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ABSTRACT

The acquisition of the metalinguistic abilities involved in ambiguity detection and resolution was studied with children. It is suggested that metalinguistic abilities may serve as potential test measures for facility in learning a second language. School children (ages 3, 5, 7, 9, 11, and 13) were tested for their ability to detect ambiguous sentences and their ability to provide multiple interpretations for common ambiguity types in the areas of lexicon and syntax. An extensive review of the literature and a pilot study on the development of metalinguistic ability of children are presented. In the pilot study, each child was asked to give two meanings of ambiguous sentences. An equal number of sentences were lexically ambiguous, ambiguous at the surface level, and ambiguous at the underlying level. Results with the 5 year olds show that they were not perceiving two meanings of the ambiguous sentences. A steady increase with age in the perception of two meanings was demonstrated. At each age level, the lexically ambiguous sentences were generally easier than the structually ambiguous ones. The 13 year olds perceived two meanings for almost all of the lexically ambiguous sentences and about half of the structurally ambiguous sentences. The current findings and those of previous research suggest that metalinguistic ability to detect ambiguity is not completely developed by the age of 13. It is suggested that a relationship may exist between the abilities to detect ambiguity and to acquire a second language. (SW)

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The Acquisition of Metalinguistic Abilities

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Invited paper prepared for the First International Conference of the AILA Commission on Psycholinguistics, November 1-3, 1982, Milan, Italy.

Recent psycholinguistic investigations have demonstrated that metalinguistic abilities vary greatly across speaker/hearer populations, and that such reflective abilities also appear at a differential rate late in the acquisition of a first language. This paper focusses upon the acquisition of such metalinguistic abilities in the detection and resolution of ambiguity. Elementary school children at the ages of 3, 5, 7, 9, 11, and 13 were investigated for their ability to detect ambiguous sentences and their ability to provide multiple interpretations for common ambiguity types in the areas of lexicon and syntax. It is obvious both that certain metalinguistic abilities like ambiguity detection and resolution appear relatively late in the acquisition process, much later than the bulk of the structural aspects of the language are acquired and there also seems to be a high degree of individual differences in such abilities. Considering the high variability in such skills, it is suggested that such metalinguistic abilities may serve as potential test measures for facility in learning a second language successfully after the first language learning experience. While first and second language learning situations may vary in their actual form and realization, they may share an interesting link in the nature of individual differences in metalinguistic abilities. These same metalinguistic abilities appear relatively late in the first acquisition process and with highly individual performance ratios; in second language learning, they may actually be predictive of the realization of success ratios in second language acquisition tasks. This paper examines the nature of this possible link in reporting upon the acquisition of the metalinguistic abilities involved in ambiguity detection and resolution.

Metalinguistic knowledge involves those abilities that underlie the way in which speakers of natural languages are aware that language may be used to analyse the talk about itself. Metalinguistic abilities have to do with what we mean when we say that a speaker knows the rules of the language, what it is he knows about his knowledge. Specifically, we're interested in the developmental aspects of the speaker's ability to reflect upon those rules that he follows in being a fluent speaker of the language. Our particular interest here is in the emergence of the child as grammarian, in the child's growing metalinguistic abilities. We can say that language is not only used by the child, but that he also knows what it is that he is using. It is not surprising that the child's awareness of language grows in much the same way that his abilities to produce and understand the mechanics of language grow.

Language abilities emerge so much earlier than other cognitive skills. It's obvious that if language was simply a tool of thought, that language and thought would emerge at about the same chronological stage of development. The two are of course separate in many aspects, and cognitive development seems to appear at a much slower rate than does linguistic development. For example, the child is painfully slow in his process in respect to logic, his belief in the conservation of matter, and his concepts of number. While there are great leaps in language structure, metalingustic abilities that require some level of cognitive maturation do not find the same ready fluency that characterizes the child's mastery of the simple mechanics of the language. We find that the child is somewhat slow in respect to his metalinguistic judgments, not entirely unlike the slower development one finds in the general area of cognitive skills.

