Ph. D. Psychology

LANGUAGE ACQUISITION AND MOTHERS' SPEECH TO CHILDREN

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The common view of developmental psycholinguists has been that language acquisition is a remarkably fast process which occurs with a minimum of environmental stimulation. In the present report an attempt was made to assess this view by characterizing the primary linguistic data actually available to successful language learners. It was found that the speech of middle class mothers was simpler and more redundant when they spoke to two-year-olds than when they spoke to ten-year-olds. Further, the children played some role in eliciting the speech modifications, since mothers did not modify their speech as much when talking to two-year-olds whose responses they could not observe. Task difficulty had no effect on the production of mothers' speech modifications, indicating that these modifications are not a response to children's general cognitive immaturity. Non-mothers performed almost as well as mothers in predicting the speech modifications which children require. Children were less attentive and less compliant when listening to unmodified adult speech. These responses to unmodified speech might be the means by which children elicit speech modifications from adult speakers.

Children who are learning language seem to be equipped with techniques for modifying and selecting their primary linguistic data. Thus they can learn language on the basis of a sample of speech which is simpler, more consistent, more redundant, and less confusing than normal adult speech.

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by

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Students of the process of language acquisition have in recent years emphasized the remarkable speed and ease with which children learn language, especially considering the poverty of the primary linguistic data available (N. Chomsky, 1965, 1968; McNeill, 1966b). These theorists point out that a child normally begins to talk at about 18 months of age, and by three-and-one-half years has mastered all the rules of the adult language, seemingly without much effort. This occurs despite the fact that the language the child hears from adults is often characterized by mistakes, garbles, false starts, mispronunciations, and stutters. The common view of the process of language acquisition is well stated in the following quotations.

> How an untutored child can so quickly attain full mastery of a language poses a challenging problem for learning theorists. With diligence, of course, an intelligent adult can use a traditional grammar and a dictionary to develop some degree of mastery of a new language; but a young child gains perfect mastery with incomparably greater ease and without any explicit instruction. Careful instruction and precise programming of reinforcement contingencies do not seem necessary. Mere exposure for a remarkably short period is apparently all that is required for a normal child to develop the competence of a native speaker (Miller & Chomsky, 1963, pp. 275-276).

> In approximately thirty months, therefore, language is acquired, at least that part of it having to do with syntax.... On the basis of a fundamental capacity for language, each generation creates language anew, and does so with astonishing speed (McNeill, 1966a, p. 99).

> Man's cognitive apparatus apparently becomes a language receiver and transmitter, provided the growing organism is exposed to minimum and haphazard environmental events (Lenneberg, 1969, p. 640).

The speed and ease of language acquisition is accepted as

evidence that the child comes to his language-learning task largely preprogrammed for that task, perhaps with innate language universals (McNeill, 1965a, 1965b, 1967), or perhaps with an innate language acquisition methodology (Fodor, 1966). One major problem confronting the developmental psycholinguist is to determine the nature of the innate abilities which equip the child so well for language acquisition. In order to be specific about the degree of sophistication of the child's innate language acquisition abilities, it is essential to consider the facts that (a) language acquisition requires more time than most theorists have suggested and (b) differences in the quality of the linguistic environment affect both the time course of language acquisition and the quality of language performance. The evidence relating to these two points will be discussed in the following sections.

The Time Course of Language Acquisition

The hypothesis that language acquisition is very fast and very easy has often been accepted uncritically. The 30 months proposed by McNeill as the time necessary for language acquisition is undoubtedly a conservative estimate. Children surely start learning something about language well before the age of 18 months. Though not yet able to express their knowledge in terms of their linguistic output, children of 10 or 12 months can demonstrate that they understand some of what is said to them (Fraser, 1966).

Syntax is most rapidly acquired between the ages of 18 and 36 months, and before the age of four years children control most

adult constructions. Nevertheless, considerable changes in the child's language performance continue to occur throughout the following years. Menyuk (1963a, 1963b, 1964a, 1964b) has found improvement until the first grade in the control of such transformations as the passive, auxiliary with "have," "if" clauses, "so" clauses, and nominalization (also see Brannon, 1968). In tests of comprehension and production of constructions embodying various syntactical and morphological rules, children show imperfect performance, compared to adult norms, sometimes as late as the age of puberty. Improvement after age four has been found in the use of rules for the formation of plurals (Anisfeld & Tucker, 1967; Berko, 1958; Lovell & Dixon, 1967), for direct and indirect objects (Lovell & Dixon, 1967), for pronoun reference and the Minimum Distance Principle (C. S. Chomsky, 1969), for past and future tenses (Herriot, 1968, 1969; Lovell & Dixon, 1967), for passive sentences (Gaer, 1969; Turner & Rommetveit, 1967), for center-embedded sentences (Gaer, 1969), and for certain temporal and causal connectives (Katz & Brent, 1968). In general, the constructions which require the longest time for complete mastery are exceptions to more general rules, that is, those constructions which require knowledge of the restrictions placed on rules (McNeill, 1970). The Russian child described by Gvozdev (cited in Slobin, 1966) was seven or eight years old before he mastered Russian sound and stress alternations and morphology. Also, the speech of American school children showed considerable development until seventh grade, and their written work continued to improve until twelfth grade (Hunt, 1965,

1970; O'Donnell, Griffin, & Norris, 1967).

Taken together, these observations indicate that complete language acquisition requires several years. Furthermore, during the period of most rapid acquisition the child is able to spend literally all his time in learning to talk. The data presented by Weir (1962, 1966) reflect the enthusiasm with which children devote themselves to learning language.

The Child's Linguistic Environment

The poverty of the primary linguistic data available to young children has also been somewhat overstated. The common use of baby talk (Casagrande, 1948; C. A. Ferguson, 1964) suggests that adults' speech to children differs somewhat from their speech to other adults. In middle class homes much active language teaching occurs--parents name objects, tell stories, answer questions, and correct errors. During one period of language development as many as 30% of a child's utterances were expanded by his mother into better-formed or more complete utterances (Brown & Bellugi, 1964). Provision of expansions has been compared to provision of well-formed model sentences as a means of improving children's language performance. Cazden (1965) found that modelling was superior to expanding. However, all the utterances of the children in the expansion group in this experiment were expanded, even if their meaning was not clear. This necessarily led to some anomalous expansions, in which the surface structure expressed by the adult did not correspond to the deep structure in the child's mind. These may have confused the child and masked the beneficial effects of the correct

expansions. Feldman and Rodgon (cited in McNeill, 1970) repeated Cazden's experiment but included a group whose utterances were expanded only if their meaning was clear from the extralinguistic context. They found a clear superiority of the children in this group over children who had heard model sentences; surprisingly, however, even the 100% expansion group was superior to the model group. Thus, though the data concerning the role of expansions in language development are contradictory, it is evident that expansions could provide valuable information to the child who is attempting to discover regularities in the speech of adults (Cazden, 1968; McNeill, 1965a). Brown, Cazden, and Bellugi (1968) have discussed prompting and echoing as further parental training devices. The effectiveness of these devices as aids to language learning has not been experimentally investigated.

Of course not all children are in a situation where they receive parental language training of the sort described above. Children raised in lower class homes or in institutions often have very little access to adults, and the adults available are frequently less accomplished and less interested in conversing with children than are middle class mothers (Stendler-Lavatelli, 1968). Interestingly, it is precisely these institution-raised and lower class or Negro children who show deficiencies in linguistic performance, both in comparison with middle class children, and in comparison with their own non-linguistic abilities (reviewed by Cazden, 1966; Gordon, 1965a; Klineberg, 1963; Pringle & Tanner, 1958; Raph, 1965). Specific findings include the following. Institutionalized preschool children showed retarded development

of vocabulary, sentence structure, comprehension, and expressive ability, when compared to normally raised children of the same age and intelligence (Pringle, 1959). Deficiencies in articulation and speech sound production have been found in lower class children (Davis, 1937; Irwin, 1948; Templin, 1953). Five-year-old white children produced more mature sentence types (complete sentences and elaborated sentences) than Negro children of the same age and social class (Anastasi & D'Angelo, 1952). Negro kindergarten children were deficient in the amount, maturity, and accuracy of speech when compared to white kindergarten children of the same socioeconomic level (Thomas, 1962). Southern Negro children nine- to eleven-years-old were inferior to Northern Negro or northern white children of the same age on tests of verbal communication ability, even though they had been matched for verbal comprehension (Carson & Rabin, 1960). John (1963) found that middle class fifth grade children were better than lower class children in performing an integrative verbal task, a concept-sorting task, and the WISC vocabulary test, but not at a descriptive verbal task. Lower class Negro boys three- to four-years-old who were compared to middle class Negro boys of the same age on a wide variety of intellective tasks were inferior only on the Peabody Picture Vocabulary Test (Palmer, 1970). Lower class Negro children tested with the Illinois Test of Psycholinguistic Abilities showed deficits in the auditory and vocal channels, as compared to the visual and motor channels. Language ages of culturally deprived subjects were significantly lower than their mental ages (Weaver, undated). Lower class

children tested on an extensive battery of mental ability tests showed a large saturation of the general factor with a verbal component, since their verbal skills were not adequate to the minimal verbal demands even of nonverbal tests (Mitchell, Jr., 1956). In a factor analysis of results from 19 visual, auditory, and cognitive tests, the general language ability factor differentiated between the lower and middle class groups most effectively (Ryckman, 1967).

