is a socially dependent phenomenon and not solely a maturational one.

The findings of this dissertation challenge the field to acknowledge that there are many other topics of knowledge besides object location and object identity, and other ways of obtaining knowledge besides direct visual observation. The field's emphasis on such limited scenarios not only distorts recognition of the kaleidoscopic complexity of knowledge to be gained and the myriad methods for its discovery, but also limits what

can be discovered about the child's developing understanding of what and how knowledge is obtained.

Appendix A:
Mothers' Results

Appendix A: Mothers' Results

Because of the large number of analyses performed, an alpha level of .01 was taken as the criterion for statistical significance in this dissertation. Findings at the .05 level were considered only suggestive; further statistical tests were not carried out on the basis of MANOVAs or ANOVAs with results at this level. However, in the interest of completeness, findings at both levels are reported here.

Part 1. Some General Findings.

1. Totals of verb and age

A repeated measures analysis of variance was run on the mothers' total rates of production of think and know with verb (think, know) as the within subject variable, and age as the between subject variable. A suggestive result only was found for the verb by age interaction, $F(1,21)=5.95$, $p < .03$. Further analyses were not carried out because the result did not meet the .01 criterion.

2. Gender

A repeated measures analysis of variance was performed with age of child (two, three) and gender of child (male, female) as between subject variables, and verb (think, know) as a within subject variable. None of the main effects (gender, age, or verb) were significant, nor were any of the interactions (age x gender; age x verb; gender x verb; age x gender x verb). The mothers thus did not appear to differentiate in their uses of think and know between their boy and girl children.

3. Context

A repeated measures analysis of variance was carried out with the age of child (two, three) as a between subject variable, and context (play, meal, hide and find, doll house) and verb (think, know) as within subject variables. Suggestive differences were found for the age by context interaction, $F(3,63) = 2.76$, $p < .05$, and the verb by context interaction, $F(3,63) = 2.82$, $p < .05$. However, because these did not meet the .01 level of significance, further tests were not performed.

4. Meaning Levels

Main Effects

A repeated measures analysis of variance was carried out with meaning level (embedded use, denotation, sense) and verb (think, know) as within subject variables, and age of child (two, three) as a between subjects variable. There was a significant effect of meaning level $F(2,42) = 120.39$, $p < .001$. There were no verb or age by variable (here, meaning level) interactions.

A repeated measures analysis of variance was carried out with meaning level alone as a within subjects variable. This analysis confirmed the significant results: $F(2,44) = 111.14$, $p < .001$. Two Roy post hoc tests with Helmert contrasts were then carried out, to see if the mothers' rate of embedded use was higher than each of denotation and sense. As well, a paired sample one-tailed t-test was performed to see if their rate of use of denotation was higher than that of sense meanings. The first two contrasts resulted in significant differences: embedded use was significantly higher than denotation, $t = 11.48$, $p < .00001$; embedded use was significantly higher than sense, $t =$

13.80, $p < .00001$. The denotation versus sense contrast was also significant, $t = 2.57$, $p < .0085$.

Part 2. How mothers differentiate between verbs: different language games

1. Person References :

Main Effects

A repeated measure analysis of variance with person reference (mother, child) and verb (know, think) as within subject variables and age of child (two, three) as a between subjects variable showed a significant interaction between verb and person reference $F(1,21) = 83.7$, $p < .001$.

Person reference by verb

A repeated measure analysis of variance with person reference (mother, child) as a within subject variable was carried out for the verb think. The mothers referred to themselves at a significantly higher rate than they referred to their children, $F(1,22) = 212.5$, $p < .001$. No difference in rate of reference to mother and child was found with the verb know.

Repeated measures analyses of variance were carried out to compare rates of reference to self and child by the mothers between the two verbs. In the first analysis, rate of reference to the self was looked at, with verb (know, think) as a repeated measure. The mothers referred to themselves at a significantly higher rate with the verb think than with the verb know; $F(1,22) = 10.53$, $p < .004$. On the other hand, a second analysis showed that they referred to their child at a significantly higher rate with know than think, $F(1,22) = 24.50$, $p < .001$.

2. Time References

Main Effects

A repeated measures analysis of variance was performed with time reference (present, past, future, generalizations, fantasy) and verb (think, know) as within subject variables and age of child (two, three) as a between subject variable. A significant interaction between verb and time reference was found, $F(4,84) = 4.53$, $p < .01$.

Time Reference by Verb Interaction

Time References within Verbs

For each verb, a repeated measure analysis of variance was carried out with time reference as a repeated measure. For think, overall significant differences were found for time reference, $F(4,88) = 62.25$, $p < .001$. Post hoc Roy tests with Helmert contrasts were carried out to compare the rate of reference to the present with the average rate of reference to the other four time values; and also the rate of fantasy reference when compared to the average of the remaining three values, excluding the present (future, past, and generalizations). Both comparisons were found to be significant, with the rate of the mothers' references to the present with think higher than the average of the other time values ($t=11.61$, $p < .001$); and the rate of reference to fantasy higher than the average of future, past and generalizations ($t=7.68$, $p < .001$). As well, the rate of the mothers' reference to the present was higher than the rate of reference to fantasy alone ($t= -6.2$, $p < .001$).

Similar results were obtained when the parallel time reference analysis was run for know. There was an overall effect found for differences between time references, $F(4,88) = 94.8, p < .001$. The mothers' rate of reference to the present was significantly higher than their references to the average of the other time values, $t=14.98, p < .001$; and the rate of references to fantasy was higher than that of the average of the three remaining variables excluding present (past, future, generalizations), $t=6.94, p < .001$. As with think, with know the mothers' rate of reference to the present was significantly higher than the rate of reference to fantasy alone, $t = 10.85, p < .001$.

Verbs within time references

The mothers' rate of use of different time references differed somewhat by verb. A repeated measure analysis of variance with verb (think, know) as a within subject variable just for uses with generalizations showed that the mothers' rate of use of generalizations was significantly higher for know than for think, $F(1,22) = 12.35, p < .002$. A repeated measure analysis of variance just for uses with fantasy talk with verb as a within subject variable (think, know) approached significance in the opposite direction; here the mothers' rate of use of fantasy talk was higher with think than with know, $F(1,22) = 5.19, p < .033$. No significant difference was found between rate of use of the verbs with references to the present.

3. Lexical frames:

For this variable, verb comparisons were not performed, as the two verbs participate in different sets of lexical frames. Instead, for each verb, age by lexical frame analyses were carried out, as well as within verb lexical frame comparisons.

Age by lexical frame

Think. A repeated measures analysis of variance was performed for mothers' rates of use of think with lexical frame as a within subject variable, and age of child (two, three) as a between subjects variable. The five lexical frames in the analysis were "I think (that) X" (frame 1); "I don't think (that) X" (frame 2); "(Do) you think X?" (frame 3); "I/you don't think so" (frame 4); and wh-questions (frame 5). Only differences between rates of lexical frame use were found, $F(4,84) = 8.43, p < .001$. There were no significant age of child differences or lexical frame by age interaction.

Know. Similar results were found for the repeated measures analysis of variance run with mothers' lexical frame rates with know. Again lexical frame was the within subject variable, and age of child (two, three) was the between subjects variable. There were eight lexical frames identified with know: "I don't know" (frame 1); "I don't know if X" (frame 2); wh-question (frame 3); "I know X" (frame 4); "X, you know" or "You know, X" (frame 5); "Do you know X?" (frame 6); "I know" (frame 7); and "(Do) (you) know what?" (frame 8). As with think, only the lexical frame effect was significant, $F(7,147) = 4.27, p < .001$. The age effect and lexical frame by age interaction were not significant.

Lexical frames within each verb

Rather than proliferate contrasts to discover all the intricacies of the different rates of lexical frame use for the rather large number of frames for each verb, it was considered sufficient only to pinpoint the one or two most common frames for each verb.

Think. A repeated measure analysis of variance with lexical frame as a within subject variable (frames 1 through 5) confirmed that there were overall significant differences between rates of lexical frame use, $F(4,88) = 33.69$, $p < .001$. A Roy post hoc test with a Helmert contrast showed that frame 1, "I think (that) X", was used by the mothers at a significantly higher rate than the average of all the other lexical frames, $t = 11.88$, $p < .00001$. As well, the rate of use of frame 1 was significantly higher than the rate of the next most frequent frame, Frame 5, wh-questions, $t=6.85$, $p < .00001$.

Know. A repeated measures analysis of variance for mothers' uses of know with lexical frame as a within subject measure (frames 1 through 8) confirmed that there were overall differences between the lexical frames $F(7,54) = 4.23$, $p < .001$. Roy post hoc tests with Helmert contrasts showed that the most frequently used lexical frame, wh-questions (frame 3) was used at a significantly higher rate than the average of the other seven lexical frames, $t=3.98$, $p < .001$. It was not significantly higher than the rate of use of the next most frequent lexical frame alone, however (frame 1, "I don't know"). To complicate matters further, a Roy test with a Helmert contrast was not significant comparing Frame 1 with the average of the other frames, excluding frame 3. The best way to summarize this situation is to state that unlike with think, which had one lexical frame which was clearly used more frequently than the others, know is used by the mothers with a wider variety of lexical frames, with no one frame clearly dominant in terms of frequency of use over the others. Examination of the actual rates of use of the various frames solidifies this view. (See Table 7)

4. Mental Verb code

Main Effects

A repeated measures analysis of variance was performed with mental verb code (direct the interaction, direct reflection, refer to internal state) and verb (think, know) as within subject variables, and age of child (two, three) as a between subject variable. The mental verb code by verb interaction was significant, $F(2,42) = 23.30$, $p < .001$. The mental verb code by age interaction approached significance, $F(2,42) = 3.44$, $p < .041$.