Children by the age of four or five speak the language well, but can they also contemplate the structure of the language that they speak so well? Do they know that they know what language is? Do they have any awareness of their general linguistic abilities, or any awareness of the specific linguistic abilities that make them a native speaker of a language? It is at this age that caretaker speech typically ceases, and we begin to address children in much the same way that we address adults. However, the child's capacity for metalinguistic judgments may be somewhat beneath the expectations we have of him, given his overt fluency. Very simply, we do know that young children are not completely well formed speakers of the language at this time, although gross errors have largely disappeared from their speech. We have come to realize that there are some subtle abilities that may be missed except by direct experimentation. Direct experimentation has its shortcomings, but these are nowhere near as great as the shortcomings of observations. Metalinguistic investigations direct our attention to eliciting from the child what it is that he may know.

We are particularily interested in the developmental aspects of metalinguistic abilities to do with ambiguity and paraphrase. What do children at the ages of 3,5,7,9,11 & 13 know about ambiguous structures? How well are they able to detect ambiguity? How well are they able to paraphrase them? We do know, of course, that children show developmental milestones in terms of their performance and understanding abilities. We are specifically interested here in what it is that children know about their knowledge of these abilities, or to put it another way, what it is

that the child knows about what he knows of language. We are particularily interested in the ages between five and ten, because other studies have indicated that this age span is also a time when other metacognitive or metamemory abilities grow and develop, as for example, both recollection, and intentional learning. It is also at this time that children begin to explain their judgments of space and number with greater accuracy. Recent Russian research has also indicated that intentional strategies for remembering are rarely adopted before the age of five, but are used thereafter.

We also know from earlier studies (for example, Carol Chomsky, 1969) that this is the age for mastering the subtle aspects of syntactic structure, like "John is eager to please" vs. "John is hard to please." We also discovered from such studies that mastery operates on a chronological range of individual differences, such that some children master them earlier than others. This suggested to us that certain metalinguistic abilities may also not be mastered by the age of five or six, and more importantly, that such metalinguistic abilities may vary in the degree of their mastery or might not even be complete by 10 or 12: Thus, we chose to concentrate on the age range between five and thirteen by alternate years.

Classificatory judgments by children for deeper or more global properties are suggested to appear earlier than judgments for more surface structural properties. According to Downing and Oliver (1973 - 74), children of five can be taught the difference between the concept of word and sentence with little difficulty. But this is not true of concept differences like those between words, syllable, and sound. Downing and

Oliver suggest that children of 5 and 6 have difficulty segmenting speech into words, even more difficulty segmenting words into syllables, and the most of all in segmenting words or syllables into phonemes. This seems to correspond with a hierarchy of difficulty which matches compellingly with the degree of deep to surface structure relationships (deep is not used here in its syntactic designation but in terms of the global higher order properties of language structure). We also find this in introductory courses in linguistics where adult students typically have the most difficulty with the level of phonology and the least difficulty with higher levels like syntax and morphology. It may in fact be that more global properties are more easily brought to surface awareness than minute properties which are less easily brought to such an awareness level. In sum, Downing and Oliver have suggested that the lower the level of linguistic representation called for in a judgmental task, the more difficult the task for young children. This would imply that tasks requiring conscious recognition and manipulation of linguistic units, and the resultant classification of these, are difficult for both adults and for children. Performance here is of course highly variable; not all of us are good language analysts and not all of us do well with tasks that require left-to-right sequential processing with minute analysis. We know that for children such skills, as well as related judgments, appear relatively late in their development; they simply find it hard to process the lower-level syntactic or phonological representation.

This has an immediate bearing on our work in ambiguity, for we have also found with some adults that surface structure ambiguity retrieval may be the easiest for subjects to detect and paraphrase. On the other hand, lexical and underlying structure compete for being the most difficult to retrieve. This is of course contrary to what linguistic theory of the 1960's would have suggested as the order of grammatical formations; deep structure to surface structure to lexical insertion was the typical heirarchy of protocol. It is, however, not at all surprising when we match it up with even the earliest ambiguity studies (for example, those by MacKay, 1966, and MacKay and Bever, 1967), which discovered that the order of ease of detection of the ambiguity was the exact inverse of any formulations suggested by linguistic theory.

