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Acquisition of the Mental State Verb Know by 2- to 5-Year-Old Children

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The production of the cognitive internal state word know by four 2- to 5-year-old children and their parents was examined. The levels of meaning of cognitive words can be categorized hierarchically along the dimensions of conceptual difficulty and abstractness (see Booth & Hall, 1995). The present study found that children and their parents expressed low levels of meaning less frequently, whereas they expressed high levels of meaning more frequently as a function of age. The children's use of know was also correlated positively with (1) their number of different words produced suggesting that cognitive words are related to more general semantic processes, and (2) with parental use of those same cognitive words suggesting that parental linguistic input may be an important mechanism in cognitive word acquisition. Finally, young children tended to use know more to refer to themselves than to refer to others, whereas their parents tended to use know equally to refer to self and others. The importance of cognitive words in a theory of language acquisition is discussed.

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When children learn new information it tends to remain "welded" to the form and the context in which it was acquired. Children initially learn words in highly specific contexts and with age learn the multifacetedness of word meaning (Bowerman, 1978; Carey, 1982). Very young children have incomplete word meanings in that a child's lexical entry may lack a constituent of or have improper elements in a definition, and this is reflected when children overextend, underextend, overlap, coincide, and mismatch with adult word meaning (see Clark, 1983). It is well documented that children do not automatically acquire adult word meanings, but gradually refine their word meanings.

Cognitive Internal State Words.

Much research on language development has investigated the first words that children produce and comprehend. More recently, researchers have been concerned with older children's acquisition of the subtleties between different meanings of the same word. At least one group of words, cognitive internal state words (cognitive words), contains these subtleties (Hall, Scholnick, & Hughes, 1987). Many cognitive words are polysemous words such as see, want, and know. Hall and Nagy (1986) proposed guidelines for identifying whether a word is a cognitive internal state word. First, the word must focus on an internal state component. That is, cognitive words refer to the act of perception rather than the object of perception. Second, internal state words refer to psychological, and not physical, processes. Third, cognitive words label transitory states rather than long-term attributes. If the production of a cognitive word meets these criteria, then it is considered to be a semantic use of that word.

Cognitive words are important to study for several reasons. First, a child's cognitive word vocabulary may determine their understanding of internal states that these word label. A child may need a conscious name for a particular mental process before they fully understand it. Second, the acquisition of internal state vocabulary may foster self-awareness and metacognitive monitoring. Since cognitive words make fine-grained distinctions between various mental states, children may compare and contrast the different meanings of these internal state words. This comparing and contrasting may lead to greater awareness and the ability of children to manipulate their thought processes. Third, an understanding of cognitive words may better prepare the child for school, because succeeding in school requires the mastery of a metacognitive language. Most tasks in school require cognitive monitoring of one's own thoughts or the thoughts of others. For example, a child must interpret the intentions of an actor in a story in order to understand the motives for the actor's actions, and when a child must

study for a test on a story, she must determine the degree of her knowledge about it. Cognitive words are important in many aspects of conceptual development because they “convey shades of meaning which adds succinctness and precision to the lexicon” and supply us with “a greater capacity for description and definition” (Corson, 1985, p. 61).

One particularly important cognitive verb is know because it is the most frequent cognitive word produced by children and it has at least six different levels of meaning (Hall et al., 1987; Shatz, Wellman, & Silber, 1983). For example, “I know where the book **is**” represents a different meaning of know than “**I** know how to be spontaneous.*” The first example refers to basic, factual knowledge, whereas the second refers to an understanding of one’s behavior and how to create that behavior. It is **important** for children to learn these distinctions in order to be able to interpret their own mental processes and infer the internal states of others.

A Hierarchical Model of Cognitive Words

Hall et al. (1987) proposed a hierarchy with six ascending levels of meaning based on production frequencies of a variety of different cognitive words by parents and their children. These levels increase in abstractness and conceptual **difficulty**. The lowest level, perception, involves perceptually registering an experience: “I **know** that the lamp is on the table.” Recognition, the next level, involves accessing some mental content in the physical presence of a to-be-remembered stimulus: “I know that face from somewhere.” The third level, **recall**, refers to retrieving specific facts in the physical absence of that information: “I know the phone number of my friend.” Understanding, the next level, refers to reasoning about or relating information to conceptual structures or frameworks: “The professor knows how to do calculus.” The fifth level is metacognition and this level focuses on discussing the awareness of mental acts: “I know I know how to do **calculus**.” The highest level in the hierarchy is evaluation, which involves making presuppositions about the truth of statements: “I **know my team will win the game**.”

The validity of this hierarchy has been supported recently by several comprehension studies. Booth and Hall (1994a) used a 24-question **multiple-choice** comprehension measure to assess knowledge of a variety of different cognitive words in **fifth-, seventh-, and tenth-grade** as well as college students. Booth and Hall (1995) also presented **3-, 6-, 9-, and 12-year-old** children with 18 video-taped skits of puppets interacting with each other and with three audio-taped stories accompanied by simple figure drawings. Each skit or story was followed by a series of comprehension questions which assessed the children’s knowledge of what the character in the story knows

or does not know. These studies and others have revealed that children as well as adults seem to have more complete knowledge of the lower levels of meaning. These studies also revealed a rapid period of development of the lower levels of meaning (perception through understanding) until about the fifth grade, and from then on acquisition of the higher levels of meaning out paced the acquisition of lower levels of meaning. In general, knowledge of cognitive words becomes more differentiated with development.