Mental Verb Code by Verb Interaction

Mental verb codes within each verb

Think. A repeated measures analysis of variance for mothers' uses with think was performed with mental verb code as a within subjects variable. Significant differences were found, $F(2,44) = 68.31$, $p < .001$. Roy post hoc tests with Helmert contrasts showed that with think, the mothers' rate of directing the interaction was significantly higher than that of referring to an internal state, $t = -4.54$, $p < .0002$; the rate of directing the interaction was significantly higher than that of directing reflection, $t = 10.84$, $p < .00001$; and the rate of referring to an internal state was higher than the rate of directing reflection, $t = -7.59$, $p < .00001$.

Know. A slightly different pattern of rates of mothers' mental verb uses appears with the verb know than with think.

For think,

direct the interaction > refer to internal state > direct reflection

For know, the results were

refer to internal state ~ direct the interaction > direct reflection

A repeated measures analysis of variance with mental verb code as a within subjects variable was significant overall $F(2,44) = 10.50, p < .001$. Roy post hoc tests with Helmert contrasts showed that the rate of mothers directing reflection was significantly lower than the average of the other two values, directing the interaction and referring to internal states, $t=-4.89, p < .0001$. There was no significant difference between the rates of directing the interaction and referring to an internal state.

Contrasts between verbs within mental verb codes

Three repeated measures analyses of variance were carried out with verb as a within subject variable, one for each of the three mental verb code values. For directing the interaction, the rate of mothers' use was higher for think than for know $F(1,22) = 29.44, p < .001$. For directing reflection, however, the mothers' rate was higher for know than for think $F(1,22) = 8.41, p < .01$. There was no significant difference in the rates between verbs for referring to an internal state.

Part 3. How mothers differentiate according to age of child

There are no significant findings at the .01 level to report under this subheading.

Appendix B:
Children's results

Appendix B: Children's results

Part 1. General description of children's uses

Totals

A repeated measure analysis of variance was carried out on the total number of uses by the children of think and know, with verb (think, know) as a within subject measure and age of the child (two, three) as a between subject measure. There was a significant effect of age, $F(1,21) = 13.66$, $p < .001$; the three-year-olds used the words and know significantly more than the two-year-olds. There was also a significant effect of verb, $F(1,21) = 30.24$, $p < .001$; the children used know more often than think. There was no significant age by verb interaction.

2. Gender:

Possible differences in total uses of think and know by boys and girls were investigated by performing a repeated measures analysis of variance with verb (think, know) as a within subject variable, and gender (boy, girl) and age (two, three) as between subject variables. No significant differences for gender, age by gender, or verb by gender were found.

3. Context:

Did the children use think and know differentially in the four different contexts studied, and did this differ by the age of the children? A repeated measure analysis of variance was performed with verb (think, know) and context (play, meal, hide and find, doll house) as within subject variables, and age of child (two, three) as a between subject variable. Only suggestive differences in context were found, $F(3,63) = 3.53$, $p < .02$. No

age by context or verb by context differences were found. Further tests were not carried out on this basis.

4. Person references:

A repeated measure analysis of variance was performed with person reference (child, mother) and verb (think, know) as within subject variables, and age of child (two, three) as a between subject variable. There was a significant difference between the person references for the group as a whole, summing over the two verbs, $F(1,21) = 3.87$, $p < .001$, with the children referring to themselves significantly more than they referred to their mothers. There were no person reference by verb or person reference by age interactions.

5. Meaning Level:

A repeated measure MANOVA with the children's meaning level (embedded use, denotation) and verb (think, know) as within subject variables, and age (two, three) as a between subject variable resulted in a significant main effect for meaning level, $F(1,21)=78.23$, $p < .001$. This demonstrates that the children engaged in embedded use significantly more than denotation. Two interactions also approached significance: age by meaning level, $F(1,21) = 5.15$, $p < .04$; and verb by meaning level, $F(1,21) = 5.61$, $p < .03$; further tests were not carried out on these interactions.

6. Time references:

A repeated measure analysis of variance was carried out with time reference (present, past, generalizations, fantasy) and verb (think, know) as within subject variables, and age of child (two, three) as a between subject variable. (Note that reference to the future was omitted from the time reference variable because it was used

with insufficient frequency to be included in the analysis.) A significant main effect was found for time reference, $F(3,63) = 37.86$, $p < .001$. The time reference by age interaction approached significance, $F(3,63) = 3.61$, $p < .02$. Because a .01 level of significance was used, further testing was not carried out on this interaction.

A repeated measure ANOVA run for time reference alone with the two mental verbs (present, fantasy, past, generalizations) confirmed that there was a significant effect for time reference, $F(3,66) = 33.19$, $p < .001$. Roy post hoc tests with Helmert contrasts showed that the children referred to the present significantly more than an average of the three other time references, $t = 6.32$, $p < .001$. As well, they used fantasy talk significantly more than an average of talking about the past and making generalizations, $t = 6.35$, $p < .001$. The difference between referring to the present and fantasy talk approached significance, $t = 2.7$, $p < .02$. There was no significant difference between talking about the past and making generalizations.

Part 2. How children differentiate between verbs

1. Mental Verb Code:

Because there were insufficient data to include Direct reflection (dir-r) as a value, only the values of Refer to internal state (is+) and Direct the interaction (dir-i) were included in the analyses of mental verb code. A repeated measure MANOVA was run with verb (think, know) and mental verb code (is+, dir-i) as within subject variables and age (two, three) as a between subject variable. A significant interaction between verb and mental verb code was found, $F(1,21) = 14.80$, $p < .001$. There was no significant age by mental verb code interaction.

Within verbs

Repeated measure ANOVAs were run to see if there differences in the frequency of referring to an internal state or directing the interaction for each verb, think and know.

Think

A repeated measure ANOVA for uses of think with mental verb code (dir-i, is+) as a repeated measure suggested that the children directed the interaction more than they referred to internal states, $F(1,22) = 5.81, p < .03$.

Know

In contrast to think, with know the results suggest that the children referred to internal states more than they directed the interaction. A repeated measure ANOVA with mental verb code (dir-i, is+) as a within subject variable approached significance, $F(1,22) = 6.60, p < .02$.

Between verbs

Further analyses were carried out to see if there were differences between the two verbs for each of the two functions, Referring to an internal state and Directing the interaction.

Referring to an internal state (is+)

A repeated measure ANOVA for references to internal state with verb (think, know) as a within subject variable showed that the children referred to internal states significantly more often with think than with know, $F(1,22) = 13.17, p < .001$.

Directing the interaction (dir-i)

A repeated measure ANOVA with verb (think, know) as a within subject variable for children's directing the interaction revealed no significant differences between the verbs in children's use of this function.

Appendix C:
Correlations

Appendix C: Correlations

It was predicted that the mothers' and children' specific categories within variables would be positively correlated in a fairly straightforward manner. Thus for example, mothers' using a particular lexical frame would be associated with the children's using the same lexical frame within the same age group. With some exceptions, the prediction of large numbers of positive correlations between corresponding variable categories for mothers and their children was not substantiated. The total number of correlations performed was 271; the number of significant correlations was 22; this is 8% of the total number run. All correlations reported on below are Spearman rank-order correlations, which were performed using SPSS-X. Summaries of the significant correlations are provided in Tables C-11 (two-year-olds) and C-12 (three-year-olds).

Person References

For think, (Table C-1), the only mother-child categories which were significantly positively correlated were mothers of two-year-old children referring to the child ("You think") and the child referring to the mother (also, "You think"). There were no significant correlations for the three-year-old dyads. For know, (Table C-2), the only mother-child significant positive correlations were between the mothers of two-year-olds referring to the self ("I know") and the children referring to the mother ("You know"). As with think, there were no significant correlations among the three-year-olds for person references.

Mental Verb Codes

Table C-3 shows that there were significant positive correlations between the mothers' using think to refer to an internal state and their three-year-old children's use of think also to refer to internal states. The mothers' total uses of think were also positively correlated with their three-year-old children's use of think to refer to internal states. No significant mother by child correlations were found for mental verb codes for either age group with know (Table C-4), or with the two-year-olds with think (Table C-3).

Meaning Levels

There were insufficient numbers of children's uses to perform correlations with think for either two- or three-year-olds. For know with the two-year-olds, (see Table C-5) both the mothers' sense meanings with the contrast of two verbs (s/c2v) and total sense meanings were significantly positively correlated with two-year-old children's embedded uses. Three of the mothers' meaning categories, embedded use, sense with mention of presupposition, and total uses were significantly positively correlated with the children's total denotational uses. Three of the mothers' sense meaning categories, contrasting two related mental verbs, mentioning presupposition, and the total sense demonstrations were positively correlated with the children's' totals. Among the three-year-olds, Table C-6), the mothers' denotation with the past was positively correlated with the children's total denotational uses; the mothers' total denotational uses were positively correlated with the children's denotational generalizations; and mothers' denotational generalizations were negatively correlated with children's denotations with the past.