In general, we do find general developmental differences in the form in which metalinguistic abilities progress. First, children can detect violations before they explain them. Their level of awareness is such that they know when something is wrong but do not know why it is wrong. This relates directly to the metalinguistic abilities which we are investigating here, in suggesting a different timetable of development than actual language skills as such. Secondly, children can often detect unacceptable variations in the domains of language, that is, phonology, morphology, syntax and semantics. Thus, their abilities to detect violations is not exclusively limited to one of the areas of language structure to the exclusion of the others. Thirdly, we also find developmental differences in the application of those abilities to particular structures within each language domain. For example, studies have shown that tense and plurality rules preceded the awareness of derivational rules; inflectional judgments

precede derivational morphology judgments. Or, for another example, we note that there are differences in how judgments are applied to sentence processing categories; the ability to detect anomaly and ungrammaticallity appear before the abilities to deal with paraphrase and ambiguity. Lastly, and most importantly, metalinguistic abilities develop progressively over the middle and late childhood years and continue on into adulthood. Given the range of individual differences which we find for adults, we may also predict a range of individual differences in metalinguistic abilities for children as well. Such metalinguistic indicators might also relate to other metalinguistic abilities as, for example, second language learning. Thus, it might not be unreasonable to expect that children with a high level of metalinguistic awareness or metalinguistic achievement, as measured by psycholinguistic tasks in ambiguity and paraphrase, may also show a high level of ability when it comes to another metalinguistic task, that of learning a second language.

It is usual that experimental approaches are the best way of assessing just what it is that the child knows at given stages. Indirect observation is typically inefficient, and consequently uninformative when matched against the rapidity with which the child's developing abilities move out of range. Indirect observation, moreover, does not always tell us what the child does understand despite the form of his speech, and at the stage we are dealing with, the child's fluency in speech may in effect hide his metalinguistic shortcomings. For the earlier child, his form may appear poor while his comprehension is rich; the older child's form may appear full and rich but his comprehension and metalinguistic awareness is often

poorer than suggested. It is obvious that experimental and direct elicitation from subjects is the most efficient way of proceeding, and much of what we report here from the literature, as well our own work, is derived from experimentation with children between the ages of 3 and 13.

There has been some early metalinguistic work, as for example, one experiment by Shipley, Smith and Gleitman (1969) investigating whether children respond differentially to well-formed and deviant syntactic constructions. They had mothers give commands to children of 18-30 months, with the commands either well-formed ("Throw me the ball") or telegraphic, reflecting the children's own speech level ("Ball", or "Throw ball"). The results in general confirm the fact that children discriminate between these two formats. One might say that such children fail to obey commands they perceive as being linguistically deviant; certainly it is obvious that the telegraphic speech of children, at least the way that telegraphic speech was responded to, does reflect the fact that even children are sufficiently aware of the differences to discriminate telegraphic speech from adult syntax. It is also apparent from the literature (see, for example, N. Smith, 1973) that the child's awareness of phonology is greater than what his productive capacities allow him to generate.

Another experiment required grammaticality judgements for young children at the age of two and a half. The sentences varied along the same intonation contour with sentences like the telegraphic "Bring ball" and mixed order sentences like "Ball me the bring" vs. "Bring me the ball". Children who undertook to judge the sentences did so with non-random results suggesting that while their classificatory skills at this age appear to be feeble, there is at least a minimal capacity in some children under three to contemplate the structure of language. This also matches up with what we found with ambiguity detection and paraphrases. With the

exception of extremely vivid situations portrayed by one meaning of the ambiguous sentences, children at the age of 3 were not adept at dealing with syntactic structures which were ambiguous at any of the three levels of lexical, surface, or underlying structure.

We should not forget that there are differences in linguistic creativity and that individual differences may be the key to unlock many questions of underlying language ability. Gleitman and Gleitman's (1970) study of paraphrase showed two adult groups split into those with great ability in respect to paraphrase and those without. The Gleitman work with paraphrase indicated for example, that the ability to deal with stress patterns like those on black bird house as opposed to blackbird house varied enormously between clerical workers vs. highly educated subjects. Paraphrasing compounds of this type differed along educational experiential lines; the more educated group was biased to attend to surface syntactic properties of the stimulus, whereas the clerical worker group more readily attended to the plausible semantic interpreation of the separate word in the compound phrase presented to them. It is interesting to note that there is a parallel with the Gleitmans' clerical worker paraphrase group and younger children who did also find paraphrases for seeing anomalies by looking for semantic explanations.