All these studies might be criticized on the basis that motivational differences between the groups could result in performance differences even if actual abilities did not differ. However, this fails to explain why language and language-related performance suffer more than nonverbal performance (Gordon, 1965b; Whiteman & Deutsch, 1968). It is also possible that lower class and especially Negro children score lower because of their inability to speak standard English. However, the same kind of class differences show up in a wide variety of tasks--articulation, vocabulary, sentence complexity, accuracy of communication, and verbal IQ tests. This suggests that differences in dialect can not explain the differences between the groups. The basic question of importance is whether nonstandard dialects are intrinsically poorer modes of communication than standard English, a point which cannot yet be decided with any assurance (for discussion of this point, see Cazden, 1966; Fries, 1940; Loban, 1963). If nonstandard dialects are not poorer modes of communication, then lower class children's verbal deficiencies must be a result of poor language learning, not just of poor language. If they are

poorer modes, then this is further indication that language is learned through long exposure and teaching, since the quality of language learned is not affected by television, radio, middle class teachers, or all the inputs of standard English available. Finally, Houston (1970) has presented a compelling criticism of conclusions drawn from studies of linguistic performance in lower class children. She reported that the linguistic deficiencies of lower class children are characteristic only of their "School register," or the language which they use with strangers and figures of authority. She found that the "Nonschool register," used in informal situations with family and friends, is as imaginative, expressive, and syntactically diverse as the language of middle class children. Assuming that the existence of a more expressive register is confirmed both for other groups of lower class children and for children raised in institutions, it remains to be explained why lower class children should be so susceptible to the formation of a deficient school register. Also, it would be interesting to see whether middle class children possess a nonschool register which is even superior to their tested language performance.

Among the many explanations offered for the linguistic deficiencies of lower class children, several select the child's verbal environment as a key factor. Bernstein suggested that lower class children show deficiencies because they have access only to a restricted language code, which is unable to express nuances of meaning with the same precision that is possible for middle class children who can also speak an elaborated code

(Bernstein, 1961a, 1961b, 1962a, 1962b; Lawton, 1963, 1964). Furthermore, he has found that lower class children whose mothers score high on an index of maternal communication do better in ability tests and in school prognosis than lower class children whose mothers are less communicative (Bernstein & Brandis, 1970). Maternal language style is correlated with a large number of variables, including among others the social class of the mothers and the ability of their children to solve various conceptual and verbal tasks (Hess & Shipman, 1965a, 1965b; Olim, 1970; Olim, Hess, & Shipman, 1965, 1967; also see Bee, van Egeren, Streissguth, Nyman, & Leckie, 1969). Holzman (1969) has suggested that lower class mothers tend to use simple, explicit commands and therefore never give their children a chance to develop facility with implicit, elliptical statements. Middle class mothers give their children more direction and more direct interactive contact than lower class mothers (Zunich, 1961). Strodtbeck (1967) has described the "hidden curriculum" of the middle class home, which teaches children that they gain power through verbal expression. Lower class children gain parental approval through silence and inactivity. Milner (1951) found that children's verbal skills were correlated positively with the amount of verbal interaction the children had at home with adults.

An even more powerful indication that the lower class child's impoverished linguistic environment is the cause of his linguistic deficiencies arises from the findings that stimulation of verbal interaction between mothers and children improves the children's verbal performance (Irwin, 1960; Karnes, Teska, Hodgins,

& Badger, 1970; Levenstein, 1969; Levenstein & Sunley, 1968; Strickland, 1967).

In summary, the development of language requires a considerable amount of time and effort, and can be seriously disrupted if primary linguistic data are poor. If language acquisition is to be fast, easy, and complete, it is probably not enough for a child merely to overhear adult conversations or to watch television. It is likely that the child must at least be talked to. Furthermore, in order for the speech he hears to be useful as primary linguistic data, it probably must be within certain limits of grammatical difficulty and semantic relevance. As Fraser speculated:

> If a child were kept in a darkened room, fed by machine, and hit over the head at five-minute intervals would he acquire English even if normal adult conversation were provided twenty-four hours a day? Perhaps not (1966, p. 118).

In fact, it seems unlikely that a child who heard the Encyclopedia Britannica read aloud during all his waking hours would ever learn to speak English, even if normally mothered, fed, cuddled, and cared for.

The Present Investigation

The nature of the language acquisition process will be best understood in light of realistic information about the speed and ease of that process, and about the kind of primary linguistic data which are necessary or helpful to the process. In Experiments 1 through 3 of the present report an attempt was made to characterize the language heard by children in middle class homes, that is, the language which other investigators have suggested is optimal

for language development. In the present experiments the speech of middle class mothers to young children was described in terms of various stylostatistical measures, and this speech was compared to the speech of the same mothers to older children and to "unseen, unheard" children. Mothers' speech to young children was subsequently compared to the speech of non-mothers to young children. The results of these experiments provided a description of the linguistic input normally available to highly successful language learners. Finally, in Experiment 4 a comparison was made between children's responses to modified and to normal speech, in order to determine whether children actively solicit the modifications of mothers' speech found in Experiments 1 through 3.

Experiment 1

The previously reviewed evidence from studies of social class differences in children's language performance suggests that middle class mothers may provide a superior linguistic environment for their children. Casual observation of middle class mothers with their children indicates that their speech is less complex and more redundant in this situation than in conversation with adults. However, Fodor (1966) suggested that the optimal linguistic environment would provide very complex speech, since only if complex speech were available would a child produce the most complete hypotheses concerning grammatical rules of which he was capable. Hearing only simplified speech would delay production of the ultimately correct hypotheses by leading the child to spend time producing and testing unnecessarily simple hypotheses.

Therefore, Experiment 1 was conducted to see whether mothers modify their speech in the presence of young children, and to describe any modifications which occur. If mothers modify their language for young children, it is of further interest to discover whether they do so because of their prior expectations concerning the level of complexity which best facilitates communication. Alternatively, it is possible that a child's attention wanders when his mother's speech becomes too complex to be understood. The mother may then modify her speech until she successfully regains the child's attention so that he answers questions and follows directions.

Mothers were observed while they conversed with children who were just learning how to talk. Their speech to these young children was compared to their speech to older children. To be able to gauge the influence of the child's reactions on the mother's speech, mothers were also observed while speaking to children whom they could not see or hear. Thus, in this experiment the two factors of primary interest were (a) the age of the child being addressed by the mother and (b) the presence of the child in the room with the mother.

Method

Subjects. Twenty-four mothers along with their 24 children participated in the experiment. All the mothers were university graduates who volunteered to take part after being contacted through their alumni association. They had been asked to participate in an experiment concerning "how children learn language," and all the mothers assumed that only the children were being tested. Twelve of the mothers had children who were approximately two years of age. Among the children in this group there were 2 girls and 10 boys, ranging in age from 2 years, 0 months to 3 years, 0 months (2-0 to 3-0), with a mean age of 2-6. The other 12 mothers had children approximately 10 years of age. Among these children there were 5 boys and 7 girls, who ranged in age from 9-5 to 12-4, with a mean of 10-10. In the interest of simplicity these groups will be referred to as the two-year-olds and the ten-year-olds.

Most of the mothers tested had other children, but none had other children who fell within the age range of the other group.

All the mothers except one mother of an older child spoke English as a first language, and all normally spoke to their children in English. All the children spoke English as a first language.

Tasks and testing materials. In order to elicit diverse speech styles from the mothers, three different kinds of tasks were devised for the mothers to perform with the children.

1. Story telling: The mother was instructed to make up a five-minute story on the basis of a picture provided for her and to tell the story to the child. In order to preserve the illusion that the child and not the mother was being tested, the mother was instructed to have the child repeat the story. Children's Apperception Test pictures Numbers 3 and 4 were used as the basis of the stories since they provided considerable pictorial content. Picture Number 3 depicts a seated lion smoking a pipe while a mouse peeks out of a hole in the corner of the room. This picture was used for the two-year-old children. Picture Number 4, used for the ten-year-olds, depicts a mother kangaroo carrying a basket down a road, accompanied by a baby in her pouch and a young kangaroo on a tricycle.
2. Object sorting: In the second task a number of small plastic toys was used. These toys included figures of astronauts, cowboys, Robin Hood characters, cars, trucks, boats, planes, horses, cows, and pigs. Five different colors were represented by the objects. The child was

instructed by the mother to sort the objects successively in the following ways: (a) by color, (b) into an animate and an inanimate group, (c) into a group used for transportation and a group not used for transportation, and (d) freely, as the child wished to sort them. The mother was provided with a scoring sheet and was asked to record the child's responses.