Lexical Frames

For know with the two-year-old children (Table C-9), positive correlations were found between mothers' use of the frame "I don't know" and children's' use of wh-

questions; also between both mothers' uses of "I don't know" and the "other" category and children's' uses in the "other" category. There were surprisingly small numbers (only 3) of significant correlations between mothers' and children's' lexical frames with know for three-year-olds as well (Table C-10): positive correlations between mothers' use of "I don't know" and children's "I know X" and "I know"; and a negative correlations between mothers' uses in the "other" category and children's "I don't know (if) X". These correlations between noncorresponding categories are difficult to explain and may very well be the spurious result of the large number of correlations carried out. There were no significant correlations between mothers' and children's' lexical frames with think for either age group (Tables C-7 and C-8). Indeed, only the categories of "I think (that) X" and Other had sufficient children's data to run the analyses.

Table 1

Mothers' Uses of Know and Think with their 13-20 month-old Children: Context, Time, Person

word	N ^a	Context (%) ^b			Time (%) ^c					Person (%) ^d			
		P	M	B	B	P	F	G	Y	M	C	O	MC
know (total)	141	48	38	14	2	86	3	8	0	46	50	3	0
know (IS+)	49	47	35	18	4	76	4	16	0	45	43	8	0
think	133	39	47	14	5	85	8	2	0	68	29	2	0

^aNumber of tokens coded. ^bPercentage of maternal uses in each activity context: Play (P) Meal (M) or Book-reading (B). ^cPercentage of maternal uses in each time context: Past (B) Present (P) Future (F) Timeless Generalization (G) or Fantasy Play (Y). ^dPercentage of maternal uses in which mental verb is attributed to each person: Mother (M) Child (C) Other Person or Object (O) or Both Mother and Child (MC).

Table 2

Mothers' Uses of Know and Think with their 13-20 month-old Children: Mental Verb Codes, Sense Meanings

Word	Mental verb code (%)					Sense meanings (%)	
	IS+ ^a	MOD ^b	DIR ^c	IDK ^d	OP ^e	C ^f	PS ^g
Know	35	19	44	2	na	6	5
Know (IS+)						10	6
Think	9	36	44	na	11	7	1

^aInternal state. ^bModifies proposition. ^cDirects interaction. ^d"I don't know". ^eOpinion. ^fContrasts related mental states. ^gMentions presupposition.

Table 3

Mothers' Uses of Know and Think with their 13-20 month-old Children: Lexical Frames

Word	Lexical Frame	Percentage
Know	You know how X?	8%
	(Do) you know what (X)?	13%
Think	What do you think?	9%
	I think X.	39%
	Do you think X?	10%
	I don't think X.	8%
	I thought X.	8%

Table 4

Total Uses of Think and Know by Mothers over Four Visits

Age of Child	Total	Mean per mother	Mean rate per hour
		Think	
Two Years	602	50.2	15.7
Three Years	428	38.9	11.9
		Know	
Two Years	533	44.4	13.8
Three Years	534	48.5	15.3

Table 5

Uses of Think and Know by Mothers of Girls and Boys over Four Visits

Age of Child	Mothers of Girls		Mothers of Boys	
	Total	Mean Rate per hour	Total	Mean Rate per hour
Think				
Two Years	339	15.3	263	16.3
Three Years	215	12.4	213	11.5
Know				
Two Years	333	15.3	200	11.4
Three Years	260	15.0	274	15.6

Table 6

Mothers' Uses of Think and Know in Rate Per Hour in Four Contexts

Age of Child	Context				Mean
	Play	Meal	Hide and Find	Doll House	
	Think				
Two Years	13.3	11.9	17.5	19.9	15.7
Three Years	13.8	16.0	9.1	9.0	12.0
Mean	13.6	14.0	13.3	14.5	13.9
	Know				
Two Years	15.9	13.1	15.1	11.0	13.8
Three Years	17.4	19.1	15.7	9.2	15.4
Mean	16.7	16.1	15.4	10.1	14.6

Table 7

Mothers' Meaning Levels in Rate per Hour for Think and Know

Age of Child	Meaning Level		
	Embedded Use	Denotation	Sense
		Think	
Two Years	12.1	2.1	1.7
Three Years	7.8	2.8	1.0
		Know	
Two Years	10.3	2.2	1.5
Three Years	9.9	3.2	1.9

Table 8

Person References in Mothers' Uses of Think and Know in Rate Per Hour

Age of Child	Person References				Total
	Child	Mother	C & M ^a	Other	
	Think				
Two Years	5.3	9.8	0.04	0.5	15.7
Three Years	2.8	8.7	0.05	0.3	11.9
Mean	4.2	9.3	0.05	0.4	13.9
	Know				
Two Years	7.6	5.8	0.10	0.3	13.8
Three Years	7.5	6.8	0.29	0.7	15.3
Mean	7.6	6.2	0.19	0.5	14.5

^aChild and mother.

Table 9

Time References in Mothers' Uses of Think and Know in Rate Per Hour

Time Reference	Age of Child		Mean
	Two Years Old	Three Years Old	
	Think		
Present	9.1	7.0	8.1
Past	1.0	1.1	1.1
Future	0.6	0.9	0.7
Generalization	0.5	0.5	0.5
Fantasy	4.6	2.3	3.5
Total	15.7	11.9	13.9
	Know		
Present	9.0	9.8	9.3
Past	1.0	1.3	1.1
Future	0.6	0.5	0.6
Generalization	0.8	1.6	1.1
Fantasy	2.4	2.2	2.3
Total	13.8	15.3	14.5

Table 10

Mothers' Lexical Frames with Think and Know in Rate Per Hour

Lexical Frame	Age of Child		
	Two	Three	Total
		Think	
"I think (that) X"	6.1	4.9	5.5
"I don't think (that) X"	1.3	1.1	1.2
"(Do) you think X?"	2.2	0.8	1.6
"I/You (don't) think so"	0.6	0.6	0.6
"Wh- do you think X?" (wh-question)	2.6	1.1	1.9
Other	2.8	3.4	3.1
Total	15.7	11.9	13.9
		Know	
"I don't know"	1.5	1.9	1.7
"I don't know (if) X"	1.4	1.8	1.6
"(Do) you know wh- (X)?" (wh-question)	3.1	2.5	2.8
"I know X" or "X, I know"	1.0	1.5	1.2
"X, you know" or "You know, X"	0.9	1.0	1.0
"(Do) you know X?" or "X, do you know?"	0.4	0.2	0.3
"I know"	0.7	0.7	0.7
"(Do) (you) know what?"	1.3	1.5	1.4
Other	3.4	4.2	3.8
Total	13.8	15.3	14.5

Table 12

Total Uses of Think and Know by Children over Four Visits

Age	Total		Mean per Child
<hr/>			
Think			
Two Years	41		3.4
Three Years	89		8.1
<hr/>			
Know			
Two Years	105		8.8
Three Years	284		25.8
<hr/>			

Table 13

Uses of Think and Know by Girls and Boys over Four Visits

Age	Girls			Boys		
	N	Total	Mean	N	Total	Mean
			Think			
Two Years	7	24	3.4	5	17	3.4
Three Years	5	48	9.6	6	41	6.8
			Know			
Two Years	7	70	10.0	5	35	7.0
Three Years	5	111	22.2	6	173	28.8

Table 14

Children's Uses of Think and Know in Four Contexts

Age	Context				Total
	Play	Meal	Hide and Find	Doll House	
	Think				
Two Years	10	2	5	24	41
Three Years	32	25	19	13	89
Total	42	27	24	37	130
	Know				
Two Years	38	29	9	41	117
Three Years	101	99	30	71	301
Total	139	128	39	122	418

Table 15

Children's Person References with Think and Know

Age	Person References				
	Child	Mother	C & M ^a	Other	Total
Think					
Two Years	35	8	0	1	44
Three Years	76	12	0	1	89
Total	111	20	0	2	133
Know					
Two Years	67	37	1	12	117
Three Years	158	122	1	21	302
Total	225	159	2	33	419

^aChild and mother.