Here we might ask what makes a sentence silly for a child? Is it falsehood? Or is it illformedness? Contrast sentences like Mud makes me clean and Mud drinks my ankle. The first looks like a sentence of English; the second appears to be an English sentence, but as one comes further down the rules of grammar we find that it violates selectional restrictions in the sense of the distinction between subcategorizational and selectional restrictions in syntax (Chomsky, 1965). Drink requires an animate subject and mud is not an animate subject. Thus, we can reject sentences on the basis of the distinction between knowledge of the world and knowledge of

the language. As the Gleitmans' point out, adults typically accept sentences like Mud makes me clean with some waffling. They accept implausible sentences, but reject selectional violations, thus not accepting Mud drinks my ankle. Two-year-olds, on the other hand, reject implausible sentences. So also do five-year-olds, but with much less frequency. Adults simply take such sentences in stride, concentrating more on the linguistic structure in question than on the truth value. Thus we might ask once again -- what makes a sentence silly? What makes a sentence syntactically deviant? What makes for semantic anomaly? If we contrast sentences like Golf plays my brother and I think that any rain will fall today we may get different answers. The youngest subjects are responsive to deformations which obscure or complicate semantic interpretations, because this is what they are most aware of. The Gleitmans' found that five-year-olds will accept a sentence if it is semantically clear even if awkward, (for example, John and Jim is a brother). But after six the saliency of syntactic deviance is no longer in doubt. In the Gleitman study (Gleitman, Gleitman, and Shipley, 1972) all six-year-olds rejected sentences like Boy is at the door and John and Jim is a brother. Only one year previousy at least some children would have acepted these sentences on the basis of their semantic plausibility, and at the age of two, young subjects would probably have accepted most of them. Two-year-olds can detect word order violations, but they cannot correct them. When such corrections take place, they are typically semantic in nature. Five-year-olds will reject sentences on the basis of semantic grounds if the sentences are bad from both semantic and syntactic features, but six-year-olds will reject sentences on both grounds, being increasingly aware of the importance of syntax in determining the grammatical status

of sentences as opposed to simply their semantic plausibility. Another study (deVilliers and deVilliers, 1974) also found that at early stages sentences are rejected on the basis of semantic grounds with violations of word order rules detected later. Menyuk (1963) also found that very young children are aware of and can judge deviance on the basis of semantic rules. For example, anomalous sentences are first judged on the basis of their semantic content, syntax coming after semantics in judging grammatical deviance. Menyuk also found that the number and types of structures children can judge to be grammatical increases with age, and that the ability to specifically correct those utterances follows children's abilities to detect them.

One of the first studies to specifically examine the developmental aspects of ambiguity was reported by Kessel in 1970. He asked children ranging in age from 6 to 12 to select the two pictures of four which illustrated the two meanings of orally presented sentences. Three types of sentences were employed, lexically ambiguous and those which were ambiguous at the surface and underlying levels. If they picked only one picture, they were coaxed to pick another through leading questions. The younger children, the 6 and 7-year olds, appeared to appreciate lexical ambiguity since they correctly identified the two pictures about 75 percent of the time for this type of sentence. Younger children processed only at the lexical level, while older children could reliably detect the two meanings of the structurally ambiguous sentences. But even among the 12-year-olds, the percentage correct, without coaxing, was only 75 suggesting that they had not mastered the task. There was a marked difference between the 12-year-old children and all the others; the 12-year-olds were explicitly aware of the ambiguity, volunteering such comments as "You can put it

differently," "There is a different emphasis," "It depends on how you phrase it." Also, these children could produce two different intonation patterns. Generally, the abstractedness of the meaning seems to be involved in the detection. Meanings which involved an unstated "someone" were not given as often as those involving "someone". The shooting of the soldier was bad elicited the "soldier shooting badly" meaning 96 percent of the time, while the more abstract "the man shot the soldier" meaning was given only 4 percent of the time.

Data consistent with Kessel's are also found in Jurgens' (1971) study, where children were given unambiguous and lexically ambiguous sentences as well as sentences that were ambiguous at the surface and underlying levels. Children were to say whether one or both of two interpretations given correctly followed from the sentence. Latency times and correct responses were recorded, and the latency scores showed a similar relationship to Kessell's findings, that is, lexical ambiguities were responded to faster than structural ambiguities of the surface and underlying type. The children in Jurgens' study ranged in age from 12 to 16 years, and the older children performed better in latency scores and the number correct than did the younger children. Her oldest children showed no difference in latencies between ambiguous and unambiguous sentences suggesting that the ability to recognize ambiguity may mature by age 16.