3. Understanding of physical laws: The first two tasks were much more difficult for the two-year-olds than for the ten-year-olds. Therefore, the third task was selected in an attempt to find something of approximately equal difficulty for all the children. Accordingly, two Piaget tasks were selected. For the two-year-olds, mothers explained conservation of volume, a concept which is not usually understood until five to seven years of age, depending on the kind of test used (Bruner, 1966; Piaget & Inhelder, 1962). The child's task was to predict that two differently shaped beakers could contain equal amounts of water. The mother's task was to explain the principle to the child. She had available two large and two small beakers and a pitcher of water to aid her explanation. The task for the ten-year-olds was to take a number of different sized rings and interpose them between a spotlight and a screen so that all the rings cast equal sized shadows, and then to explain the principle which enabled them to do this. According to Piaget's norms the generalized principle by which one

solves this problem is not available until stage III-B, normally about fourteen years of age (Inhelder & Piaget, 1958). The mother's task was to explain the nature of the light cone emanating from the spotlight so that the child might be able to derive the solution to the problem and place the rings correctly.

Testing procedure. Appointments were scheduled so that the mother of a two-year-old and the mother of a ten-year-old came to the laboratory at the same time. The mothers were taken to separate testing rooms without the children and were given printed instruction sheets with directions for the three tasks described above. The mothers were asked to read the sheets. Any questions they had about the tasks were answered. It was explained that each mother would be helping her own child and another child of a different age from her own child to perform these tasks. Half the mothers did the tasks with their own children first and half did the tasks with the other children first.

As a pretext for collecting data in the Absent condition, the mothers were then told that children's reactions to tape-recorded instructions given in the absence of adults were also going to be studied. They were asked to help us in this study by taping their stories and explanations with no children present in the room. They were told that they could consider this a rehearsal for what they would subsequently say in the presence of the children. When each mother had finished taping instructions for the absent child, the mother repeated all three tasks with the child present. The entire session with the

child was tape-recorded. The experimenter was not present during any of the actual testing.

When each mother had completed the three tasks with the first child, she repeated the entire procedure with the child of the other group. Half the mothers followed this sequence of conditions:

I. a. Talking to a two-year-old who was not present.

b. Talking to a two-year-old who was present.

II. a. Talking to a ten-year-old who was not present.

b. Talking to a ten-year-old who was present.

Conditions I and II were reversed for the other half of the mothers. Condition b always followed Condition a. Subjects were not given the Child-present condition before the Child-absent condition because it was felt that memory of the child's responses could then have influenced the mother in the Child-absent condition, thereby undermining the appearance of any Child-present effect on the mother's behavior.

Scoring procedures. Tapes of the experimental sessions were transcribed and all scoring was done on the typewritten transcriptions. Included in the transcription were all of the mother's speech, all of the child's speech in repeating the story, and after that only as much of the child's speech as was necessary to understand the conversation. Only the mother's speech was included in the scoring. Measures 1 through 10 described below were borrowed or adapted from the Language Styles Scoring Manual (Olim, undated). The last three measures were devised to test hypotheses specific to this experiment.

1. Quantity of Speech: Total number of words spoken.
2. Mean Length of Utterance: Ratio of the total number of words spoken to the total number of utterances. An utterance was defined as the expression of a complete thought. They were scored by listening to the tapes and marking the transcriptions as indicated by phonetic cues and pauses in the mothers' speech. Thus, what was scored as a complete utterance was not necessarily a complete sentence as defined by traditional grammar.
3. Sentence Complexity: Ratio of the number of compound verbs plus subordinate clauses to the total number of utterances.
4. Mean Pre-verb Length: Ratio of the total number of words before the main verb in all clauses to the number of clauses. Imperatives were excluded from both these counts.
5. Incidence of Imperatives: Ratio of the total number of imperative sentences to the total number of utterances.
6. Incidence of Utterances without Verbs: Ratio of the number of utterances that did not contain verbs to the total number of utterances.
7. Incidence of Contractions: Ratio of the number of contractions to the total number of words.
8. Incidence of First-person Pronouns: Ratio of the total number of occurrences of the pronouns I, me, my, mine, we, us, our, and ours to the total number of words in the protocol.

9. Incidence of Second-person Pronouns: Ratio of the total number of occurrences of the pronouns you, your, and yours to the total number of words.

10. Incidence of Third-person Pronouns: Ratio of the total number of occurrences of the pronouns he, she, it, they, him, her, them, his, her, hers, its, their, and theirs to the total number of words.

11. Incidence of Complete Repetitions: Ratio of the number of complete repetitions of sentences (that is, utterances which contained both subjects and verbs) to the total number of utterances. Repetitions were scored only if they occurred within three utterances of the original sentence.

12. Incidence of Partial Repetitions: Ratio of the number of repetitions of one or more major units within an utterance (for example, repetition of the subject phrase or a subordinate clause) or of an entire utterance without a verb to the total number of utterances. If all major units were repeated, a Complete Repetition was scored. If only some of the units were repeated, a Partial Repetition was scored. Again, the repetition was scored only if it occurred within three utterances of the original.

13. Incidence of Semantic Repetitions: Ratio of the number of repetitions of the meaning of a previous utterance which did not include repetition of any of its grammatical units to the number of utterances. An utterance was

scored as a Semantic Repetition only if it was a true paraphrase and did not qualify as a Complete or a Partial Repetition. The repetition was scored only if it occurred within three utterances of the original.

Statistical procedures. The three repetition scores described above depended to some extent upon the subjective judgment of the scorer. Accordingly, a judge who was unaware of the parameters and purposes of the experiment was trained to score the repetition measures. The scores obtained by the experimenter and by the naive judge were tested for interjudge reliability using Pearson's product-moment correlation coefficient (G. A. Ferguson, 1966). For the Partial Repetition score, $r = .70$; for the Semantic Repetition score, $r = .87$; for the Complete Repetition score, $r = .89$. These reliability scores were highly significant ($p < .01$). On the basis of these results, the scores for the two judges were averaged and the mean was used as each subject's score. Since the first ten measures described above were simple counting procedures, no reliability scores were calculated for them.

Lack of co-operation by several two-year-olds who were unwilling to converse with women other than their own mothers resulted in 12 missing scores. In order to be able to apply an analysis of variance for repeated measures to the results, these scores were estimated according to the procedure described in Winer (1962). The estimated scores were then treated like all the other scores in the analysis of variance. Degrees of freedom were subtracted from the error terms to compensate for the

effects of estimation (Winer, 1962).

Scores were analyzed separately for the story, as well as for the entire protocol, on the three measures which were thought most likely to show a difference between narrative and non-narrative styles of speech, Quantity of Speech, Mean Pre-verb Length, and Incidence of Third-person Pronouns.

A three-way analysis of variance was performed for each stylostatistical measure, the main factors being Groups (mothers of two-year-olds and mothers of ten-year-olds), Age (two-year-old or ten-year-old children being addressed), and Presence (children either absent or present). Considering the hypothesis that two-year-olds would elicit differences in mothers' speech if the children were present to respond to that speech, the most interesting condition became the Two-year-old Present condition. Accordingly, Scheffé tests (1953) were performed for all the measures, including those which did not show any significant main effects in the analysis of variance (see G. A. Ferguson, 1966, for a discussion of a priori means tests).

Results

Cell means and significant effects for the three-way analyses of variance are shown in Table 1. In no case did the Groups effect, that is, the difference between the mothers of two-year-olds and the mothers of ten-year-olds, reach significance. Therefore, the two groups have been pooled in the presentation of the data. The separate cell means for the two groups are shown in Appendix I. Summary tables for the analyses of variance which showed significant effects are given in Appendix II.

For ease of interpretation, results of related measures will be considered together.

1. Quantity of Speech measures: The analysis of variance indicates that both in the story situation and in the entire protocol mothers talked longer when a child was present in the room. For the entire protocol, mothers also talked longer to two-year-olds than to ten-year-olds. The Age X Presence interaction for Quantity of Speech in the entire protocol was significant, because the increase of scores in the Present condition was much greater for two-year-olds than for ten-year-olds. Results of the Scheffé tests (indicated by lines between the cell means in Table 1) for the entire protocol show that the Two-year-old Present condition was significantly different from all the others, and the Ten-year-old Present condition was significantly different from the Ten-year-old Absent condition. There was no difference in the Quantity of Speech between the Two-year-old Absent and the Ten-year-old Absent conditions. Scheffé tests on the Quantity of Speech scores in the story indicate that the mothers spoke significantly longer to two-year-olds who were present than to either two-year-olds or ten-year-olds who were absent. No other differences were statistically significant.