Table 16

Children's Mental Verb Codes with Think and Know

	Age		
	Two Years	Three Years	Total
	Think		
Refers to internal state	7	22	29
Directs the interaction	26	40	66
Directs reflection	1	5	6
Opinion	0	6	6
Other	7	16	23
Total	41	89	130
	Know		
Refers to internal state	29	52	81
Directs the interaction	7	34	41
Directs reflection	15	28	43
"I don't know"	27	68	95
Other	27	102	129
Total	105	284	389

Table 17

Meaning Levels in Children's Uses of Think

Context	Meaning Level					
	e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	s ^f
Two-Year-Olds						
Play	7	0	1	0	2	0
Meal	1	0	0	1	0	0
Hide and Find	5	0	0	0	0	0
Doll House	25	1	0	0	0	1
Three-Year-Olds						
Play	30	0	0	1	0	1
Meal	16	3	2	2	1	1
Hide and Find	18	0	1	0	0	0
Doll House	13	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 18

Meaning Levels in Children's Uses of Know

Context	Meaning Level					
	e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	s ^f
Two-Year-Olds						
Play	33	1	0	3	1	0
Meal	17	10	0	0	1	1
Hide and Find	9	0	0	0	0	0
Doll House	38	0	1	0	1	1
Three-Year-Olds						
Play	91	5	0	0	4	1
Meal	70	14	5	0	8	2
Hide and Find	28	1	0	0	1	0
Doll House	65	0	1	0	6	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 20

Time References in Children's Uses of Think and Know

Time Reference	Age		Total
	Two Years Old	Three Years Old	
Think			
Present	16	54	70
Past	1	8	9
Future	1	2	3
Generalization	2	1	3
Fantasy	24	24	48
Total	44	89	133
Know			
Present	47	149	196
Past	14	37	51
Future	3	2	5
Generalization	4	21	25
Fantasy	49	93	142
Total	117	302	419

Table 21, page 1 of 4

Individual Two-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
CB	1,2	0	0	0	0	0	0
	3	1	0	0	0	0	0
	4	0	1	0	0	0	0
CF	1	7	0	0	0	0	1
	2	1	0	0	0	0	0
	3	4	0	0	2	0	0
	4	9	0	0	0	0	0
DV	1	1	0	0	0	0	0
	2	8	0	0	0	0	0
	3	0	1	0	0	0	0
	4	2	0	0	1	1	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 21, page 2 of 4

Individual Two-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
EM	1	3	0	0	0	0	0
	2,3	0	0	0	0	0	0
	4	2	0	0	0	0	0
IK	1	0	0	0	0	0	0
	2	1	0	0	0	0	0
	3	1	0	0	0	0	0
	4	2	0	1	0	1	0
JA	1	5	0	0	0	0	0
	2,3	0	0	0	0	0	0
	4	1	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 21, page 3 of 4

Individual Two-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
LB	1	0	0	0	0	0	0
	2	4	0	0	0	0	0
	3	1	1	0	1	0	0
	4	3	0	0	0	0	0
MD	1	0	0	0	0	0	0
	2	4	0	0	0	0	1
	3	3	0	0	0	0	0
	4	4	0	0	0	0	0
RW	1	0	0	0	0	0	0
	2	5	0	0	0	0	0
	3	9	0	0	0	0	0
	4	3	3	0	0	1	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 21, page 4 of 4

Individual Two-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
SM	1	0	0	0	0	0	0
	2	1	0	0	0	0	0
	3	0	0	0	0	0	0
	4	1	0	0	0	0	0
WH	1, 2, 3	0	0	0	0	0	0
	4	1	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 22, page 1 of 4

Individual Three-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
AF	1	3	1	0	0	0	0
	2	4	1	0	0	0	0
	3	5	1	0	0	0	0
	4	4	0	0	0	0	0
BC	1, 2, 3	0	0	0	0	0	0
	4	3	0	0	0	0	0
BE	1	5	0	0	0	1	0
	2	9	0	0	0	1	0
	3	12	0	0	0	0	0
	4	7	0	0	0	2	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 22, page 2 of 4

Individual Three-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
ERi	1	0	0	0	0	0	0
	2	2	0	1	0	0	0
	3	1	1	0	0	1	0
	4	1	0	0	0	0	0
ERo	1	2	4	0	0	1	0
	2	2	0	0	0	0	0
	3	3	0	0	0	1	3
	4	13	0	0	0	1	0
KP	1	3	2	0	0	0	0
	2	14	2	0	0	0	0
	3	2	0	0	0	0	0
	4	12	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 22, page 3 of 4

Individual Three-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
LS	1	0	0	0	0	0	0
	2	1	0	0	0	0	0
	3	1	0	0	0	0	0
	4	15	0	5	0	0	0
NP	1	13	3	0	0	1	0
	2	45	0	0	0	0	0
	3	0	0	0	0	0	0
	4	4	0	0	0	0	0
NR	1	3	0	0	0	0	0
	2	5	0	0	0	0	0
	3	7	0	0	0	0	0
	4	2	0	0	0	2	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 22, page 4 of 4

Individual Three-Year-Old Children's Meaning Levels with Know by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
PD	1	5	0	0	0	0	0
	2	11	0	0	0	0	0
	3	0	0	0	0	0	0
	4	4	0	0	0	0	0
SL	1	3	0	0	0	0	0
	2	6	0	0	0	3	0
	3	8	1	0	0	0	0
	4	2	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 23, page 1 of 3

Individual Two-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
CB	1, 2, 3	0	0	0	0	0	0
	4	0	0	0	1	0	0
CF	1	1	0	0	0	0	0
	2	0	0	0	0	0	0
	3	1	0	0	0	0	0
	4	1	1	0	0	0	0
DV	1, 2, 3	0	0	0	0	0	0
	4	1	0	0	0	0	0
EM	1, 2, 3, 4	0	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 23, page 2 of 3

Individual Two-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
IK	1	0	0	0	0	0	0
	2	2	0	0	0	0	0
	3	6	0	0	0	0	0
	4	2	0	0	0	0	1
JA	1, 2, 3, 4	0	0	0	0	0	0
LB	1	0	0	0	0	0	0
	2	1	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	2	0
LV	1,2	0	0	0	0	0	0
	3	1	0	0	0	0	0
	4	2	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 23, page 3 of 3

Individual Two-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
MD	1	0	0	0	0	0	0
	2	1	0	0	0	0	0
	3,4	0	0	0	0	0	0
RW	1	1	0	0	0	0	0
	2	1	0	0	0	0	0
	3	0	0	0	0	0	0
	4	7	0	0	0	0	0
SM	1, 2, 3, 4	0	0	0	0	0	0
WH	1	1	0	0	0	0	0
	2	1	0	0	0	0	0
	3	2	0	0	0	0	0
	4	6	0	1	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 24, page 1 of 4

Individual Three-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
AF	1	1	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	1	0	0	0
	4	0	0	0	0	0	0
BC	1, 2, 3*	0	0	0	0	0	0
	4	5	0	0	0	0	0
BE	1	0	0	0	0	0	0
	2	3	0	0	0	0	0
	3	2	0	0	0	0	0
	4	3	0	0	0	0	0
ERi	1, 2, 3	0	0	0	0	0	0
	4	3	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

*Visit 3 did not take place.

Table 24, page 2 of 4

Individual Three-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
ERo	1	6	0	1	1	0	0
	2	1	0	0	0	0	0
	3	1	1	0	0	0	2
	4	9	0	1	0	0	0
KP	1	2	0	0	0	0	0
	2	4	0	0	0	0	0
	3	1	0	0	0	0	0
	4	1	0	0	0	0	0
LS	1, 2, 3	0	0	0	0	0	0
	4	9	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 24, page 3 of 4

Individual Three-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/cr ^c	d/f ^d	d/g ^e	
NP	1	1	0	0	0	0	0
	2	9	0	0	0	0	0
	3*						
	4	2	0	0	0	0	0
NR	1	0	0	0	0	0	0
	2	1	1	0	0	1	0
	3	0	0	0	0	0	0
	4	1	0	0	0	0	0
PD	1	4	0	0	0	0	0
	2, 3*, 4	0	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

*Visit 3 did not take place.

Table 24, page 4 of 4

Individual Three-Year-Old Children's Meaning Levels with Think by Visit

Child	Visit	Meaning Level					s ^f
		e ^a	d/b ^b	d/ci ^c	d/f ^d	d/g ^e	
SL	1	1	0	0	0	0	0
	2	2	0	0	2	0	0
	3	2	0	0	0	0	0
	4	3	0	0	0	0	0

^aembedded use. ^bdenotation/past. ^cdenotation/contrast with reality. ^ddenotation/future.
^edenotation/generalization. ^fsense.

Table 25

Individual Two-Year-Old Children's Person References with Think by Visit

Child	Person References											
	Visit 1			Visit 2			Visit 3			Visit 4		
	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c
CB	0	0	0	0	0	0	0	0	0	0	1	0
CF	1	0	0	0	0	0	1	0	0	2	0	0
DV	0	0	0	0	0	0	0	0	0	1	0	0
EM	0	0	0	0	0	0	0	0	0	0	0	0
IK	0	0	0	2	0	0	6	0	0	3	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0
LB	0	0	0	1	0	0	0	0	0	2	0	0
LV	0	0	0	0	0	0	1	0	0	2	0	0
MD	0	0	0	1	0	0	0	0	0	0	0	0
RW	1	0	0	0	1	0	0	0	0	1	6	0
SM	0	0	0	0	0	0	0	0	0	0	0	0
WH	1	0	0	1	0	0	2	0	0	6	0	1

^aChild. ^bMother. ^cOther Person.

Table 26

Individual Three-Year-Old Children's Person References with Think by Visit

Child	Person References											
	Visit 1			Visit 2			Visit 3			Visit 4		
	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c
AF	1	0	0	0	0	0	1	0	0	0	0	0
BC	0	0	0	0	0	0	0	0	0	5	0	0
BE	0	0	0	3	0	0	1	0	1	3	0	0
ERi	0	0	0	0	0	0	0	0	0	0	3	0
ERo	8	0	0	1	0	0	4	0	0	10	0	0
KP	0	2	0	1	3	0	1	0	0	0	1	0
LS	0	0	0	0	0	0	0	0	0	9	0	0
NP	1	0	0	9	0	0	0	0	0	1	1	0
NR	0	0	0	4	0	0	0	0	0	1	0	0
PD	4	0	0	0	0	0	0	0	0	0	0	0
SL	1	0	0	3	1	0	1	1	0	3	0	0

^aChild. ^bMother. ^cOther Person.