This hierarchy has also been supported by studies that have used a very different methodology (Schwanenflugel, Fabricius, & Alexander, 1994; Schwanenflugel, Fabricius, & Noyes, 1996; Schwanenflugel, Fabricius, Noyes, Bigler, & Alexander, 1994). Schwanenflugel and colleagues had children and adults make similarity judgments of cognitive words. Using multidimensional scaling, they found that cognitive words vary along a dimension they called “information processing” from input functions (e.g., *notice* and *see*), to processing and memory functions (e.g., *remember* and *figure out*), and to output functions (e.g., *decide* and *explain*). The input functions are similar to our perception level, the processing and memory functions are similar to our recognition, recall, and understanding levels, and the output functions are similar to our metacognition and evaluation levels. Many different avenues of research, regardless of the methodology used or the variety of cognitive words tested, now support a cognitive word hierarchy. However, the mechanisms underlying children’s acquisition of these cognitive words are still unclear.

Mechanisms of Cognitive Word Acquisition

Very few studies have been done that compare child and adult use of cognitive words. Beeghly, Bretherton, and Mervis (1986) found that the total amount of ($r = .39$ to $r = .62$) and the number of different ($r = .46$ to $r = .61$) internal state utterances by the mother **were** positively correlated with the children’s (**13- to 28-month-olds**) spoken frequency of different internal state words, of internal state words referring to self and other, and of decontextualized internal state words. Similarly, Hall et al. (1987) found a significant correlation between child (**4;6 to 5 years**) and parental use in number of different levels of meaning ($r = .62$) and the diversity of cognitive words used ($r = .52$). However, another study has not supported a relationship between parent and child use of cognitive words. Lamb (1991) found that cognitive word acquisition in children was not related to parental verbal frequency of these words. However, this investigation only examined children from 12 to 24 months old. Lamb may have found that parents devoted less than 2% of their lexicon to cognitive words precisely because the children were so young. Indeed, the children did not express their first

cognitive words until about **18** months, and this was preceded by a rapid increase in the number of different words that the children produced.

Other studies which have not directly examined cognitive word acquisition also suggest that parental input seems to influence lexical development in children. The content of parental speech is **often** closely related to the concepts that children acquire first. For example, Ninio (1992) found that the majority of children's utterances were similar to what the mother had said in comparable situations. Of 17,471 utterances from twenty-four **18**-month-old children, 97% of those utterances were also used by mothers with the same intent. From this, Ninio proposed that children's single-word utterances are likely to be learned directly from mothers. Harris, Barrett, Jones, and Brooks (1988) also showed that there was a close relationship between children's initial use of a word with the most frequent usage by the parents (see also Barrett, Harris, & Chasin, 1991; Hart, 1990; Moerk, 1980; Snow, 1991). They recorded the first IO words spoken by four different children. For 33 of the 40 words, the children's initial use was closely related to the most frequently occurring parental use. Harris et al. concluded that children were **modelling** their first uses of words based on the most frequent parental use. Taken together, this research clearly shows that parents have significant effects on semantic aspects of child language acquisition.

How then do parents influence the lexical development of their children? Cross (1977) proposed the fine-timing hypothesis, which suggests that mothers, and fathers, adjust their speech to the linguistic level of the child (see Rondal, 1980, for some similarities in mother and father **infant-directed**-speech, and Pratt, Kerig, Cowan, & Cowan, 1992, for some differences). That is, parents carefully observe a child's language capacities, use linguistic output at a level suitable to or slightly above the child's current capacities, provide linguistic feedback to their child, and only move ahead **as** the child shows progress. Good language teachers also often produce statements which are dependent on the child's last utterance and limit their conversation to topics introduced by the child (Cross, 1978). Therefore, according to this hypothesis, children receive linguistic information at the most beneficial level for their development.

Other researchers argue that gross-tuning precedes fine-tuning. For example, there appears to be a decrease in maternal mean length of utterance (MLU) during the first year (e.g., **Murry**, Johnson, & Peters, 1990; Phillips, 1973). During the early months of development, parents may be attempting to determine the capabilities of their child, and therefore, their MLU may be inappropriately large. Gross-tuning appears to be followed by fine-tuning in the second half of the first year, in which parents more accurately adjust their speech to their child's developing linguistic level (see Sokolov, 1993, for recent support of the fine-tuning hypothesis with additions and **substi-**

tutions of modals and pronouns). Parents may begin to intuitively understand that simpler input assists more advanced receptive language development in their children.

The goals of the present investigation were to provide longitudinal support for our hierarchical model of internal state words, and to determine whether children's production of cognitive words is related to general mental processes and to parental linguistic input. Like Hall et al. (1987), we analyzed the production frequencies of the cognitive word know by parents and their children.

Specific Aims of Present Study

First, based on prior research on cognitive words, we predicted developmental changes in the production of the different levels of meaning of know (e.g., Booth & Hall, 1995). As children develop cognitively, we predicted that they would produce fewer lower levels of meaning utterances (e.g., perception, recognition, and recall) and more higher level of meaning utterances (e.g., understanding, metacognition, and evaluation). We also expected that the developmental trajectories of these levels of meaning in children would be paralleled by similar production trends in their parents.