2. Complexity of Speech measures: Mean Length of Utterance, Sentence Complexity, and Mean Pre-verb length are all measures of the grammatical complexity of speech. In

each case a higher score indicates more complex speech. Mean Length of Utterance and Sentence Complexity showed significant differences for the Age and Presence factors for the entire protocol. Mean Pre-verb Length and Mean Pre-verb Length in the story task showed only a Presence effect, although the Age effect approached significance for Mean Pre-verb Length in the entire protocol. Mean Pre-verb Length and Sentence Complexity also showed a significant Age X Presence interaction; both these interactions reflect a much greater difference between Present and Absent scores in the Two-year-old than in the Ten-year-old condition. In every case, the Absent condition elicited more complex speech than the Present condition, and the ten-year-olds elicited more complex speech than the two-year-olds. Scheffé tests for all three main measures show an identical pattern; there were no significant differences among the Two-year-old Absent, Ten-year-old Absent, and Ten-year-old Present conditions, but all of these differed significantly from the Two-year-old Present condition. Significantly less complex speech was observed in the Two-year-old Present condition, compared to every other condition, and on every measure of complexity. The same pattern was observed in Mean Pre-verb Length in the story task, except that here there was no difference between the Two-year-old Present and the Ten-year-old Present conditions.

3. Repetition measures: All three repetition measures showed significant Age and Presence effects. In all cases mothers made more repetitions to two-year-olds than to ten-year-olds. Also, Complete Repetitions and Semantic Repetitions occurred more frequently in the Present than in the Absent condition. Scheffé test results for these two repetition measures show the same pattern as for the complexity measures. Thus, more repetitions occurred in the Two-year-old Present condition than in any of the other conditions, which did not differ one from another. This pattern is confirmed by the significant Age X Presence interaction for Semantic Repetitions. However, the direction of the difference between the Absent and the Present conditions was reversed in the results for Incidence of Partial Repetitions. There were more Partial Repetitions in the Absent condition than in the Present condition. Scheffé tests indicate that the Two-year-old Absent condition elicited significantly more Partial Repetitions than any of the other conditions. The Two-year-old Present condition also elicited more Partial Repetitions than the Ten-year-old Present condition.

4. Incidence of Pronouns: Of the four pronoun measures taken, only the Incidence of Second-person Pronouns and the Incidence of Third-person Pronouns showed any significant main effects. More second-person pronouns were used in the Present condition and in the Two-year-old condition.

Scheffé tests show that the Two-year-old Present condition elicited more second-person pronouns than either the Two-year-old Absent condition or the Ten-year-old Absent condition, but not significantly more than the Ten-year-old Present condition. Similarly, the Ten-year-old Present condition elicited more second-person pronouns than the Ten-year-old Absent condition. Significantly fewer third-person pronouns were used in the Present and the Two-year-old conditions. Scheffé tests indicate that fewer third-person pronouns were used in the Two-year-old Present condition than in either Ten-year-old condition, and fewer were used in the Two-year-old Absent condition than in the Ten-year-old Absent condition.

5. Incidence of Imperatives: Incidence of Imperatives showed a significant Presence effect but no Age effect. Scheffé tests indicate that more imperatives were elicited in the Two-year-old Present condition than in either Absent condition, and more imperatives were elicited in the Ten-year-old Present condition than in the Two-year-old Absent condition.

6. Utterances without Verbs: Both Presence and Age factors were significant for Incidence of Utterances without Verbs. More utterances which were incomplete sentences were elicited by two-year-olds, and more were elicited in the Present condition. Scheffé test results show that the Two-year-old Present condition elicited more

utterances without verbs than either Absent condition, and the Ten-year-old Present condition elicited more utterances without verbs than the Ten-year-old Absent condition.

7. Incidence of Contractions: The analysis of variance and Scheffé tests show no significant effects for Incidence of Contractions.

Several significant interaction effects occurred. The significant Age X Presence interactions have already been noted. These interactions simply emphasized the pattern seen in the Scheffé test results; the Presence factor had a much greater effect in the Two-year-old condition than in the Ten-year-old condition.

Incidence of Contractions showed a significant Groups X Presence interaction. Inspection of the relevant cell means (Table 2) reveals that mothers of two-year-olds modified their production of contractions in the presence of children more than did mothers of ten-year-olds.

Cell means for measures which showed significant Groups X Age interactions are given in Table 3. These interactions can perhaps best be understood as differences between mothers talking to their own children and to strangers' children. In the Quantity of Speech measures the interaction appears because mothers of two-year-olds talked more to their own children than to the older children, while mothers of ten-year-olds talked about the same amount to both groups of children. The two complexity measures, Mean Length of Utterance and Sentence Complexity, reveal that mothers of two-year-olds used less

TABLE 1

Results of statistical analyses for Experiment 1.

MEASURE		MEANS		ANALYSIS OF VARIANCE SIGNIFICANT EFFECTS		
		2-year-olds	10-year-olds	Age	Presence	Age X Presence
Quantity of Speech	Absent	426.7	390.0	.01	.01	.05
	Present	1448.2	861.2			
Quantity of Speech in Story Task	Absent	291.4	297.1		.01	
	Present	445.9	394.9			
Mean Length of Utterance	Absent	9.839	11.245	.01	.01	
	Present	6.596	9.633			
Sentence Complexity	Absent	0.473	0.543	.01	.01	.05
	Present	0.189	0.464			
Mean Pre-verb Length	Absent	2.685	2.594		.01	.01
	Present	2.044	2.448			
Mean Pre-verb Length in Story Task	Absent	2.709	2.604		.01	
	Present	2.268	2.487			
Incidence of Imperatives	Absent	0.058	0.069		.01	
	Present	0.164	0.120			
Utterances without Verbs	Absent	0.074	0.043	.05	.01	
	Present	0.165	0.121			

Note: Scheffé test results are indicated by lines between cell means; ——$p < .01$, ...$p < .05$.

TABLE 1, continued

MEASURE		MEANS		ANALYSIS OF VARIANCE SIGNIFICANT EFFECTS		
		2-year-olds	10-year-olds	Age	Presence	Age X Presence
Incidence of Contractions	Absent	0.029	0.031			
	Present	0.037	0.033			
First-person Pronouns	Absent	0.021	0.017			
	Present	0.023	0.023			
Second-person Pronouns	Absent	0.021	0.013	.05	.01	
	Present	0.040	0.035			
Third-person Pronouns	Absent	0.049	0.062	.01	.01	
	Present	0.039	0.051			
Third-person Pronouns in Story Task	Absent	0.057	0.067			
	Present	0.057	0.067			
Complete Repetitions	Absent	0.008	0.003	.01	.01	
	Present	0.029	0.007			
Partial Repetitions	Absent	0.284	0.138	.01	.01	
	Present	0.157	0.105			
Semantic Repetitions	Absent	0.059	0.032	.01	.01	.05
	Present	0.136	0.049			

Note: Scheffé test results are indicated by lines between cell means; —— $p < .01$, ... $p < .05$.

TABLE 2

Cell means for the measure which showed a Groups X Presence interaction in Experiment 1.

MEASURE		MEANS		SIGNIFICANCE LEVEL
	Condition	Mothers of 2-year-olds	Mothers of 10-year-olds	
Incidence of Contractions	Absent	0.024	0.036	.05
	Present	0.036	0.034	

TABLE 3

Cell means for the measures which showed Groups X Age interactions in Experiment 1.

MEASURE		MEANS		SIGNIFICANCE LEVEL
	Condition	Mothers of 2-year-olds	Mothers of 10-year-olds	
Quantity of Speech	2-year-old	1084.7	790.2	.05
	10-year-old	567.7	680.8	
Quantity of Speech in Story Task	2-year-old	371.7	370.6	.05
	10-year-old	278.2	413.7	
Mean Length of Utterance	2-year-old	7.833	8.603	.01
	10-year-old	11.399	9.479	
Sentence Complexity	2-year-old	0.284	0.379	.01
	10-year-old	0.578	0.429	

complex language when speaking to the younger children and more complex language when speaking to the older children than did the mothers of ten-year-olds. The mothers of ten-year-olds simplified their speech somewhat for two-year-olds, but also spoke more simply to the ten-year-olds than did the other group of mothers.

Discussion

The results of Experiment 1 strongly indicate that when adults address children who are just learning how to talk they modify their speech in characteristic ways. These modifications include reduction of grammatical complexity, increase in repetition, decrease in the use of third-person pronouns, and increase in the use of second-person pronouns and utterances without verbs. Viewed as a whole, these modifications effectively simplify the grammatical structure and give redundant information about the meaning of adults' speech. The finding that mothers used more utterances without verbs when speaking to two-year-olds strongly suggests that the grammatical modifications which occur favor simplicity and redundancy over rigidly correct information about the rules for producing sentences.

On all the measures where a significant difference occurred between mothers speaking to two-year-olds and to ten-year-olds, there was also a significant difference between the Absent and Present conditions. In every measure except one (Incidence of Partial Repetitions), the direction of the change was the same in the Present condition and in the Two-year-old condition. Scheffé test results and the Age X Presence interactions confirmed

that if mothers modified their speech for two-year-olds, they did so only when the children were present. In the case of the three complexity measures and the three repetition measures mothers modified their speech only for the two-year-olds and not for the ten-year-olds. These data suggest that modifications in the mothers' speech result from the children's demands for simplified speech.