Another developmental ambiguity study was conducted by Shultz and Pilon (1973) who asked children from ages 6 to 15 years to paraphrase two meanings of ambiguous sentences and then to select pictures which went with

the two meanings of the sentence. In addition to lexical, surface, and underlying ambiguity, there were sentences which were phonologically ambiguous, for example "eight tea cups" verus "eighty cups" ("eight-cups-of-tea" meaning versus the "cups-the-total-of-which-are-80" meaning). As with the Kessel study there was a positive relationship between age and the ability to detect ambiguity. The youngest children, 6-year-olds, were not able to detect much ambiguity at all, whether it was in the paraphrase or picture part of the experiment. Nine-year-olds detected 60 percent of the phonological ambiguity and were able to detect some lexical ambiguity but hardly any structural ambiguity. Twelve-year-olds were able to detect about one half of the structural ambiguities and a majority of the lexical and phonological ambiguities. But even the oldest children, the 15-year-olds, did not detect all the ambiguities.

In a different kind of study, Frommer (1975) tried to shift children's dominant interpretation of a lexically ambiguous sentence. Some theories have suggested that the older the child becomes, the less dependent he is on non-linguistic contexts and the more he is able to use linguistic contexts to decode the meaning of sentences. Frommer examined the possibility by using linguistic contexts for ambiguous sentences for four, six, and eight-year old children. The first step of the experiment determined whether the child had both meanings of a word such as ant/aunt, and only those words for which all children had both meanings were used in the experiment. One week later the child's interpretation of an ambiguous

sentence which used one of the words previously examined, was determined for example, Charlie looked for his ant/aunt all morning. One week following this an attempt was made to shift the child's interpretation by providing a sentential context -- prior or post -- which disambiguated each lexically ambiguous sentence differently from his initial interpretation; for example, providing Sometimes small pets are hard to find or Sometimes kids get lost at the beach for Charlie looked for his ant/aunt all morning. The number of shifts of interpretations was positive related to age with the youngest, the four-year olds, shifting on 23 percent of the sentences and the oldest, eight-year olds, shifting on 41 percent of the sentences. Once again we see that younger children are less able to have available two meanings of an ambiguous sentence, and in this case, even though both meanings of the ambiguous word are presumably available. Frommer suggested that four-year olds tend to be locked into one meaning and may be at Piaget's pre-operational stage in which there is an irreversibility in the child's thinking. The six-year-olds may be at a transition between the preoperational and concrete-operational stages and can appreciate both meanings but not be able to really shift. However, the eight-year olds may be at the concrete-operational stage and can use their newly acquired cognitive abilities to decentralize their attention and use the context more. But it should be noted that even the eight-year olds did not shift 50 percent of the time.

From Hirsh-Pasek, Gleitman and Gleitman (1970), it is obvious that young children are unable to give accurate judgments concerning ambiguity. They overcame the problems of ambiguity presentation in experimentation, by using a verbal joke format, since the bias shift is the key property of certain verbal jokes. Young subjects do here given evidence of competence for ambiguity in verbal jokes at earlier ages; the verbal joke format serves to sharpen their attention and to elicit ambiguity judgments which are not as easily forthcoming with normal sentences.

There are some very interesting possibilities here for ambiguity as a test measure. Very simply, is it possible that ambiguity as a metalinguistic measuring device can be correlated with abilities in other areas, as for example in reading and second language abilities. This is a suggestion we will refer to later in this paper.

To further examine the development of the metalinguistic ability to detect ambiguity, the present study with children between 5 and 13 was carried out. Each child was asked to give two meanings of ambiguous sentences.

The pilot study had shown that 5-year olds' attention span would permit the presentation of about only 5 sentences. Therefore, all the subjects received the same 15 sentences first. However, the 7 to 13-year old children also received an additional 12 sentences making their total number of sentences equal 27.

An equal number of sentences which were lexically ambiguous, ambiguous at the surface level, and ambiguous at the underlying level were selected. Examples of each type are: Lexical, The cow ran into the barn; surface, My grandmother used to fry pancakes in her stockings; underlying, The chicken is ready to eat.