Second, we expected that children would use cognitive words to refer to themselves more than to refer to others because they cannot fully appreciate the perspectives of others (Piaget, 1969). Young children are **often** egocentric and constrained to communicating about their own thoughts and actions. Indeed, Bartsch and **Wellman** (1995) found that the children in their study used think and know to refer to their own internal state 79% of the time. If cognitive words are used to monitor and make line-grained distinctions between mental states, one would expect that children will first use these words to describe and manipulate their own inner states. With development, children should use cognitive words to characterize and interpret others' internal states. On the other hand, most parents are very concerned with the intellectual progress of their children, and, therefore, they frequently ask their children about their mental states. Indeed, Smiley and Huttenlocher (1989) found that adults used internal state words to refer to the child's internal states more often than to their own.

Third, we predicted that parents' use of cognitive words should be related to the production of cognitive words by their children precisely because of the abstract and subtle nature of cognitive words. This relationship would manifest in a correlation between parent and child production in the number of utterances of know for each level of meaning. This finding would add to the growing data on the parental influences on children's language development (e.g., Ninio, 1992).

Fourth, cognitive words seem to be a very important domain of words in a child's lexicon because they label and monitor mental states. Because cognitive words are so frequently used by children and their parents to refer to and manipulate internal states, acquisition of these words is likely to be related to other important aspects of cognitive development. We predicted positive correlations between the children's use of know and their and number of different words they used (a measure of semantic ability).

METHOD

Subjects

The transcripts of four children were analyzed for their utterances and their parent's utterances of know. All data was obtained from the CHILDES data base (MacWhinney, 1992). A brief description of each child and his or her parents follows:

Sarah. Sarah's and her parents were studied by Brown (1973) and his students between 1962 and 1966. This database contains 139 separate sessions ranging from when Sarah was 27 months old to when she was 61 months old. Sarah was the child of a working class family.

Adam. Adam was the child of a minister and an elementary school teacher. His family was middle class and well educated. There are 55 files in the Adam corpus and his age ranges from 27 to 58 months (Brown, 1973).

Ross. Ross was studied by MacWhinney (1992) between 1980 and 1985. Ross's speech was recorded between the ages of 30 and 90 months. Only the first 37 files of this corpus were coded because only they fell within the age range of the other children in this study. Since the experimenter was also the boy's father, these data represent a fairly natural record of the family's interactions.

Abe. This corpus consists of 210 files containing the diary study (1973–1975) of Stan Kuczaj's son. Approximately 1 hour of Abe's spontaneous speech in his home environment was recorded each week (two 1/2-hour sessions per week) when he was 26 to 49 months old and 1/2-hour of spontaneous speech was recorded each week when he was 49 to 60 months old.

For selected samples of each level of meaning for the word **know** for each of these children, see the Appendix.

Semantic Versus Pragmatic.

Cognitive words have "semantic" and "pragmatic" uses. An utterance is semantic if the word is used to refer to an internal state. It is considered

pragmatic if the word is used to communicate about something other than an internal state. The transcripts were coded separately for each child and his/her parents. Each specific utterance of know was coded along several dimensions. If applicable, the semantic level was coded (see above hierarchy). Nonsemantic uses were coded as pragmatic. There were several different types of pragmatic uses (see Hall & Nagy, 1986).

Conversational Devices. These usages tend to be highly conventionalized, make a minimal contribution to the content of the sentence, and function as fillers. For example, **know** has a solely pragmatic usage in "You **know**, we ought to go to the movies.**"

Indirect Requests and Suggestions. The cognitive word is closely connected with the literal meaning of the sentence, but the implied meaning is the intended use. For example, only a "smart **aleck**" would answer the question "Do you know what time it is?" with "Yes." The use of know contributes little to the meaning because "What time is it?" conveys the same meaning.

Rhetorical Questions. A rhetorical question is an instance in which the literal meaning of the cognitive word is lost. The speaker elicits permission to continue speaking or renews attention to a particular topic. For example, "Do you know how silly you are?"

Hedges. The use of a cognitive word to communicate uncertainty. For example, "It's going to snow, I think". These uses are very infrequent with **know**, because **know** implies certainty, by definition.

Opinion Questions. The speaker is asking for a belief or opinion rather than a statement of knowledge. Often, the cognitive word can be let out without affecting the meaning of the sentence much. For example, "Do you think I will do well on this test?" can easily be changed to "Will I do well on this test?" without losing any meaning.

Attentional Devices. The cognitive word is used to get the addressee's attention. For example, "Know what, it's an enchilada."

Self Versus Other

In addition, each utterance of know was coded as referring to self, e.g., "I know how to play the game," or referring to other, e.g., "You know his name."

Reliability

Each coder was trained in the semantic and pragmatic uses of know. Each coder was then given an exam requiring him or her to define and give examples for each level of meaning in the semantic hierarchy and for each type of pragmatic use. Each coder then independently coded 50 criterion

files from the transcripts. All coders attained at least 85% percent agreement with the criterion coder in the six semantic categories described above and in the self versus other distinction. The coders also attained at least 85% agreement in the semantic versus pragmatic distinction—they were not required to distinguish between the different types of pragmatic uses.

MLU and Number of Different Words.

MLU and number of different words were extracted for each child and for each file using the Childes Clan Program (MacWhinney, 1992). Only MLU was extracted for the parents. MLU provided a measure of syntactic ability, and number of different words provided a measure of semantic level at each age.