It is not clear why Incidence of Partial Repetitions, alone among the repetition measures, should have been greater in the Absent condition than in the Present condition. Mothers, especially the mothers of two-year-olds but also to some extent the mothers of ten-year-olds, seem to have predicted that repetition of key phrases would help young children to understand and to follow directions. They were apparently unable to predict that complete repetitions, paraphrases, or grammatical simplification would have the same effect.

The Groups interaction effects show that mothers of two-year-olds were more sensitive than the mothers of ten-year-olds to the demands made by the two-year-old children. Whenever a significant interaction occurred the mothers of two-year-olds made greater modifications than the mothers of ten-year-olds, both in the Present condition and in the Two-year-old condition. The occurrence of several Groups X Age interaction effects probably means that the children's demands were more effective with their own mothers than with strangers. It is not clear whether cues to their own mothers are more effective because the children's behavior changed with unfamiliar women or because the women could

not respond correctly to cues from unfamiliar children.

Quantity of Speech in the story-telling task and Incidence of Imperatives showed a significant Presence effect but no Age effect. These measures are thus not of particular interest in that they represent only a generalized difference between speech styles to responsive and to unresponsive listeners, but do not tell us anything about modifications made especially for young listeners. Although Mean Pre-verb Length also showed no significant Age effect, it is of greater interest because (a) it was almost significant and (b) it is a measure of speech complexity, which as gauged by other measures is clearly affected by the age of the listener.

The speech of middle class mothers in the Two-year-old Present condition was in some ways similar to the speech of lower class mothers as previously described by Hess and Shipman (1965b). This similarity is surprising since Hess and Shipman viewed the lower class mothers' simplified, restricted speech style as a cause of the cognitive deficiencies which they observed in lower class children. However, it should be noted that the mothers in Hess and Shipman's study were talking to four-year-old children, who were old enough to understand more complex speech. Middle class mothers did in fact produce more complex speech for four-year-olds (Hess and Shipman, 1965b). The linguistic deficiencies of lower class children may result from the inability of their mothers to respond to changes in the children's abilities. Perhaps middle class mothers are so effective in teaching their children to talk because they are especially responsive to the developing

needs and linguistic capacities of the children. Thus, they provide a good "match" between the children's language abilities and the language they hear. For a two-year-old child they provide redundant, grammatically simple speech, and for a four-year-old child they provide semantically richer, grammatically more complex speech.

Experiment 2

The results of Experiment 1 indicated that mothers modify their speech for young children, to some extent in response to cues provided by those children. A two-year-old is linguistically unaccomplished, and it is reasonable to think that he might behave so as to induce adults to simplify their speech. However, the two-year-old's general cognitive abilities are also less developed than those of older children. The problems in Experiment 1 were more difficult for the two-year-olds than for the ten-year-olds. Even the Piaget tasks, which had originally been selected in order to equate difficulty for the two age groups, were in fact somewhat more difficult for the two- than for the ten-year-olds. It is possible that the modifications observed in mothers' speech styles occurred in response to the children's general cognitive deficiencies rather than to their linguistic deficiencies. If the modifications in the mothers' speech were a response to the children's cognitive deficiencies, then these modifications should be more apparent when the mother and child are performing a task which is very difficult for the child. This prediction was tested in Experiment 2.

The manipulation of the Presence factor in Experiment 1 was not entirely satisfactory. Listening to the tape-recordings of the mothers in the Absent condition indicated that not all of them behaved as if they thought these tape-recordings were actually going to be played to children. The fact that the protocols were uniformly shorter in the Absent than in the Present

condition confirmed this conclusion. In order to have more confidence in the effect of the Presence factor, that factor was retested in Experiment 2. In the present experiment each mother was impressed with the fact that the tape-recording she made in the Absent condition would actually be played to her child. The middle class mothers who served as subjects in this experiment tended to view the tasks as tests of their children's intelligence, and thus were highly motivated to make tapes which could effectively direct their children's behavior. Also, in Experiment 2 the order of the Absent and Present conditions was varied, so that possible differences in the mothers' speech could not be attributed to order effects.

Method

Subjects. The subjects were 12 women drawn from the same source as the subjects in Experiment 1, and their children. None had been previously tested. The children ranged in age from 2-3 to 3-4, with a mean of 2-10. There were seven boys and five girls. The mothers were told that their children were being tested in a study of child development. Apparently no mother suspected that her speech and not the child's performance was of primary interest in the experiment.

Tasks and testing materials. Two kinds of tasks were devised for the mothers to perform while speaking to their children. Since each mother-child pair did the tasks in both Absent and Present conditions, two complete sets of problems were required, each set including both an easy and a difficult version of each task.

1. Block selection: A set of commercial plastic stacking blocks was used for the first task. These blocks were available in four colors (yellow, red, blue, and green) and two sizes. The small blocks were square, with a raised impression depicting one of eight animals. The large blocks were rectangular, equal in size to two of the smaller blocks, and each block carried an impression of two different animals. The complete set consisted of three small blocks of each color (12 in all) and six large blocks of each color (24 in all). There were no exact duplicates. The mother was instructed to describe a preselected block to her child so that he could choose that block correctly from among the others. The easy task consisted of selecting a small block with only one picture from among the 12 possibilities. The difficult task consisted of selecting a large block with two animal pictures from among the 24 possibilities.
2. Pattern construction: A set of commercial hardwood blocks of various shapes was used in the second task. The blocks, made from either light- or dark-colored wood, included cubes, small rectangles, large rectangles, and solid triangles. The mother's task was to describe a closed pattern of these blocks (diagrammed for her on her instruction sheet) so that the child could reproduce the pattern, using the blocks and a board marked into appropriately sized squares. The easy problems required placement of five or six blocks, not

including the triangles, while the difficult problems were patterns of 14 to 16 blocks, including the triangles.

Testing procedure. Testing was done in the laboratory. One mother participated with her own child in each testing session. The mothers received instruction sheets with directions for the tasks and space for them to record their children's responses. Half of the mothers received the Absent condition first, and the other half received the Present condition first. All the mothers were asked to perform the tasks in the following order:

Block selection: 1. Easy problem (single block).
2. Difficult problem (double block).

Pattern construction: 1. Easy problem (5-6 blocks).
2. Difficult problem (14-16 blocks).

However, if for some reason the child was unwilling to perform one of the tasks in the suggested order, the mother was instructed to go on to the next problem. During the Present condition the mother was alone with the child and their conversation was tape-recorded. During the Absent condition the mother was entirely alone with the tape recorder and the testing materials. It was carefully explained that the task directions given in the Absent condition would be played back to the child. Immediately after the mother taped the directions in the Absent condition the child was brought back to the testing room. The mother stayed in the room with him while the tape was played back. The mother was of course instructed not to talk to the child about the tasks during the playback of the recorded directions. However, some

general talk, for instance in directing the child's attention to the tape, was unavoidable. The mother wrote down all the child's responses during both the Present and Absent conditions. The experimenter was not present during any of the testing.

Scoring procedure. As in Experiment 1, the tapes were transcribed and the typewritten transcriptions scored on the various stylostatistical measures. The measures taken in Experiment 2 were the same as in Experiment 1 except that Incidence of Contractions, Incidence of First-person Pronouns, and Incidence of Second-person Pronouns were omitted. Also, two additional measures were computed.

1. Incidence of Questions: Ratio of the number of sentences which had the form of a question, as indicated by grammatical cues (a mere rise in intonation did not suffice for a sentence to be scored as a question), to the total number of utterances.
2. Incidence of Adjectives: Ratio of the number of uncommon adjectives to the number of words. Counting of adjectives excluded articles, demonstratives, possessives, and cardinal numbers.

Statistical procedures. As in Experiment 1, a naive judge was trained to score the three repetition measures. Reliability was determined for the scores of the naive judge and the experimenter using Pearson's product-moment correlation coefficient. For Complete Repetitions, $r = .77$; for Partial Repetitions, $r = .90$; for Semantic Repetitions, $r = .70$. These values of r are all significant at $p < .01$.

An unwillingness on the part of some of the children to perform all the tasks resulted in two missing scores for the Block-selection task and four missing scores for the Pattern-construction task. As in Experiment 1, these scores were estimated and degrees of freedom were subtracted from the within subjects error terms in the analyses of variance (Winer, 1962).

A two-way analysis of variance with repeated measures was performed on the results. Factor 1 was Difficulty, the two levels being Easy or Difficult. Factor 2 was Presence, the two levels being Absent or Present. The two tasks were analyzed separately because of the problem of rank ordering difficulty in two disparate tasks.

Since information was available about the children's success in solving the problems, it was possible to perform a second analysis of the results. This analysis was a check on the effectiveness of the Difficulty factor, in that speech to children who were successful at solving the problems could be compared to speech to children who were unsuccessful. Presumably one difference between the successful and the unsuccessful children was that the problems were easier for the successful children and more difficult for the unsuccessful children. Accordingly, the mothers were divided into two groups. The first group, labelled Successful, consisted of the six mothers whose children were best at solving the eight problems. The median score for this group was 5.6 problems correct out of a possible 8, with a range of 4 to 8. The second group, labelled Unsuccessful, consisted of the six mothers whose children had a median of 0.6 problems correct out

of 8, with a range of 0 to 2. These data were analyzed with a three-way analysis of variance, the factors being Groups (Successful and Unsuccessful), Difficulty (Easy and Difficult), and Presence (Absent and Present).