Table 27

Individual Two-Year-Old Children's Person References with Know by Visit

Child	Person References											
	Visit 1			Visit 2			Visit 3			Visit 4		
	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c
CB	0	0	0	0	0	0	1	0	0	0	1	0
CF	5	3	0	1	0	0	1	4	1	2	7	0
DV	0	1	0	2	0	6	1	0	0	3	1	0
EM	3	0	0	0	0	0		n.a.		2	0	0
IK	0	0	0	1	0	0	1	0	0	3	1	0
JA	5	0	0	0	0	0	0	0	0	0	0	1
LB	0	0	0	2	2	0	1	0	0	3	0	0
LV	1	0	0	0	0	0	0	0	0	2	0	0
MD	0	0	0	4	1	0	3	0	0	4	0	0
RW	0	0	0	2	3	0	2	6	1	2	2	3
SM	0	0	0	1	0	0	0	0	0	1	0	0
WH	0	0	0	0	0	0	0	0	0	1	0	0

^aChild. ^bMother. ^cOther Person.

Table 28

Individual Three-Year-Old Children's Person References with Know by Visit

Child	Person References											
	Visit 1			Visit 2			Visit 3			Visit 4		
	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c	C ^a	M ^b	O ^c
AF	5	0	0	1	4	0	5	0	1	4	0	0
BC	0	0	0	0	0	0	0	0	0	3	0	0
BE	5	2	0	8	2	0	6	4	1	4	5	0
ERi	0	0	0	3	0	0	2	1	0	0	1	0
ERo	5	2	0	2	0	0	6	1	0	6	8	0
KP	2	3	0	11	5	0	2	0	0	10	2	0
LS	0	0	0	1	0	0	0	2	0	7	13	0
NP	3	1	13	1	43	1	0	0	0	3	1	0
NR	1	1	1	1	3	1	7	0	0	4	1	0
PD	5	0	0	10	1	0	0	0	0	4	0	0
SL	0	2	1	0	9	0	5	3	0	1	0	1

^aChild. ^bMother. ^cOther Person.

Table 29

Two-year-olds' uses of think and know in the four most frequent language games

Language Game	<u>Think</u>	<u>Know</u>
Guiding	9	19
Naming	6	15
Guessing	7	9
Play-acting	11	33
Other	8	30
Total	41	106
% of total uses in four games	80%	72%

Table 30, page 1 of 2

Two-year-old children's roles in four most frequent language games with think

Language Game	Role	Frequency
Guiding	"I think" + choice	6
	Other	3
	Total	9
	% of uses in role	67%
Naming	"I think" + name	4
	Other	2
	Total	6
	% of uses in role	67%
Guessing	"I think" + location	5
	Other	2
	Total	7
	% of uses in role	71%

Table 30, page 2 of 2

Two-year-old children's roles in four most frequent language games with think

Language Game	Role	Frequency
Play-acting		
	"I think s/he wants" + doll's desire	5
	"I think" + pretend situation	4
	Other	2
	Total	11
	% of uses in roles	82%
Total % of uses in five roles in four language games		73%

Table 31, page 1 of 2

Two-year-old children's roles in four most frequent language games with know

Language Game	Role	Frequency
Guiding		
	"I/you (don't) know how (+X) [takes control]	9
	"I/you know (+X)" [makes, accepts, or rejects suggestion]	7
	Other	3
	Total	19
	% of total uses in roles	84%
Naming		
	"I don't know" [name]	6
	What-question [asks name]	4
	Other	5
	Total	15
	% of total uses in roles	67%
Guessing		
	"Know wh- (+X)" [invites guessing]	3
	"I don't know" [location]	3
	Other	2
	Total	8
	% of uses in roles	75%

Table 31, page 2 of 2

Two-year-old children's roles in four most frequent language games with know

Language Game	Role	Frequency
Play-acting		
	Wh-question [introduces pretend activity]	11
	"[doll] (does/doesn't) know how (+ activity)"	8
	"I don't know" [answers wh-question about pretend activity]	9
	Other	5
	Total	33
	% of uses in roles	85%
Total % of uses in nine roles in four language games		80%

Table 32, page 1 of 4

Individual two-year-old children's uses of roles in language games with think over four visits

Child	Visit	Language Games and Roles									
		Guiding		Naming		Guessing		Playacting			Other
		role1 ^a	other	role2 ^b	other	role3 ^c	other	role4 ^d	role5 ^e	other	
CB	1,2,3	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	1
	total	0	0	0	0	0	0	0	0	0	1
CF	1	1	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0
	3	1	0	0	0	0	0	0	0	0	0
	4	0	0	0	1	0	1	0	0	0	0
	total	2	0	0	1	0	1	0	0	0	0
DV	1,2,3	0	0	0	0	0	0	0	0	0	0
	4	1	0	0	0	0	0	0	0	0	0
	total	1	0	0	0	0	0	0	0	0	0

^a"I think" + choice ^b"I think" + name ^c"I think" + location ^d"I think s/he wants" + doll's desire
^e"I think" + pretend situation

Table 32, page 2 of 4

Individual two-year-old children's uses of roles in language games with think over four visits

Child	Visit	Language Games and Roles									
		Guiding		Naming		Guessing		Playacting			Other
		role1 ^a	other	role2 ^b	other	role3 ^c	other	role4 ^d	role5 ^e	other	
IK	1	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	1	1	0	0
	3	0	0	2	0	1	0	0	0	0	3
	4	2	0	0	0	0	0	0	0	0	1
	total	2	0	2	0	1	0	1	1	0	4
LB	1	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	1	0
	3	0	0	0	0	0	0	0	0	0	0
	4	1	1	0	0	0	0	0	0	0	0
	total	1	1	0	0	0	0	0	0	1	0
LV	1,2	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	1	0	0	0	0	0
	4	0	0	0	0	0	0	0	1	0	1
	total	0	0	0	0	1	0	0	1	0	1

^a"I think" + choice ^b"I think" + name ^c"I think" + location ^d"I think s/he wants" + doll's desire
^e"I think" + pretend situation

Table 32. page 3 of 4

Individual two-year-old children's uses of roles in language games with think over four visits

Child	Visit	Language Games and Roles									
		Guiding		Naming		Guessing		Playacting			Other
		role1 ^a	other	role2 ^b	other	role3 ^c	other	role4 ^d	role5 ^e	other	
MD	1	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	1
	3,4	0	0	0	0	0	0	0	0	0	0
	total	0	0	0	0	0	0	0	0	0	1
RW	1	0	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	1
	3	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	1	1	1	0	0	0	0
	total	0	1	0	1	1	1	0	0	0	1

^a"I think" + choice ^b"I think" + name ^c"I think" + location ^d"I think s/he wants" + doll's desire
^e "I think" + pretend situation

Table 32. page 4 of 4

Individual two-year-old children's uses of roles in language games with think over four visits

Child	Visit	Language Games and Roles									
		Guiding		Naming		Guessing		Playacting			Other
		role1 ^a	other	role2 ^b	other	role3 ^c	other	role4 ^d	role5 ^e	other	
WH	1	0	0	0	0	0	0	1	0	0	0
	2	0	0	0	0	0	0	1	0	0	0
	3	0	0	0	0	0	0	0	1	1	0
	4	0	0	1	0	2	0	2	1	0	1
	total	0	0	1	0	2	0	4	2	1	1
Totals for 9 children		6	2	3	1	5	2	5	4	2	8

^a"I think" + choice ^b"I think" + name ^c"I think" + location ^d"I think s/he wants" + doll's desire
^e "I think" + pretend situation

Table 33, page 1 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles													
		Guiding			Naming			Guessing			Play-acting				Other
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^j	5 ^e	6 ^f	0 ^j	7 ^g	8 ^h	9 ⁱ	0 ^j	
CB	1,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	total	0	1	0	0	0	0	0	0	0	0	0	0	1	0
CF	1	2	0	1	0	0	1	0	0	0	0	0	0	2	2
	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	3	0	0	0	0	0	0	2	0	0	3	0	0	1	0
	4	2	0	0	0	0	0	0	0	1	2	0	0	0	4
	total	4	0	1	0	0	1	2	0	2	5	0	0	3	6

^a"I/you (don't)know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know" [name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table 33, page 2 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles													
		Guiding			Naming			Guessing			Play-acting			Other	
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^j	5 ^e	6 ^f	0 ^j	7 ^g	8 ^h	9 ⁱ		0 ^j
DV	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	6	1	0	1
	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	4	0	0	0	0	0	1	0	0	0	0	0	0	1	2
	total	0	0	1	0	0	1	0	0	0	0	6	2	1	3
EM	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0
	2,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0
	total	0	1	0	0	0	1	0	2	0	0	0	1	0	0

^a"I/you (don't) know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know" [name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table 33, page 3 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles													
		Guiding			Naming			Guessing			Play-acting			Other	
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^j	5 ^e	6 ^f	0 ^j	7 ^g	8 ^h	9 ⁱ		0 ^j
IK	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	4	0	1	0	0	1	0	0	0	0	0	0	0	0	2
	total	0	1	0	0	1	0	0	0	0	0	0	0	0	4
JA	1	4	0	0	0	0	1	0	0	0	0	0	0	0	0
	2,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	total	4	0	0	0	0	1	0	0	0	0	1	0	0	0