RESULTS

Analyses of Variance

Parents and children were analyzed separately in all analyses of variance (ANOVAs). Three types of ANOVAs were calculated. First, the 441 corpora files of all four children were grouped into 6-month age groups (27, 33, 39, 45, 51, and 57 months). For example, the first age group was 2.0 to 2.5 years old and so on. Age group was a within-subjects variable for all ANOVAs. Level of meaning (perception, recognition, recall, understanding, metacognition, and evaluation) was also considered a within-subjects variable, and ANOVAs were calculated with total numbers of occurrences of know at each level of meaning as well as with mean percentage of the know lexicon devoted to a particular level of meaning as a dependent variable. The latter variable was calculated by dividing the total number of know utterances representing one level of meaning in each corpus file by the total number of semantic uses of know in that corpus file (undefined numbers were considered missing values). This was done only with the level-of-meaning analyses because the low frequency of know production in some files may have underestimated the importance of certain levels of meaning. Second, ANOVAs were calculated with utterance length (with know, without know) and age group as within-subjects variables. Third, ANOVA analyses were calculated with referent (self, other) and age group as within-subjects variables. Fourth, ANOVAs were calculated with usage (semantic, pragmatic) and age group as within-subjects variables.

Level-of-Meaning Differences. In order to quantify developmental differences devoted to each level of meaning, a 6 (Age Group) X 6 (Level of Meaning) ANOVA was computed separately for total number of occurrences

and mean percentage lexicon. For the parents, there was a significant main effect in total number of occurrences for level of meaning, $F(5, 393) = 76.12, p < .001$; and there were significant effects in mean percentage lexicon for level of meaning, $F(5, 346) = 86.53, p < .001$, and for the Level of Meaning X Age Group interaction, $F(25, 346) = 2.56, p < .001$. For the children, there were significant effects in total number of occurrences for age group, $F(5, 393) = 7.42, p < .001$, level of meaning, $F(5, 393) = 89.88, p < .001$, and for the Level of Meaning X Age Group interaction, $F(5, 393) = 5.74, p < .001$. For mean percentage correct, there were significant effects for level of meaning, $F(5, 322) = 13.98, p < .001$, and for the Level of Meaning X Age Group interaction, $F(25, 322) = 5.61, p < .001$. The basic finding was that the lower levels of meaning tended to decrease in Frequency with age, whereas higher levels of meaning tended to increase in frequency with age for both parents and their children. We will defer a consideration of the level-of-meaning results until the Discussion section.

Utterance Length of Cognitive Word Sentences. In order to compare the mean length (in words) of the children's utterances containing the cognitive word know to those not containing know, a 6 (Age Group) X 2 (Utterance Length) ANOVA was computed. This analysis revealed significant effects for age group, $F(1, 393) = 8.08, p < .01$, and for the Utterance Length x Age Group interaction, $F(5, 393) = 2.93, p < .05$. Figure 1 displays the children's mean length of sentences (in words) containing know and those not containing know as a function of their age group. For the young age

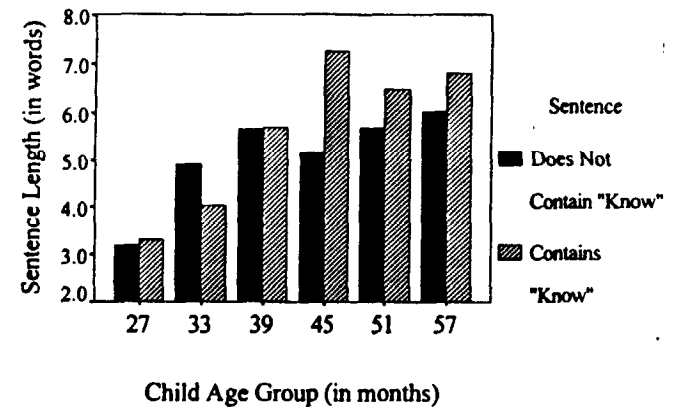


Fig. 1. Children's mean sentence length (in words) for sentences containing know and those not containing know as a function of their age group.

groups (27 to 39 months old), the sentences not containing know were either the same length ($ts < 1$) or slightly longer [$t(72) = 1.82, p = .07$] than the sentences containing **know**, whereas for the older age groups (45 to 57 months old), the sentences containing **know** were always longer than the sentences not containing **know** ($ts > 2.3, ps < .05$). This suggests that the semantic context of sentences that contain cognitive verbs become more enriched with development as compared to sentences that do not contain cognitive verbs.

Self Versus Other Differences. In order to determine whether there were developmental differences in the use of know to refer to self more or less than to refer to others, a 6 (Age Group) X 2 (Referent) ANOVA was computed. For the parents, this analysis revealed significant effects for referent, $F(1, 393) = 2.92, p < .10$, and for the Referent X Age Group interaction, $F(5, 393) = 3.13, p < .01$. *Post hoc* t-tests revealed no significant differences in parental frequency of self versus other referents in the 27- to 45-month age groups ($ts < 1, ps > .30$); however, the parents used know significantly more to refer to other than self in the 51- and 57-month age groups ($ts > 2.1, ps < .05$). For the children, there were significant effects for age group, $F(5, 393) = 8.10, p < .001$, for referent, $F(1, 393) = 30.58, p < .001$, and for the Referent X Age Group interaction, $F(5, 393) = 3.20, p < .05$. *Post hoc* t-tests revealed that the children used know to refer to self significantly more than to refer to other in the 27- to 45-month age groups ($ts > 2.2, ps < .05$); however, they used know equally to refer to self and other in the 51- and 57-month age groups ($ts < 1.9, ps > .1$). See the Discussion section for an explanation of these results.