Results

The results for the Presence factor will be considered first. In general, the findings are the same as those of Experiment 1, except that some of the measures which showed an Absence-Presence difference in Experiment 1 no longer showed this difference under the more rigorous conditions of Experiment 2.

The cell means and levels of significance for the two-way analyses of variance are given in Table 4. Complete analysis of variance summary tables for those measures which showed significant effects are given in Appendix III. As predicted from Experiment 1 Quantity of Speech was greater in the Present condition. Significantly less complex speech occurred in the Present condition in the Pattern-construction task, as reflected in Mean Length of Utterance and Mean Pre-verb Length. For the Block-selection task, however, only Mean Length of Utterance decreased significantly in the Present condition.

Scores on repetition measures were similar to results obtained in Experiment 1. Complete Repetitions increased in the Present condition, and Partial Repetitions decreased. There were no significant differences for Semantic Repetitions.

The only pronoun measure taken, Incidence of Third-person Pronouns, showed no significant Presence effect. Whereas Incidence of Imperatives and Incidence of Utterances without Verbs

were higher in the Present condition in Experiment 1, they showed no significant Presence effects in Experiment 2.

The Incidence of Questions increased in the Present condition. This is a significant difference for the Pattern-construction task, and it approaches significance for the Block-selection task. Incidence of Adjectives decreased in the Present condition in both tasks.

The Difficulty factor had only scattered effects, as indicated by the fact that for any given measure the Difficulty factor was never significant for both tasks. As might be expected, Quantity of Speech increased with more difficult problems. However, this was only true for the Pattern-construction task, where greater difficulty was partly a function of more steps in the solution to the problem.

Of the speech complexity measures, Sentence Complexity increased in the Difficult condition in the Pattern-construction task, and Mean Pre-verb Length increased in the Difficult condition in the Block-selection task. Mean Length of Utterance tended to increase in the Difficult condition in the Pattern-construction task, but this difference did not reach statistical significance.

No repetition measures showed any Difficulty effects in either of the tasks.

Incidence of Third-person Pronouns and Incidence of Adjectives decreased in the Difficult condition only in the Block-selection task. Incidence of Utterances without Verbs, Imperatives, and

Questions were not affected by Difficulty.

The only Presence X Difficulty interaction effect occurred for Incidence of Partial Repetitions in the Block-selection task. The Difficult condition elicited more Partial Repetitions in the Absent condition and fewer in the Present condition.

The means for the Successful and Unsuccessful groups are given in Table 5. There was only one case in which the difference between the groups reached significance. Mean Length of Utterance was significantly smaller for the Unsuccessful group in the Block-selection task. The summary table for the analysis of variance for this measure is given in Appendix IV. Sentence Complexity tended to decrease for the Unsuccessful group in the Block-selection task. These results are in the opposite direction from the analogous results on the Difficulty factor. Whereas complexity tended to increase with greater difficulty in comparison of the Easy and Difficult tasks, the Unsuccessful group, for whom the tasks were more difficult, showed less complex speech.

Mean Length of Utterance in the Block-selection task showed the only Groups X Presence interaction effect (Table 6). The two groups of mothers produced utterances of the same length in the Present condition, but successful mothers produced much longer utterances in the Absent condition.

No Groups X Difficulty or three-way interactions reached significance.

Discussion

The results of Experiment 2 lend further support to the conclusion of Experiment 1, namely that the presence of

TABLE 4

Results of two-way analyses of variance performed on data from Experiment 2.

MEASURE	TASK[a]	MEANS				SIGNIFICANCE LEVELS		
		Absent		Present				
		Easy	Difficult	Easy	Difficult	Presence	Difficulty	Presence X Difficulty
Quantity of Speech	A	147.2	148.9	321.0	269.0	.05		
	B	181.6	631.3	398.8	889.2	.05	.01	
Mean Length of Utterance	A	8.555	8.497	6.314	6.037	.01		
	B	9.851	10.180	6.497	6.749	.01		
Sentence Complexity	A	0.214	0.163	0.118	0.104			
	B	0.195	0.246	0.126	0.171		.05	
Mean Pre-verb Length	A	2.111	2.353	2.003	2.101		.01	
	B	2.260	2.598	2.204	2.242	.01		
Incidence of Imperatives	A	0.169	0.132	0.150	0.157			
	B	0.274	0.363	0.275	0.325			
Utterances without Verbs	A	0.163	0.247	0.212	0.213			
	B	0.159	0.122	0.191	0.176			
Incidence of Questions	A	0.165	0.116	0.216	0.402			
	B	0.093	0.062	0.142	0.118	.05		
Incidence of Adjectives	A	0.117	0.084	0.092	0.069	.01	.05	
	B	0.114	0.118	0.075	0.066	.01		

[a]Task A denotes the Block-selection task. Task B denotes the Pattern-construction task.

TABLE 4, continued

MEASURE	TASK[a]	MEANS				SIGNIFICANCE LEVELS		
		Absent		Present				
		Easy	Difficult	Easy	Difficult	Presence	Difficulty	Presence X Difficulty
Third-person Pronouns	A	0.052	0.029	0.044	0.025		.01	
	B	0.039	0.034	0.034	0.046			
Complete Repetitions	A	0.030	0.022	0.055	0.087	.05		
	B	0.042	0.031	0.057	0.085	.05		
Partial Repetitions	A	0.259	0.325	0.164	0.134	.01		.05
	B	0.273	0.208	0.182	0.143	.05		
Semantic Repetitions	A	0.016	0.027	0.015	0.022			
	B	0.047	0.030	0.026	0.013			

[a]Task A denotes the Block-selection Task. Task B denotes the Pattern-construction Task.

TABLE 5

Cell means for the Successful and the Unsuccessful Mothers in Experiment 2.

MEASURE	TASK[a]	SUCCESSFUL MOTHERS	UNSUCCESSFUL MOTHERS
Quantity of Speech	A	203.4	239.7
	B	623.1	427.4
Mean Length of Utterance	A	7.881	6.820
	B	8.311	8.333
Sentence Complexity	A	0.211	0.088
	B	0.179	0.189
Mean Pre-verb Length	A	2.133	2.152
	B	2.235	2.416
Incidence of Imperatives	A	0.184	0.121
	B	0.254	0.365
Utterances without Verbs	A	0.198	0.256
	B	0.148	0.176
Incidence of Questions	A	0.205	0.245
	B	0.107	0.101
Incidence of Adjectives	A	0.088	0.093
	B	0.107	0.079
Third-person Pronouns	A	0.044	0.031
	B	0.039	0.039
Complete Repetitions	A	0.042	0.056
	B	0.045	0.062
Partial Repetitions	A	0.231	0.210
	B	0.184	0.219
Semantic Repetitions	A	0.011	0.029
	B	0.035	0.024

Note: The difference between the groups was significant only for Mean Length of Utterance in Task A ($p < .05$).

[a]Task A denotes the Block-selection task. Task B denotes the Pattern-construction task.

TABLE 6

Cell means for the measure which showed a significant Groups X Presence interaction in Experiment 2.

MEASURE		MEANS		SIGNIFICANCE LEVEL
		Successful mothers	Unsuccessful mothers	
Mean Length of Utterance in the Block-selection Task	Absent	9.447	7.605	.01
	Present	6.319	6.034	

the child is a necessary condition for much of the simplification that occurs when mothers speak to two-year-olds. However, differences between the results of the two experiments indicate that properly motivated mothers who were very familiar with young children were able to predict, to some extent, the kinds of speech modifications the children required, and were able to provide these even in the children's absence. Inspection of the cell means for Experiments 1 and 2 shows that the difference between the means for the Absent and Present conditions was much greater in Experiment 1. Nevertheless, the child's presence was still a potent factor in producing even greater modifications from the highly practiced and highly motivated mothers of Experiment 2.

The difficulty of the tasks for the child did not affect the complexity of the mothers' speech. Whenever task difficulty had an effect, mothers' speech became more complex and concurrently less redundant in the Difficult condition. This finding suggests that the simplification of the mothers' speech observed in Experiment 1 could not have been a response to the difficulty of the tasks for the children. This conclusion is further strengthened by the lack of differences on almost every measure between mothers who were successful and those who were unsuccessful in teaching the tasks to the children. The tested difficulty of the tasks for the child, as measured by his success in solving the problems, was an even less effective predictor of modifications in mothers' speech than the ranked difficulty of the tasks, as planned by the experimenter. This fact suggests that the difference

between the Easy and Difficult conditions may have been due more to the mother's difficulty in explaining the tasks than to the child's difficulty in solving the tasks.