The number of sentences of each type of ambiguity -- lexical, surface, and underlying -- where the child perceived two meanings was the datum used in the analyses. The first analysis included the five-year-old children, and, therefore, used only the 15 sentences that all the children received. Both the factor of age and the factor of sentence were significant. The means associated with this analysis can be seen in Table 1.

Insert Table 1 about here

The second analysis also used age and type as factor in a 4X3 ANOVA where only the data from children over seven years of age were included and all 27 sentences were used. This analysis also showed age and type as significant. The means associated with this analysis can also be seen in Table 1.

The two sets of results appear consistent with each other as well as with past research. The results with the youngest children, the 5-year olds, show that for all intents and purposes they are not perceiving two meanings of the ambiguous sentences, (see Table 1). The results demonstrate a steady increase with age in the perception of two meanings. Also, at each age level the lexically ambiguous sentences are generally easier than the structurally ambiguous ones. Finally, notice that the 13-year-old children are perceiving two meanings for almost all of the lexically ambiguous sentences and about on half of the structurally ambiguous sentences.

The finding that the youngest children were not able to perceive both meanings of the ambiguous sentences is consistent with both Shultz and Pilon's (1973) and Frommer's (1975) work. There is a suggestion that the youngest children lock in on one meaning of an ambiguous sentence and are somehow unable to perceive the other meaning. Our pilot work with even younger children than those used in the repesent study suggests this as well. Even when an attempt was made to coax the second meaning of an ambiguous sentence with a picture illustrating it, these children seem not able to perceive it. The focussing on one meaning of a lexically ambiguous sentence can occur even when the children may be able to perceive both meanings of the ambiguous word when it is presented in isolation. Frommer's study has demonstrated this. It may be that some aspect of the sentence context locks the child into one meaning of the ambiguous word.

Also consistent with the past work is the finding that two meanings of lexically ambiguous sentences are perceived more readily than the two meanings of structurally ambiguous sentences. However, while several studies find the same with adults, not all the studies with adults are consistent on this point. It may not be universally the case, see, for example, a study by Hoppe and Kess (1980) that reports easier detection of surface structure ambiguity in Japanese.

It is interesting to note that the oldest children did not reliably report the two meanings of all the sentences, particularly those which were structurally ambiguous. While these same sentences have not been tested on adults, most of them came from our studies with adults where items to detect the ambiguity were measured. In these studies (Hoppe and Kess,

1980, Hoppe and Kess, In press) failure to detect the ambiguity occurred approximately four percent of the time demonstrating that most adults perceive both meanings most of the time. Therefore, it appears that the metalinguistic ability to detect ambiguity is not completely developed by the age of 13. Moreover, detection and ambiguity resolution are not linguistic abilities which are exhibited in the same fashion or in the same degree by all adult subjects in psycholingustic tasks; rather, one finds considerable individual differences in this area. Adults seem to vary in metalinguistic abilities, and this seems to roughly match up with the latency of appearance of the same skills in developmental terms. In other words, the more variability among adult speakers of the language, the more likely it is that such skills will emerge relatively later in the child's acquisition sequence.

Finally, the detection of ambiguity has been shown to be related to second language acquisition. Cummins and Mulcahy (1978) found that first and third grade native English-speaking children who were relatively fluent in Ukranian as a second language were better able to detect two meanings of ambiguous sentences than were children who were unilingual or who had some training in the second language but who were not fluent. The ambiguity task was that of Kessel's (1970) where the child selected two of four stick drawings which illustrated the two meanings, a relatively easier task than used in the present study and most other studies. While it has been found that bilinguals are better able to detect ambiguity than unilinguals,

we may not readily conclude that the relationship operates in the other direction and that children who are better able to detect ambiguity are better able to acquire a second language. However, we submit that such a relationship may exist and is certainly a worthy subject for future research.

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TABLE 1

Mean Number of Double Meanings seen by Children of each Age Group

First 15 sentences
Ambiguity

Age	Lexical	Surface	Underlying
5	.84	.05	.16
7	1.74	.32	.79
9	3.10	.89	1.79
11	4.05	1.74	2.21
13	4.16	2.42	2.79

27 Sentences
Ambiguity

Age	Lexical	Surface	Underlying
7	3.00	1.79	1.37
9	5.37	2.57	3.89
11	7.21	4.42	5.10
13	7.37	5.16	5.42