Semantic Versus Pragmatic Differences. In order to determine whether there were developmental differences in the use of know for semantic versus pragmatic purposes, a 6 (Age Group) X 2 (Usage) ANOVA was computed. For the parents, this analysis revealed significant effects for usage, $F(1, 393) = 10.88, p < .001$. *Post hoc* f-tests revealed that the parents used know more for semantic purposes than for pragmatic purposes at every age group ($ts > 2.3, ps < .05$; for 57 months, $p < .1$). For the children, there were significant effects for age group, $F(5, 393) = 8.70, p < .001$, for usage, $F(1, 393) = 13.62, p < .001$, and for the Usage X Age Group interaction, $F(5, 393) = 4.23, p < .01$. *Post hoc* f-tests revealed that the children used **know** equally for semantic and pragmatic purposes from 27 to 45 months ($ts < 1.9, ps > .1$), then they expressed more semantic than pragmatic uses of know at 51 and 57 months ($ts > 2.5, ps < .05$). This finding supports other research which shows that young children use internal state words more for pragmatic purposes than for semantic communication probably because of the abstract and subtle nature of these words (Shatz et al., 1983).

Correlational Analyses

The MLU and mean number of different words uttered by the children increased as a function of age group. An ANOVA with mean number of different words revealed a significant effect for age group, $F(5, 435) = 10.74, p < .001$. Children produced significantly more different words as they got older ($M = 173$ at 27 months to $M = 322$ at 57 months). Another ANOVA comparing child and adult MLUs revealed significant effects for age group, $F(5, 435) = 9.59, p < .001$, for speaker, $F(1, 435) = 8.70, p < .01$, and for the Age Group X Speaker interaction, $F(5, 435) = 21.93, p < .001$. Children's MLU increased with age group ($M = 3.1$ at 27 months to $M = 6.2$ at 57 months), whereas the parent's MLU remained constant over age group ($M = 5.0$). Since there were significant increases in children's mean number of different words and MLU, partial correlations were computed between parent and child cognitive word use because we wanted to determine effects that result specifically from cognitive words rather than the known correlations between parent and child speech, for example, between the number of different words produced.

The correlational analyses were based on the total number of occurrences for each level of meaning of **know** in each file for all children (441 files). Correlations were calculated between children's total number of occurrences for each level of meaning and their number of different words and MLU, and between the children's total number of occurrences for each level of meaning and their parent's cognitive word measures and MLU. Table I presents the bivariate correlations, and Table II presents the partial correlations between parent and child language measures. Children's MLU and

Table I. Bivariate Correlations of Children's Cognitive Words Measures with Number of Different Words, Mean Length of Utterance (MLU), and Parent's Cognitive Word Measures

Children's Cognitive words	Children's		Parents'		
	Different words	MLU	Cognitive word	MLU	Cognitive MLU ^a
Perception	.35 ^c	.00	.08	.01	-.01
Recognition	.19 ^c	-.04	.26 ^c	.00	-.09
Recall	.39 ^c	.00	.44 ^c	.08	-.05
Understanding	.55 ^c	-.04	.38 ^c	.05	-.02
Metacognition	.01	.14 ^b	.37 ^c	-.03	.02
Evaluation	.18 ^c	.14 ^b	.14 ^b	.02	.14 ^b

^a Cognitive-MLU represents the correlation between the parent's cognitive word use and MLU.

^b $p < .01$.

^c $p < .001$.

Table II. Partial Correlations of Children's Cognitive Words Measures with Number of Different Words, Mean Length of Utterance (MLU), and Parent's Cognitive Word Measures?

Children's Cognitive words	Children's		Parents'	
	Different words	MLU	Cognitive word	MLU
Perception	.34 ^c	.01	.05	.02
Recognition	.18 ^c	-.03	.25 ^c	.01
Recall	.38 ^c	.02	.35 ^c	.09
Understanding	.55 ^c	-.01	.15 ^b	.07
Metacognition	.02	.14 ^a	.38 ^c	-.03
Evaluation	.19 ^c	.17 ^c	.13 ^b	.03

Children's MLU and parents' cognitive word use and MLU are partialled for children's number of different words. Children's number of different words is partialled by their MLU.

^a $p < .01$.

^c $p < .001$.

parents' cognitive word use and MLU were partialled for children's number of different words. Children's number of different words was partialled by their MLU. The partial correlations between children's cognitive word use and children's mean number of different words was significant for all levels of meaning (except metacognition). The correlations between child and parental cognitive word use were also significant for all levels of meaning (except perception). These results suggest that cognitive word acquisition by children is related to other aspects of their semantic development and may be influenced importantly by parental input.

DISCUSSION

The primary purpose of this study was to provide longitudinal support for a hierarchical model of the cognitive internal state lexicon that was based on cross-sectional comprehension and production studies (Booth & Hall, 1994a, 1995; Hall et al., 1987). This model suggests that there are six levels of meaning which increase in conceptual difficulty and abstractness, and predicts that the lower levels of meaning such as perception, recognition, and recall should be comprehended before the higher levels of meaning such as understanding, metacognition, and evaluation (see Introduction for definitions). In terms of production, the lower levels should decrease in frequency, whereas the higher levels should increase in frequency, with development.