^a"I/you (don't) know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know" [name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table 33, page 4 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles													
		Guiding			Naming			Guessing			Play-acting			Other	
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^e	5 ^e	6 ^f	0 ^g	7 ^g	8 ^h	9 ⁱ		0 ^j
LB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2	0	0	0	0	1	0	1	0	0	0	0	0	2	
	3	0	0	0	0	0	0	0	0	0	0	0	0	3	
	4	0	0	0	2	0	0	0	0	0	0	0	1	0	
	total	0	0	0	2	1	0	1	0	0	0	0	1	5	
LV	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
	2,3	0	0	0	0	0	0	0	0	0	0	0	0	0	
	4	0	1	0	0	0	0	0	0	0	0	0	0	1	
	total	0	1	0	0	0	0	0	0	0	0	0	0	2	

^a"I/you (don't) know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know" [name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table 33, page 5 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles													
		Guiding			Naming			Guessing			Play-acting				Other
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^j	5 ^e	6 ^f	0 ^j	7 ^g	8 ^h	9 ⁱ	0 ^j	
MD	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	1	0	2	0	0	0	1	0	0	0	0	0	1
	3	0	0	0	2	0	0	0	0	0	0	0	1	0	0
	4	0	1	0	0	0	0	0	0	1	0	0	1	0	1
	total	0	2	0	4	0	0	0	1	1	0	0	2	0	2
RW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	0	0	0	0	1	0	0	0	3	0	0	0	0
	3	0	0	1	0	2	0	0	0	0	3	0	0	1	2
	4	0	1	0	0	0	0	0	0	0	0	1	0	0	5
	total	1	1	1	0	2	1	0	0	0	6	1	0	1	7

^a"I/you (don't)know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know"[name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table 33, page 6 of 6

Individual two-year-old children's uses of roles in language games with know over four visits

Child	Visit	Language Games and Roles												
		Guiding			Naming			Guessing			Play-acting			Other
		1 ^a	2 ^b	0 ^j	3 ^c	4 ^d	0 ^j	5 ^e	6 ^f	0 ^j	7 ^g	8 ^h	9 ⁱ	0 ^j
SM	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	1	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	1
	total	0	0	0	0	0	0	0	0	0	0	0	1	0
WH	1,2,3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	1	0
	total	0	0	0	0	0	0	0	0	0	0	0	1	0
Totals		9	7	3	6	4	5	3	3	3	11	8	9	4

^a"I/you (don't) know how (+X)" [takes control]

^b"I/you know" (+ X) [makes, accepts, or rejects suggestion] ^c"I don't know" [name]

^dwhat question [asks name] ^eknow wh-? [invites guessing] ^f"I don't know" [location]

^gwh- question [introduces pretend activity] ^h[doll] (does/doesn't) know how (+ activity)

ⁱ"I (don't) know" [in answer to wh-question about pretend activity] ^jOther

Table A-1

Mothers' Total Uses of Think and Know by Age of Child: MANOVA Results

Variable Levels	Effect	df	F-value
<u>Mothers' Total Uses of Think and Know: Repeated Measure MANOVA</u>			
verb (think, know) x	age	(1,21)	.04
age (two, three)	verb	(1,21)	1.07
	age x verb	(1,21)	5.95*

* p < .05

Table A-2

Mothers' Uses of Think and Know by Gender of Child: MANOVA Results

Variable Levels	Effect	df	F-value
<u>Mothers' Uses of Think and Know by Gender of Child: Repeated Measure MANOVA</u>			
Age of child (two, three) x Gender of child (boy, girl) x Verb (think, know)	gender	(1,19)	.96
	age	(1,19)	.38
	verb	(1,19)	.48
	age x gender	(1,19)	.24
	age x verb	(1,19)	.02
	gender x verb	(1,19)	.68
	age x gender x verb	(1,19)	1.89

Note: There were no significant F-values found in this analysis.

Table A-3

Mothers' Uses of Think and Know by Context: MANOVA Results

Variable Levels	Effect	df	F-value
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Mothers Uses of Think and Know in Four Contexts: Repeated Measure MANOVA

Age (two, three) x Context (play, hide and find, doll house) x verb (think, know)	age	(1,21)	.05
	verb	(1,21)	.46
	context	(3,63)	1.86
	age x verb	(1,21)	2.23
	age x context	(3,63)	2.76*
	verb x context	(3,63)	2.82*
	age x verb x context	(3,63)	1.81

* p < .05

Table A-4

Mothers' Meaning Levels with Think and Know: MANOVA, ANOVA, and Post Hoc Results

Variable Levels	Effect	df	F-value
<u>Repeated Measure MANOVA: Mothers' Meaning Levels by Verb and Age</u>			
Meaning Level (embedded use, denotation, sense) x verb (think, know) x age of child (two, three)	meaning level	(2,42)	120.39**
	verb	(1,21)	1.14
	age	(1,21)	.06
	meaning level x verb	(2,42)	.30
	meaning level x age	(2,42)	3.14
	verb x age	(1,21)	5.28*
	meaning level x verb x age	(2,42)	1.32
	<u>Repeated Measure ANOVA: Mothers' Meaning Levels</u>		
Meaning Level (embedded use, denotation, sense)	meaning level	(2,44)	111.14**
<u>Roy Post Hoc Tests, Helmert Contrasts: Mothers' Meaning Levels</u>			
<u>Contrast</u>	<u>t-value</u>		
embedded vs. denotation	11.48**		
embedded vs. sense	13.80**		
<u>Paired Sample One-Tailed t-test</u>			
denotation vs. sense	2.57**		

*p < .05 **p < .01

Table A-5, Page 1 of 2

Mothers' Person References with Think and Know: MANOVA and ANOVA Results

Variable Levels	Effect	df	F-value
<u>MANOVA: Mothers' person references by verb by age of child</u>			
Person reference (mother, child) x verb (think, know) x age of child (two, three)	age	(1,21)	.18
	verb	(1,21)	1.78
	age x verb	(1,21)	4.66*
	person reference	(1,21)	13.43**
	age x person reference	(1,21)	1.31
	verb x person reference	(1,21)	33.99**
	age x verb x person reference	(1,21)	.33

* p < .05 ** p < .01

Table A-5, Page 2 of 2

Mothers' Person References with Think and Know: MANOVA and ANOVA Results

Variable Levels	Effect	df	F-value
<u>Person References within verbs</u>			
<u>Repeated measure ANOVA: Mothers' Person References with Think</u>			
Person reference (mother, child)	person reference	(1,22)	212.5**
<u>Repeated measure ANOVA: Mothers' Person References with Know</u>			
Person reference (mother, child)	person reference	(1,22)	1.22
<u>Verbs within Person References</u>			
<u>Repeated measure ANOVA: Mothers' references to self</u>			
Verb (think, know)	verb	(1,22)	10.53**
<u>Repeated measure ANOVA: Mothers' references to child</u>			
Verb (think, know)	verb	(1,22)	24.50**

* p < .05 ** p < .01

Table A-6, Page 1 of 2

Mothers' Time References with Think and Know: MANOVA, ANOVA and Post Hoc Results

Variable Levels	Effect	df	F-value
<u>Mothers' time references by verb by age of child: repeated measure MANOVA</u>			
Time reference (present, past, future, generalization, fantasy) x verb (think, know) x age of child (two, three)	age	(1.21)	.04
	verb	(1.21)	3.26
	age x verb	(1.21)	3.70
	time reference	(4.84)	118.30**
	age x time reference	(4.84)	1.78
	verb x time reference	(4.84)	4.53**
	age x verb x time reference	(4.84)	.96
Mothers' Time References Within Verb			
<u>Mothers' time references with think: repeated measure ANOVA</u>			
Time reference (present, past, future, generalization, fantasy)	time reference	(4.88)	62.25**
<u>Mothers' time references with think: Roy Post Hoc tests, Helmert contrasts</u>			
<u>Contrast</u>		<u>t-value</u>	
present vs. average of (past, future, generalization, fantasy)		11.61**	
fantasy vs. average of (past, future, generalization)		7.68**	
present vs. fantasy		-6.22**	

**p < .01

Table A-6, Page 2 of 2

Mothers' Time References with Think and Know: MANOVA, ANOVA and Post Hoc Results

Variable Levels	Effect	df	F-value
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Mothers' Time References Within Verb, continued

Mothers' time references with Know: repeated measure ANOVA

Time reference (present, past, future, generalization, fantasy)	time reference	(4,88)	94.8**
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Mothers' time references with Know: Roy Post Hoc tests, Helmert contrasts

<u>Contrast</u>	<u>t-value</u>
Present vs. average of (past, future, generalization, fantasy)	14.98**
Fantasy vs. average of (past, future, generalization)	6.94**
Present vs. fantasy	10.85**

Mothers' verbs within time references

Generalizations: Repeated Measure ANOVA

Verb (think, know)	verb	(1,22)	12.35**
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Fantasy Talk: Repeated Measure ANOVA

Verb (think, know)	verb	(1,22)	5.19*
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Reference to the Present: Repeated Measure ANOVA

Verb (think, know)	verb	(1,22)	2.64
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* p < .05 ** p < .01