The occurrence of a Presence X Difficulty interaction for Partial Repetitions underlines the tendency, noted in Experiment 1, for mothers in the Absent condition to predict that children will require many partial repetitions. In Experiment 2 this tendency was stronger when the task was more difficult; 32% of the mothers' utterances contained partial repetitions in the Difficult condition, compared to 26% in the Easy condition. However, in the Present condition, when feedback from the children concerning the required number of repetitions was available, the Easy and Difficult conditions did not differ.

The Groups X Presence interaction for Mean Length of Utterance reflects a difference between successful and unsuccessful mothers in the Absent condition. Successful mothers predicted that their children would understand much longer utterances (9 words per utterance in the Absent condition) than the children in fact elicited (6 words per utterance in the Present condition). Unsuccessful mothers had somewhat lower and, in fact, more realistic expectations of their children's comprehension. Both groups of mothers were able to use information from the children's reactions as a basis for adjusting the length of their utterances. They produced utterances of about equal length in the Present condition.

Experiment 3

Although in Experiment 2 mothers' speech in the Absent condition was neither as simple nor as redundant as in the Present condition, the similarity of speech styles between the two conditions was much greater than it had been in Experiment 1. This finding indicates that the well-motivated middle class mothers employed in Experiment 2 could to some extent predict the speech modifications their children would require. The question thus arises whether mothers' speech in the Absent condition is the only appropriate comparison for mothers' speech in the Present condition. The central concern of this thesis has been to determine how the speech heard by young children differs from normal adult speech. It is unlikely that the mothers' speech in the Absent condition of Experiment 2 was normal adult speech. That speech was probably influenced by the mothers' previous experience in talking to their children. To determine to what extent that speech diverged from normal adult speech, the speech of mothers was compared to the speech of other women who were not familiar with young children in Experiment 3.

Method

Subjects. Six women who had no children and who were not often in the company of children aged two to three were asked to participate. These women ranged in age from 22 to 31 years; all were college graduates. They were told that their help was needed to make a stimulus tape to be played to children aged two to three-and-one-half years. The 12 women who had been tested

in Experiment 2 were used as a comparison group of Mothers. The Absent condition data collected from these women in Experiment 2 was compared to Absent condition data collected from the Non-mothers.

Tasks and testing materials. The tasks used were identical to those used in Experiment 2. Only two of the problems within each task were used for any single subject, since only Absent condition data were collected in Experiment 3.

Testing procedure. The procedure for collecting the data from the Mothers is described in the method section of Experiment 2. Non-mothers were also tested in the laboratory. It was emphasized to the Non-mothers that the tapes would be used to test young children who could not yet speak or understand English very well, and that they must therefore speak slowly and simply. The Non-mothers were then given the same kind of instruction sheet as was given the Mothers in Experiment 2, containing descriptions of the Block-selection and Pattern-construction tasks for which they were to record directions. The Non-mothers were left alone with the testing materials to make the tape-recordings. These recordings were not in fact ever played to children.

Scoring procedure. The tapes were transcribed. The typewritten transcriptions were scored at the same time and in the same manner as those from Experiment 2.

Statistical procedures. Since the transcriptions were scored along with those of Experiment 2, the reliability coefficients given in Experiment 2 were calculated including the data from the Non-mothers.

A two-way analysis of variance was performed on the results for each of the measures. As in Experiment 2, the two tasks were analyzed separately. Factor 1 was Groups (Mothers or Non-mothers) and Factor 2 was Task Difficulty (Easy or Difficult).

Results

As can be seen from Table 7, there were very few differences between Mothers and Non-mothers. Summary tables for those analyses of variance which showed significant effects are given in Appendix V.

Non-mothers had significantly higher scores on Quantity of Speech in the Pattern-construction task. Inspection of the protocols indicates that this difference was due to much greater precision and detail in the Non-mothers' directions. Non-mothers' Mean Length of Utterance was significantly higher for the Block-selection task. In all the other complexity measures the direction of difference was the same; Non-mothers' speech was more complex. However, the other differences did not reach significance. The only other significant difference between the groups occurred in the Incidence of Utterances without Verbs. In both tasks Mothers produced many more grammatically incomplete sentences than Non-mothers.

The Difficulty factor produced four significant differences. Two of these, Quantity of Speech in the Pattern-construction task and Incidence of Adjectives in the Block-selection task, were the same as Difficulty effects found in Experiment 2. Quantity of Speech increased and Incidence of Adjectives decreased in the Difficult condition. Mean Length of Utterance was significantly

greater in the Difficult condition in both tasks. Comparison of Easy and Difficult conditions for the other complexity measures indicates that, although the differences were not significant, almost all of them were in the direction of greater complexity in the Difficult condition. There were significantly more Partial Repetitions in the Difficult condition in the Block-selection task. However, in the Pattern-construction task there were fewer Partial Repetitions in the Difficult condition, though this was not a significant difference. No other repetition measures showed any Difficulty effects.

There were three significant Groups X Difficulty interaction effects. The increase in Quantity of Speech in the Difficult condition in the Pattern-construction task was much greater for Non-mothers than for Mothers. Mothers' Mean Length of Utterance decreased slightly in the Difficult condition in the Block-selection task, while Non-mothers Mean Length of Utterance increased substantially. Mothers used fewer Imperatives in the Difficult than in the Easy condition in the Block-selection task, while Non-mothers used many more in the Difficult condition. In every case the difference between the conditions affected the Non-mothers more than it affected the Mothers.

Discussion

The results of Experiment 3 suggest that the speech of Mothers differs only slightly from the speech of Non-mothers, when both are trying to predict how they can best communicate with young children. Mothers' speech in the Absent condition

TABLE 7

Results of the two-way analyses of variance performed on data from Experiment 3.

MEASURE	TASK[a]	MEANS				SIGNIFICANCE LEVELS		
		Mothers		Non-mothers				
		Easy	Difficult	Easy	Difficult	Groups	Difficulty	Groups X Difficulty
Quantity of Speech	A	147.2	148.9	192.2	157.3			
	B	181.6	631.4	472.2	1328.0	.01	.01	.05
Mean Length of Utterance	A	8.555	8.497	9.747	12.640	.05	.05	.05
	B	9.851	10.180	10.008	11.242		.05	
Sentence Complexity	A	0.214	0.163	0.218	0.267			
	B	0.195	0.246	0.327	0.341			
Mean Pre-verb Length	A	2.111	2.353	2.582	2.587			
	B	2.260	2.598	2.733	2.947			
Incidence of Imperatives	A	0.169	0.132	0.180	0.266			.05
	B	0.274	0.363	0.343	0.333			
Utterances without Verbs	A	0.163	0.247	0.019	0.022	.01		
	B	0.159	0.122	0.051	0.065	.05		
Incidence of Questions	A	0.165	0.116	0.089	0.230			
	B	0.093	0.062	0.055	0.053			
Incidence of Adjectives	A	0.117	0.084	0.102	0.087		.05	
	B	0.114	0.118	0.113	0.107			

[a]Task A denotes the Block-selection Task. Task B denotes the Pattern-construction Task.

TABLE 7, continued

MEASURE	TASK[a]	MEANS				SIGNIFICANCE LEVELS		
		Mothers		Non-mothers				
		Easy	Difficult	Easy	Difficult	Groups	Difficulty	Groups X Difficulty
Third-person Pronouns	A	0.052	0.029	0.040	0.031			
	B	0.039	0.034	0.035	0.041			
Complete Repetitions	A	0.030	0.022	0.014	0.014			
	B	0.042	0.031	0.011	0.016			
Partial Repetitions	A	0.259	0.325	0.177	0.227		.01	
	B	0.273	0.208	0.227	0.178			
Semantic Repetitions	A	0.016	0.027	0.036	0.011			
	B	0.047	0.030	0.014	0.010			

[a]Task A denotes the Block-selection Task. Task B denotes the Pattern-construction Task.

was always more similar to their speech in the Present condition than was the speech of Non-mothers in the Absent condition. Non-mothers' speech varied more as a function of task and of difficulty, while Mothers' speech was less affected by what they were talking about. Mothers' speech was simpler and more repetitive; Non-mothers' speech was more formal and more detailed. Apparently mothers have learned something about the speech modifications that children demand. However, the differences between Mothers and Non-mothers were generally too small to reach statistical significance. Even though Non-mothers lacked the unique experience of talking to young children daily for more than two years, they performed nearly as well as Mothers in predicting the sorts of modifications that young children require. It may be that all adult speakers of English have as part of their linguistic competence some knowledge of the kinds of speech modifications which facilitate communication with young children and other non-English speaking people.

Experiment 4

The results of Experiments 1 and 2 suggest that young children somehow demand modification of speech styles from adult speakers. Considerable modification of adult speech occurred for the two-year-old listener only if that listener was physically present while the speaker was talking. The two-year-old apparently provided cues which indicated to the adult speaker that certain speech styles were ineffective and that others should be tried. However, Experiments 1 and 2 offered no information about the specific behavior changes with which two-year-olds gave information that their linguistic environment should be modified. It seems likely that children who are listening to unmodified adult speech will become inattentive and will fail to comprehend. Experiment 4 was conducted to determine whether inattention and failure to comprehend result from children's exposure to unmodified adult speech. If these changes in the children's behavior do occur, and if they are obvious to the adult speaker, they may be the cues that cause mothers to modify their speech in the presence of the children. In the present experiment children's attention and comprehension were measured while the children listened to simplified and to unmodified adult speech.