Are There Level-of-Meaning Differences?

The most important finding of this study was that level of meaning interacted with age group. In general, percentage of the lexicon devoted to certain lower levels of meaning decreased, while percentage of the lexicon devoted to certain higher levels of meaning increased with age. For the parents, percentage of lexicon devoted to recognition decreased while understanding increased with age (see Figs. 2 and 3). Parents' percentage of

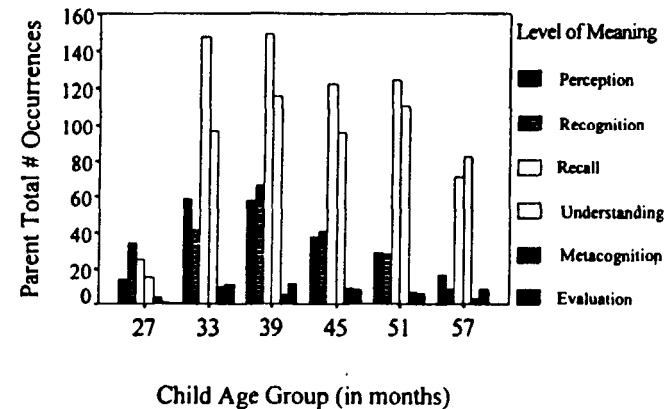


Fig. 2. Parents' total number of occurrences of know devoted to each level of meaning as a function of their children's age group.

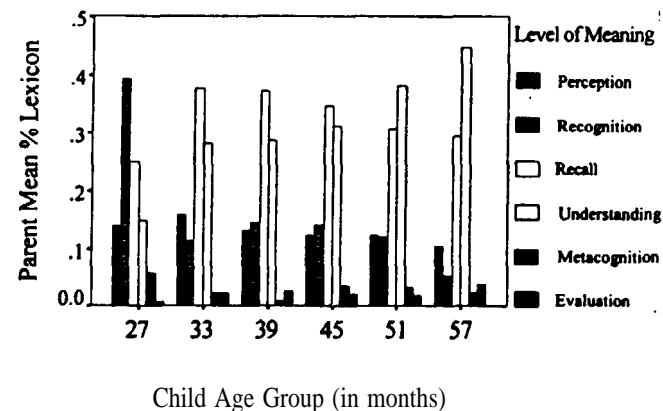


Fig. 3. Parents' mean percentage of the lexicon devoted to each level of meaning of know as a function of their children's age group.

lexicon for perception and recall showed a slight increase from 27 to 33 months, but then a slight decrease across the rest of the age groups. **Meta**-cognition and evaluation were rarely used by the parents, suggesting that these levels are conceptually more demanding. All significant differences were consistent with a level-of-meaning hierarchy.

The children exhibited similar trends in their production **frequency** as the adults. Children's percentage of lexicon devoted to recognition decreased while understanding increased with age (see Figs. 4 and 5). Like the parents,

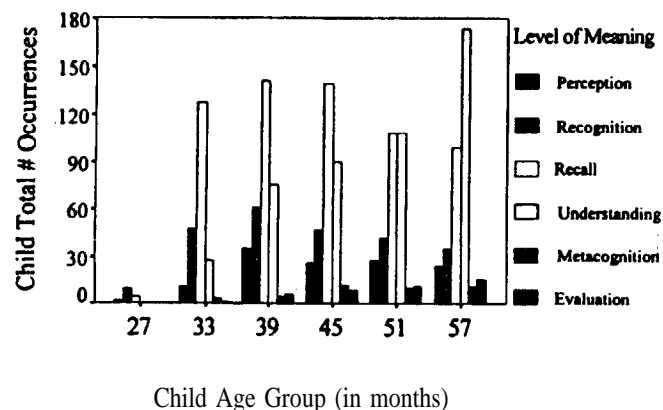


Fig. 4. Children's total number of occurrences of know devoted to each level of meaning as a function of their age group.

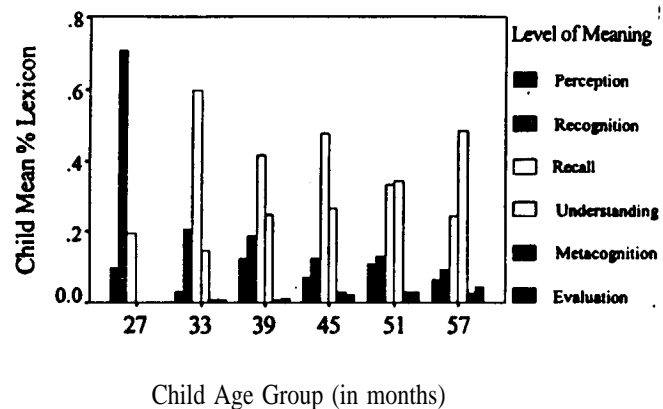


Fig. 5. Children's mean percentage of the lexicon devoted to each level of meaning of know as a function of their age group.

there was an increase in percentage of lexicon devoted to recall from 27 to 33 months, but then a decrease across the rest of the age groups. **Meta**cognition and evaluation were rarely used by the children in any of the age groups, suggesting that these higher levels of meaning are conceptually difficult. Perception was also rarely used by the children even though it is the lowest level in the hierarchy. This result may reflect production **constraints**—**direct** measurement of comprehension of the levels of meaning could not be administered to these children. Other comprehension studies indicate that children do not have trouble with the perception level (Booth & Hall, 1994a, 1995).