Table A-7, Page 1 of 2

Mothers' Lexical Frames with Think and Know: MANOVAs, ANOVAs and Post Hoc Tests

Variable Levels	Effect	df	F-value
<u>Mothers' Lexical Frames with Think: Repeated Measure MANOVA</u>			
lexical Frame (frames 1 to 5) x age of child (two, three)	age	(1,21)	1.70
	lexical frame	(4,84)	34.04**
	age x lexical frame	(4,84)	1.34
<u>Mothers' Lexical Frames with Know: Repeated Measure MANOVA</u>			
lexical frame (frames 1 to 8) x age of child (two, three)	age	(1,21)	.00
	lexical frame	(7,147)	4.27**
	age x lexical frame	(7,147)	.77

** p < .01

Table A-7, Page 2 of 2

Mothers' Lexical Frames with Think and Know: MANOVAs, ANOVAs and Post Hoc Tests

Variable Levels	Effect	df	F-value
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Mothers' Lexical Frames with Think: Repeated Measure ANOVA

lexical Frame (frames 1 to 5)	lexical frame	(4,88)	33.69**
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Mothers' Lexical Frames with Think: Roy Post Hoc Tests with Helmert Contrasts

<u>Contrast</u>	<u>t-value</u>
frame 1 vs. average of (frames 2 to 5)	11.88**
frame 1 vs. frame 5	6.85**

Variable Levels	Effect	df	F-value
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Mothers' Lexical Frames with Know: Repeated Measure ANOVA

lexical Frame (frames 1 to 8)	lexical frame	(7,54)	4.23**
-------------------------------	---------------	--------	--------

Mothers' Lexical Frames with Know: Roy Post Hoc Tests with Helmert Contrasts

<u>Contrast</u>	<u>t-value</u>
frame 3 vs. average of (other 7 lexical frames)	3.98**
frame 3 vs. frame 1	-1.50
frame 1 vs. average of (other 6 frames, excluding frame 3)	1.66

** p < .01

Table A-8, Page 1 of 2

Mothers' Mental Verb Codes with Think and Know: MANOVAs, ANOVAs, and Post Hoc Tests

Variable Levels	Effect	df	F-value
<u>Mothers Mental Verb Codes by Verb and by Age of Child: Repeated Measure MANOVA</u>			
Mental Verb Code (direct the interaction, direct reflection, refer to internal state) x verb (think, know) x age of child (two, three)	age	(1,21)	.08
	verb	(1,21)	.20
	mental verb code	(2,42)	51.92**
	age x verb	(1,21)	1.72
	age x mental verb code	(2,42)	3.44*
	verb x mental verb code	(2,42)	23.30**
	age x verb x mental verb code	(2,42)	.29

Mothers' Mental Verb Codes within Each Verb

Mothers' Mental Verb Codes with Think: Repeated Measure ANOVA

Mental Verb Code (direct the interaction, direct reflection, refer to internal state)	Mental verb code	(2,44)	68.31**
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Mothers' Mental Verb Codes with Know: Repeated Measure ANOVA

Mental Verb Code (direct the interaction, direct reflection, refer to internal state)	Mental verb code	(2,44)	10.50**
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* p < .05

** p < .01

Table A-8, Page 2 of 2

Mothers' Mental Verb Codes with Think and Know: MANOVAs, ANOVAs, and Post Hoc TestsMothers' Mental Verb Codes with Think: Roy Post Hoc Tests with Helmert Contrasts

<u>Contrast</u>	<u>t-value</u>
Direct the interaction vs. refer to internal state	-4.54**
Direct the interaction vs. direct reflection	10.84**
Refer to internal state vs. direct reflection	-7.59**

Mothers' Mental Verb Codes with Know: Roy Post Hoc Tests with Helmert Contrasts

<u>Contrast</u>	<u>t-value</u>
Direct reflection vs. average of (direct the interaction and refer to internal state)	-4.89**
direct the interaction vs. refer to internal state	-1.84

Variable Levels	Effect	df	F-value
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Mothers' Verbs within each Mental Verb Code

Mothers' verbs within directing the interaction: repeated measure ANOVA

Verb (think, know)	verb	(1,22)	29.44**
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Mothers' verbs within directing reflection: repeated measure ANOVA

Verb (think, know)	verb	(1,22)	8.41**
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Mothers' verbs within referring to internal states: repeated measure ANOVA

Verb (think, know)	verb	(1,22)	2.45
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**p < .01

Table B-1

Children' Total Uses of Think and Know by Age: MANOVA

Variable Levels	Effect	df	F-value
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Children's Total Uses of Think and Know: Repeated Measure MANOVA

verb (think, know) x	age	(1,21)	13.66**
age (two, three)	verb	(1,21)	30.24**
	age x verb	(1,21)	1.51

**p < .01

Table B-2

Children's Uses of Think and Know by Gender: MANOVA results

Variable Levels	Effect	df	F-value
<u>Children's Uses of Think and Know by Gender: Repeated Measure MANOVA</u>			
Age (two, three) x Gender(boy, girl) x Verb (think, know)	gender	(1,19)	.24
	age	(1,19)	14.43**
	verb	(1,19)	24.68**
	age x gender	(1,19)	.62
	age x verb	(1,19)	1.61
	gender x verb	(1,19)	.43
	age x gender x verb	(1,19)	.63

** p < .01

Table B-3

Children's Uses of Think and Know by Context: MANOVA Results

Variable Levels	Effect	df	F-value
<u>Children's Uses of Think and Know in Four Contexts: Repeated Measure MANOVA</u>			
Age (two, three) x Context (play, hide and find, doll house) x verb (think, know)	age	(1,21)	13.21**
	verb	(1,21)	31.58**
	context	(3,63)	3.53*
	age x verb	(1,21)	2.76
	age x context	(3,63)	1.97
	verb x context	(3,63)	1.87
	age x verb x context	(3,63)	.38

* p < .05

Table B-4

Children's Person References with Think and Know: MANOVA results

Variable Levels	Effect	df	F-value
<u>MANOVA: Children's person references by verb by age</u>			
Person reference (mother, child) x verb (think, know) x age (two, three)	age	(1,21)	14.86**
	verb	(1,21)	45.24**
	age x verb	(1,21)	4.87*
	person reference	(1,21)	23.87**
	age x person reference	(1,21)	.74
	verb x person reference	(1,21)	1.26
	age x verb x person reference	(1,21)	1.37

* $p < .05$ ** $p < .01$

Table B-5, Page 1 of 2

Children's Mental Verb Codes with Think and Know: MANOVAs and ANOVAs

Variable Levels	Effect	df	F-value
<u>Children's Mental Verb Codes by Verb and by Age: Repeated Measure MANOVA</u>			
Mental Verb Code (direct the interaction, refer to internal state) x verb (think, know) x age of child(two, three)	age	(1,21)	7.48*
	verb	(1,21)	1.25
	mental verb code	(1,21)	.07
	age x verb	(1,21)	.35
	age x mental verb code	(1,21)	.10
	verb x mental verb code	(1,21)	14.80**
	age x verb x mental verb code	(1,21)	.21

Children's Mental Verb Codes within Each Verb

Children's Mental Verb Codes with Think: Repeated Measure ANOVA

Mental Verb Code (direct the interaction, refer to internal state)	Mental verb code	(1,22)	5.81*
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Children's Mental Verb Codes with Know: Repeated Measure ANOVA

Mental Verb Code (direct the interaction, refer to internal state)	Mental verb code	(1,22)	6.60*
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* p < .05

** p < .01

Table B-5, Page 2 of 2

Children's Mental Verb Codes with Think and Know: MANOVAs and ANOVAs

Variable Levels	Effect	df	F-value
Children's Verbs within each Mental Verb Code			
<u>Children's verbs within directing the interaction: repeated measure ANOVA</u>			
Verb (think, know)	verb	(1,22)	13.17**
<u>Children's verbs within referring to internal states: repeated measure ANOVA</u>			
Verb (think, know)	verb	(1,22)	2.45

**p < .01

Table B-6

Children's Meaning Levels with Think and Know: MANOVA Results

Variable Levels	Effect	df	F-value
<u>Repeated Measure MANOVA: Children's Meaning Levels by Verb and Age</u>			
Meaning Level (embedded use, denotation) x verb (think, know) x age (two, three)	meaning level	(1,21)	78.23**
	verb	(1,21)	32.88**
	age	(1,21)	13.62**
	meaning level x verb	(1,21)	5.61*
	meaning level x age	(1,21)	5.15*
	verb x age	(1,21)	3.70
	meaning level x verb x age	(1,21)	.02

*p < .05 **p < .01

Table B-7, Page 1 of 2

Children's Time References with Think and Know: MANOVA, ANOVA and Post Hoc Results

Variable Levels	Effect	df	F-value
<u>Children's time references by verb by age: repeated measure MANOVA</u>			
Time reference (present, past, generalization, fantasy) x verb (think, know) x age (two, three)	age	(1,21)	15.39**
	verb	(1,21)	37.45**
	age x verb	(1,21)	4.55*
	time reference	(3,63)	37.86**
	age x time reference	(3,63)	3.61*
	verb x time reference	(3,63)	1.21
	age x verb x time reference	(3,63)	.36

* $p < .05$ ** $p < .01$

Table B-7, Page 2 of 2

Children's Time References with Think and Know: MANOVA, ANOVA and Post Hoc Results

Variable Levels	Effect	df	F-value
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Children's time references: repeated measure ANOVA

Time reference (present, past, generalization, fantasy)	time reference	(3,63)	37.86**
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Children's time references: Roy Post Hoc Tests with Helmert Contrasts