In sum, all level-of-meaning differences adhered to a hierarchical model of cognitive internal state words (Hall et al., 1987). Specifically, this study found that percentage of lexicon devoted to low levels of meaning tended to decrease with age, and percentage devoted to high levels of meaning tended to increase with age *for both children and their parents*. The cognitive word lexicons of children became more differentiated with age—they used more of the different levels of meaning. This increase in differentiation for the children replicates an earlier comprehension study of know with **3- to 12-year-old** children (Booth & Hall, 1995). As children develop, they begin to make subtle distinctions between mental states and this is reflected in their greater use of different cognitive words. Interestingly, the parents cognitive word productions tended to become less differentiated with age. For example, parents were primarily using recall and understanding at 57 months, whereas they were frequently producing **perception, recognition, recall, and understanding** at 33 and 39 months. The decrease in differentiation for parents supports past research and theory which suggests that parents “gross-tune” their speech to very young children. Parents use a greater variety of the different levels of meaning when their children ‘are young because the parents are attempting to determine what level works best with their children. Parents eventually “fine-tune” their speech and are more successful in adjusting to their linguistic input to their child’s cognitive level (Cross, 1977; Sokolov, 1993).

Are Cognitive Words Used To Refer to Self More Than to Other?

Past studies have found that adults use internal state words more to refer to other’s mental states than to their own (Smiley & Huttenlocher, 1989), whereas children use cognitive words to refer primarily to themselves (Barstch & Wellman, 1995). These results support the more general belief that young children are less able to appreciate another person’s perspective (Piaget, 1969). We **further** argue that, since mental verbs are conceptually demanding and refer to abstract internal states, they are more likely, than

other words, to be used to describe and explain inner experiences. **Only** with development are children able to fully appreciate that others can experience these same mental states. Therefore, we expected that young children would use cognitive words more **often** to refer to their own mental states than to refer to others' mental states, and as they developed, they would use cognitive words to refer to others' mental states with greater frequency. Indeed, the children in our study used cognitive words to refer to themselves more than to refer to others until 45 months, then they used cognitive words equally **often** to refer to themselves and to others (at 51 and 57 months).

To our knowledge, no studies have investigated whether there are developmental differences in parents' use of cognitive words to refer to self versus other. The present investigation found that parents use cognitive words equally often to refer to themselves and others until 45 months, and then they use cognitive words more often to refer to others (at 51 and 57 months). This suggests that parents are more often commenting on and describing their children's internal states as their children become more cognitively capable. At 51 and 57 months children have a relatively well-developed language facility and are capable of discussing a range of topics in an interactive manner, so they talk more about their parents and parents talk more about their children.

Are Cognitive Words Related to Intellectual Functioning?

The cognitive word **know** is important to study because it is the most common internal state word in the young children's developing lexicon (see **Shatz et al.**, 1983). Since cognitive words like **know make fine-grained distinctions** between different mental states, they encourage children to reflect upon their internal processing and make the conceptual distinctions that these words label. We argue that mental state verbs are very important for conceptual development precisely because of the internal processes they designate. Indeed, cognitive word understanding is related to metacognitive development and skilled reading comprehension (**Booth & Hall, 1994a, 1994b**). The present investigation provides further support for the importance of cognitive words in semantic development. We found that the total number of occurrences of cognitive words explained a significant and unique amount of variance in the number of different words the children produced (see **Table II**).

Our study revealed that cognitive words seem to be an important lexical domain correlated with vocabulary acquisition. However, cognitive word acquisition appears to be somewhat distinct from other aspects of semantic or vocabulary development. Even though **know** is a **very** frequent cognitive word, it makes up a minor part of the children's total production vocabulary.

For example, the sentences containing the cognitive word **know represented** less than 5% of the total words spoken by the children in our study. Furthermore, sentences containing the cognitive word **know** were longer than those sentences not containing **know** for the three oldest age groups, suggesting that cognitive verbs are associated with more complex semantic contexts. It is interesting to note that sentences containing **know** increased in length exactly at the point in which level-of-meaning frequencies were also changing rapidly. In the three oldest age groups, the low level-of-meaning of recall exhibited its largest decrease, whereas the high level of meaning of understanding exhibited its largest increase. Since children's **know** utterances accounted for a small portion of their total number of utterances and occurred in more complex sentences, but still correlated with the number of different words they produced, this suggests that cognitive verbs may play an important role in semantic development.

Research also shows that parental linguistic input is related to children's semantic and syntactical development (**Barrett et al.**, 1991; **Hampson & Nelson**, 1993; **Harris et al.**, 1988; **Hart**, 1990; **Hoff-Ginsberg**, 1990; **Moerk**, 1980; **Ninio**, 1992). These **studies** suggest that parents influence their children's language development in important ways. The present investigation adds to this literature by showing that parents' total number of occurrences of cognitive words explained a significant and unique amount of variance in their children's production of all levels of meaning except perception (see **Table II**). These results suggest that children are producing the cognitive words they hear, and that parental input may play an important role in the abstract and subtle domain of cognitive word acquisition. It is also important to note that the parents' as well as children's **MLUs** did not correlate with their cognitive word measures. This rules out the possibility that parents just produced overall more complex speech as their children aged—there is something unique about cognitive word production in adults that changes with their children's development. This dissociation also suggests that cognitive words and **MLU** are tapping into different child and parental characteristics. Cognitive words may be tapping into a form of semantic competence, whereas **MLU** may be tapping into a distinct syntactical ability.