<u>Contrast</u>	<u>t-value</u>
present vs. (fantasy + past + generalization)	6.32**
fantasy vs. (past + generalization)	6.35**
present vs. fantasy	2.67*
past vs. generalization	1.64

* p < .05 **p < .01

Table C-1

Spearman Rank-Order Correlations between Children's and Mothers' Person References
with Think

Mothers' Person References	Children's Person References	
	Child	Mother
	Two-Year-Olds	
Child	-.04	.60*
Mother	.02	.52
	Three-Year-Olds	
Child	.37	-.21
Mother	.37	-.19

* $p < .05$

Table C-2

Spearman Rank-Order Correlations between Children's and Mothers' Person References
with Know

Mothers' Person References	Children's Person References	
	Child	Mother
	Two-Year-Olds	
Child	.07	.36
Mother	.17	.59*
	Three-Year-Olds	
Child	.13	.04
Mother	.26	-.01

* $p < .05$

Table C-3

Spearman Rank-Order Correlations between Children's and Mothers' Mental Verb Codes with Think

Mothers' Mental Verb Codes	Children's Mental Verb Codes			
	IS+ ^a	Dir-R ^b	Dir-I ^c	Total
	Two-Year-Olds			
IS+ ^a	i.d.	i.d.	.11	.23
Dir-R ^b	i.d.	i.d.	.09	.16
Dir-I ^c	i.d.	i.d.	.10	.22
Total	i.d.	i.d.	-.06	.05
	Three-Year-Olds			
IS+ ^a	.66*	.14	-.05	.04
Dir-R ^b	.34	.00	.04	.15
Dir-I ^c	.57	.14	.31	.39
Total	.67*	.21	.24	.37

^a Refers to internal state. ^b Directs reflection. ^c Directs the interaction.

* $p < .05$

Table C-4

Spearman Rank-Order Correlations between Children's and Mothers' Mental Verb Codes
with Know

Mothers' Mental Verb Codes	Children's Mental Verb Codes			
	IS+ ^a	Dir-R ^b	Dir-I ^c	Total
	Two-Year-Olds			
IS+ ^a	.47	.42	-.07	.34
Dir-R ^b	.32	.37	.06	.35
Dir-I ^c	-.05	.30	-.28	.11
Total	.43	.47	-.05	.28
	Three-Year-Olds			
IS+ ^a	.14	-.12	-.25	-.51
Dir-R ^b	.46	.28	-.11	.15
Dir-I ^c	-.25	.03	-.28	-.16
Total	.23	.19	-.15	-.01

^a Refers to internal state. ^b Directs reflection. ^c Directs the interaction.

* $p < .05$

Table C-5

Spearman Rank-Order Correlations between Two-Year-Old Children's and Mothers' Meaning Levels with Know

Mothers' Meaning Level	Children's Meaning Level		
	emb ^a	den/tot ^f	total
emb ^a	.22	.63*	.31
den/b ^b	-.04	.00	-.04
den/f ^c	-.16	.20	-.09
den/g ^d	.34	.18	.31
den/tot ^f	.17	.24	.18
s/presup ^g	.53	.68*	.58*
s/c2v ^h	.81**	.48	.79**
s/total ⁱ	.70*	.55	.70*
total	.20	.58*	.28

^aembedded use. ^bdenotation/past. ^cdenotation/future. ^ddenotation/generalization.

^edenotation/contrast with reality. ^fdenotation/total. ^gsense/presupposition.

^hsense/contrasts two mental verbs. ⁱsense/total

* $p < .05$

** $p < .01$

Table C-6

Spearman Rank-Order Correlations between Three-Year-Old Children's and Mothers' Meaning Levels with Know

Mothers' Meaning Level	Children's Meaning Level				
	emb ^a	den/b ^b	den/g ^d	den/tot ^f	total
emb ^a	-.14	-.14	.29	.01	-.13
den/b ^b	.17	.24	.42	.70*	.35
den/f ^c	.09	-.58	.46	-.08	-.08
den/g ^d	-.29	-.76**	.44	.10	-.22
den/c ^e	-.06	.60	.24	.45	.09
den/tot ^f	-.11	-.41	.69*	.30	-.02
s ^g	-.29	.23	-.25	.11	-.12
total	-.11	-.11	.37	.30	-.01

^aembedded use. ^bdenotation/past. ^cdenotation/future. ^ddenotation/generalization.
^edenotation/contrast with reality. ^fdenotation/total. ^gsense.

* $p < .05$ ** $p < .01$

Table C-7

Spearman Rank-Order Correlations between Two-Year-Old Children's and Mothers' Lexical Frames with Think

Mothers' Lexical Frames	Children's Lexical Frames	
	O ^f	1 ^a
O ^f	-.41	.02
1 ^a	-.27	.23
2 ^b	.23	.55
3 ^c	-.20	.35
4 ^d	.18	.32
5 ^e	-.05	.27

^a"I think (that) X". ^b"I don't think (that)X". ^c"(Do) you think X?".

^d"I/You (don't) think so". ^e"How/What/Where/Which/Who/Why do you think (Y)?".

^fOther.

* $p < .05$

** $p < .01$

Table C-8

Spearman Rank-Order Correlations between Three-Year-Old Children's and Mothers'Lexical Frames with Think

Mothers' Lexical Frames	Children's Lexical Frames	
	O ^f	1 ^a
O ^f	.36	.41
1 ^a	.40	.46
2 ^b	.13	.30
3 ^c	.50	.46
4 ^d	.13	.24
5 ^e	.44	.05

^a"I think (that) X". ^b"I don't think (that)X". ^c"(Do) you think X?". ^d"I/You (don't) think so".
^e"How/What/Where/Which/Who/Why do you think (Y)?" ^fOther.

* $p < .05$

** $p < .01$

Table C-9

Spearman Rank-Order Correlations between Two-Year-Old Children's and Mothers'Lexical Frames with Know

Mothers' Lexical Frames	Children's Lexical Frames				
	O ⁱ	1 ^a	3 ^c	4 ^d	7 ^g
O ⁱ	.63*	-.24	.37	.08	.35
1 ^a	.65*	-.17	.71**	.02	.08
2 ^b	.07	-.02	.33	-.21	.15
3 ^c	.49	.02	.51	-.11	.13
4 ^d	-.06	-.04	-.30	-.34	-.19
5 ^e	.21	.05	.52	-.28	.11
6 ^f	.51	.15	.43	-.04	.49
7 ^g	-.26	-.23	.01	-.27	-.06
8 ^h	-.14	.25	.02	-.64*	-.38

^a"I don't know". ^b"I don't know (if) X". ^c"(Do) you know how/what/when/where/which/who/ why (X)?" ^d"I know X" or "X, I know". ^e"X, you know" or "You know, X".
^f"(Do) you know X?" or "X, do you know?". ^g"I know". ⁱOther.

* $p < .05$

** $p < .01$

Table C-10

Spearman Rank-Order Correlations between Three-Year-Old Children's and Mothers'Lexical Frames with Know

		Children's Lexical Frames						
		O ⁱ	1 ^a	2 ^b	3 ^c	4 ^d	7 ^g	8 ^h
Mothers' Lexical Frames								
O ⁱ		-.28	.09	-.67*	-.15	-.10	-.18	-.43
1 ^a		.10	.27	.37	.37	.66*	.61*	.26
2 ^b		.14	.25	.35	-.12	-.35	.30	.19
3 ^c		.57	.12	-.15	.30	.08	-.50	.19
4 ^d		.24	.14	-.00	-.02	-.31	-.13	.06
5 ^e		.16	.19	-.60	.04	-.16	-.13	-.01
6 ^f		.12	.56	-.04	-.48	-.48	-.09	.02
7 ^g		.10	.19	-.28	.23	.11	-.10	-.07
8 ^h		.47	.11	-.27	.29	.11	-.27	.27

^a"I don't know". ^b"I don't know (if) X". ^c"(Do) you know how/what/when/where/which/who/ why (X)?" ^d"I know X" or "X, I know". ^e"X, you know" or "You know, X".
^f"(Do) you know X?" or "X, do you know?". ^g"I know". ⁱOther.

* $p < .05$

Table C-11

Summary of Significant Correlations Between Mothers' and Two-Year-Old Children's Measures

Word	Variable	Mother's Category	Child's Category	Direction
think	person reference	child	mother	+
know	person reference	mother	mother	+
know	meaning level	embedded use	denotation/total	+
know	meaning level	sense/contrast two verbs	embedded use	+
know	meaning level	sense/contrast two verbs	total	+
know	meaning level	sense/total	embedded use	+
know	meaning level	sense/total	total	+
know	meaning level	total	denotation/total	+
know	lexical frame	other	other	+
know	lexical frame	"I don't know"	other	+
know	lexical frame	"I don't know"	wh-question	+
know	lexical frame	"I know"	"I know X"	-

Table C-12

Summary of Significant Correlations Between Mothers' and Three-Year-Old Children's Measures

Word	Variable	Mother's Category	Child's Category	Direction
think	mental verb code	internal state	internal state	+
think	mental verb code	total	internal state	+
know	meaning level	denotation/past	denotation/total	+
know	meaning level	denotation/generalization	denotation/past	-
know	meaning level	denotation/total	denot./generalization	+
know	lexical frame	other	"I don't know (if) X"	-
know	lexical frame	"I don't know"	"I know X"	+
know	lexical frame	"I don't know"	"I know"	+

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