Can Cognitive Words Inform Theories on the Relationship Between Language and Thought?

Many theorists claim that the relationship between language and thought can be explained most accurately by a model that depends on the domain of knowledge one is attempting to characterize. For example, **Brown** (1958) suggested that certain concepts only crystallize with the assistance

of language, such as the apparent universals, i.e., “conceptions of space, time, causality, and enduring object” (p.195), while other concepts are probably a product of a child’s observation of fluent language use in which new words and morphemes provide a “lure to cognition*” (p. 206). Following in Brown’s tradition, **Bowerman** (1988) stated:

Nonlinguistic cognition, no matter how powerful, does not directly provide children with the categories of meaning they need to become fluent speakers of their language. nor with the information about how these categories work together to determine choice among alternative forms. Some distinctions are no doubt so salient for humans that the contrasting categories they define are accorded separate lexical, morphological. or syntactic treatment in the structure of every language. Others may be so unimportant that no language obligatorily honors them. But in between are vast stretches of “semantic space” in which partitioning is not determined by the structure of human cognition. In consequence, an important part of the child’s “induction of latent structure” must be to work out the distinctions in meaning that correlate with contrasts in form in the language being learned. (p. 35)

Scholnick and Hall (1991) also elaborated on the hypothesis that the relationship between language and thought depends on the domain. They suggested that objects and events are easily perceived in one’s environment, and thus it is highly probable that children first have a concept of these tangible realities that they subsequently map words onto. It is not a coincidence that children first talk about things that are in their immediate environment. On the other hand, since many higher-level cognitive words characterize the inductive and deductive capabilities of the mind, it seems impossible for children, without cognitive word input, to make the necessary conceptual distinctions and acquire the appropriate terminology through the mere observation of a logical and causal world. But mere **exposure** to cognitive words seems to be only a necessary and not a sufficient mechanism of development. Children must analyze and interpret the context in which a cognitive word is spoken or written in terms of their knowledge of logic and of the world.

We also propose that the relationship of language and thought depends on the domain in question. This suggestion is supported by the findings of this study and others (e.g., Booth & Hall, 1995; Hall et al., 1987) which have found that children learn the less conceptually demanding cognitive word levels of perception, recognition, and recall before the more conceptually demanding levels of understanding, metacognition, and evaluation because language can more easily be mapped onto the cognitive structures of the less abstract and less elusive levels of meaning (but see Leslie, 1987; **Wellman & Estes**. 1986, 1987). We argue that exposure to cognitive words is an important mechanism for developing an awareness of how the mind

operates and that cognitive words are a vehicle for exploring the properties of thought.

APPENDIX

Selected Samples of Each Level of Meaning for the Cognitive Word Know for Sarah, Ross, Mark, Adam, and Abe

<i>Perception</i>	
Adam:	De lights went off.
Adam:	Do you know de light went off?
Adult:	The what went off?
Adult	You’re not dressed.
Sit:	(Sarah wears pajamas)
Sarah:	I know.
<i>Recognition</i>	
Adult:	What do you think she’s carrying?
Sarah:	What is this?
Adult:	What do you think?
Sarah:	Do you know?
Sarah:	Sun tan lotion.
Abe:	What’s this thing I’m holding?
Father:	I don’t know.
Abe:	Why did you didn’t know?
<i>Recall</i>	
Father:	Mark listen to brother.
Father:	He’s telling me about what he had on his test.
Mark:	Ooh.
Father:	Listen to your brother.
Father:	He knows what he had on his test.
Mark:	I know what I had on my test.
Mother:	We’re going to help Lou and Elliot move today.
Abe:	I don’t know where their house is their new house.
Mother:	It’s just down the street from their old house.
<i>Understanding</i>	
Adam:	No, you’re not big enough to play the game.
Sit:	(To Paul)
Adam:	You don’t <u>know</u> how to play the game.
Father:	Tell Mom when you cried.
Mother:	And why you cried.
Abe:	I don’t <u>know</u> how come I cried.

Metacognition

- Adam: What is dis?
 Adam: A.
 Mother: He's the color of grass.
 Mother: And he hops.
 Mother: What do you think he might be?
 Adam: Agrasshopper.
 Mother: Yes a grasshopper.
 Adam: How did you know I know these in the hook?
- Father: Ok, Abe. what are you doing?
 Father: You're not saying much.
 Abe: I'm just thinking.
 Father: What are you thinking about?
 Abe: I don't even know what I'm thinking about.

Evaluation

- Sarah: That goes right here but it don't fit. I guess.
 Adult: What if you went...
 Adult: Kept going around and around?
 Sarah: There, it goes.
 Sarah: Now I know.
 Adult: Yeah.
 Sarah: There.
 Sarah: Bet I know where that part goes.
- Ross: We'll definitely have a snow in winter.
 Father: You think so huh?
 Ross: Mhm.
 Sit: (Yes)
 Father: Who told you?
 Ross: I know so!
 Father: Ok.
 Ross: Nobody told me.
 Father: You just feel it in your bones.
 Father: Right?
 Ross: Mhm.
 Sit: (Yes)

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