Method

Subjects. The subjects were five boys and five girls with a mean age of 2-11, ranging from 2-5 to 3-7. Five of these children had participated in Experiment 1. The other five were

also children of mothers contacted through their alumni association. They had not been previously tested.

Tasks and testing materials. Two tasks were employed, one for the scoring of attention and one for the scoring of comprehension.

1. Story task: A story was written on the basis of a picture book designed for children aged three to five. The entire story was written in adult English, then translated into simplified English following the rules suggested by the results of Experiments 1 and 2. Thus, the simplified version of the story contained shorter utterances, fewer compound sentences, fewer subordinate clauses, fewer third-person pronouns, and more repetitions than the unmodified version. Both versions were split in the middle, and the two halves juxtaposed so that two test stories resulted, one with the simplified half first and one with the non-simplified half first. These were both tape-recorded by a reader who did not know the variables being manipulated in the experiment. The two versions of the story are given in Appendix VI.

2. Object-placement task: A number of small plastic toys, including cars, boats, an airplane, cowboys, horses, cows, and pigs, and a colored picture, two feet by three feet, were used. The picture showed a lake, a road, an airfield, a barn, a corral, a field, and a house. Instructions were written in adult English describing where each toy was to be placed on the picture--the boats on the lake, the cars on the road, the pigs in the barnyard, etc. These

instructions were then translated into simplified English. The two versions were split and the halves juxtaposed, as for the story. The two resulting sets of instructions were tape-recorded by the experimenter. Both are given in Appendix VII.

Testing procedure. The children were tested individually in their homes. Their mothers participated in the testing session to the extent of holding the children on their laps during the Story task, and turning the pages of the picture book in response to clicks on the tape.

The experimenter and a naive observer each independently scored the children during the playing of the tapes. During the Story task the child's attention was scored on a time sample basis. At 15-second intervals the two judges scored the child as either attentive or inattentive to the story. The child was scored as attentive if he was sitting quietly, was looking at the pictures in the book, was not trying to play with toys in the room, and seemed to be listening.

In the second part of the test session the children were scored on their compliance with the taped instructions for placing toys on the picture. Before the Object-placement instruction tape was played to each child, he was familiarized with both the toys to be used and the picture. The tape was not played until the child could correctly name each toy and the color of each part of the picture (color was used in the instructions to help the child identify parts of the picture). One point was scored whenever the child followed an instruction correctly at the appropriate time, for instance, if he placed the boat on the lake in response

to the command to do so. One-half point was given if the child responded to the appropriate toy in response to the command, but did not complete the action correctly, for instance, if he picked up the boat during or shortly after the command to do so was given but put it down again or put it somewhere on the picture other than the lake. Two judges were necessary for scoring because it was sometimes difficult to decide if the child had in fact responded to the taped instructions or if he was playing with the toys according to whim.

Two complete testing tapes were made. One-half of the children heard the tape which presented the tasks in the order:

Story: Simplified--Non-simplified.

Object-placement instructions: Non-simplified--simplified.

The other half of the children heard the tape which presented the counterbalanced order:

Story: Non-simplified--simplified.

Object-placement instructions: Simplified--non-simplified.

Statistical procedures. Pearson product-moment correlation coefficients were calculated for the two judges' scores on the two tasks. For the Story task, $r = .72$; for the Object-placement task, $r = .97$. Both these correlations were significant at $p < .01$. The judges' scores were averaged, and the mean was used as the subject's score. The subjects' scores are represented as ratios because the split between the Simplified and Non-simplified halves of the tasks did not come quite in the center of either task. For example, half the subjects received 17 commands in the Simplified condition and 20 in the Non-simplified condition

of the Object-placement task. The other half of the subjects received 20 commands in the Simplified condition and 17 in the Non-simplified condition. The scores, then, for the Story task represent the ratio of the time-sample scores in which the child was attending to the total. For the Object-placement task the scores represent the ratio of the number of points scored to the total number possible. Thus, a score of 1.0 in the Story task indicates perfect attention, and a score of 1.0 in the Object-placement task indicates perfect compliance with instructions. The scores were analyzed statistically using the Wilcoxon signed-ranks test for matched pairs (Siegel, 1956). Since the a priori hypothesis was that children would score better in the Simplified condition, a one-tailed test was used.

One subject was dropped from the Object-placement task results because of unacceptable amounts of interference from her mother. Thus, there were nine subjects for the Object-placement task and ten subjects for the Story task.

Results

For the Story task the subjects scored significantly better in the Simplified condition ($p < .05$). The medians and ranges of the scores are presented in Table 8. In seven cases subjects scored higher in the Simplified condition. One subject was equally attentive in both conditions and two subjects scored worse in the Simplified than in the Non-simplified condition. Both the subjects who scored worse in the Simplified condition had received the Simplified condition after the Non-simplified condition, thereby maximizing fatigue and restlessness in the

TABLE 8

Attention and comprehension scores from Experiment 4.

TASK	n	SIMPLIFIED CONDITION		NON-SIMPLIFIED CONDITION		SIGNIFICANCE LEVEL
		Median	Range	Median	Range	
Story	10	.93[a]	.61-1.0	.89	.61-1.0	.05
Object-placement	9	.62[b]	.15-.91	.35	0.0-1.0	.06

Note: Conditions were compared using Wilcoxon signed-ranks tests.

[a]Ratio of the time-sample scores in which the child was attending to the total number of time-sample scores.

[b]Ratio of the number of points scored to the total number of possible points.

Simplified condition.

For the Object-placement task, the results of the Wilcoxon signed-ranks test were very close to statistical significance ($p < .06$) (see Table 8). As in the Story task two subjects had lower scores in the Simplified condition. Again both children had received the Simplified condition second. This result in conjunction with the result of the Story task certainly suggests that children respond more attentively and with greater comprehension to simplified speech than to unmodified adult speech.

Discussion

The child controls his linguistic environment so that he hears speech biased toward repetitions and simple constructions. In this experiment children responded to simplified speech with greater compliance and better attention than they gave unmodified speech. It is likely that both of these responses, insofar as they are noticeable to adult speakers, would influence the adult to speak in a simpler manner. Probably the modifications of mothers' speech observed in the Present condition in Experiments 1 and 2 can be attributed to these same behavior changes in the children.

The children's inattention to unmodified adult language suggests a second process which may bias primary linguistic data toward simple speech. Perhaps children simply ignore complex speech so that it never becomes the basis for rule formulation. Further evidence that this occurs has been presented by Shipley, Smith, and Gleitman (1969). In an ingenious experiment they

presented children of 18 to 30 months with commands varying in syntactic complexity and in the use of nonsense words. They recorded whether the children repeated or obeyed the commands. They found more obedience to commands which were syntactically just one level above the child's spontaneous speech, i. e., to adult-form commands for children who produced telegraphic utterances, and to telegraphic commands for children who produced holophrastic utterances. Further, they found diminished obedience but increased repetition to commands containing nonsense words. The unfamiliar word most often caused the child to "tune out"; however, more mature children sometimes responded to unfamiliar material with repetition, as if they were trying to remember and learn it. Slobin and Welsh (1968) also reported increased repetition of sentences containing unfamiliar words by a two-year-old child. Further evidence for the existence of selective listening processes, even in preverbal infants, has been presented by Friedlander and by Turnure. Turnure (1969) found that babies of nine months, but not of three or six months, attended selectively to non-distorted recordings of their mothers' voices, as compared to distorted recordings of their mothers' voices or to natural recordings of strangers' voices. Friedlander (1968, 1970) has given 11- to 15-month-old babies access to two response switches, each of which controlled the playing of one tape selection, over periods of several days. Many different stimulus comparisons were made, including familiar versus unfamiliar voices, intonations, and vocabularies, and highly redundant versus less redundant conversations. The general principle which summarizes Friedlander's many findings

is that the babies preferred familiar or redundant stimuli at first, but after a few days "crossed-over" to a preference for the unfamiliar or less redundant selection.

It has been suggested, then, that children have "some general techniques through which they may approach the buzzing confusion of the ambient linguistic environment (Shipley et al., 1969, p. 338)." First, the child filters out complex and extremely unfamiliar speech; second, he selects slightly unfamiliar stimuli for special attention and repetition. He thereby provides himself (a) with tractable input which he can use as a guide to his non-linguistic behavior and as a basis for testing his hypotheses about language, and (b) with a procedure for broadening his linguistic skills, for formulating new rules, and for adding to his lexicon. If the child filters the language he hears in the way described, then the input he receives will be biased toward the simple and the comprehensible, even if adults are totally unresponsive or if all primary linguistic data are provided by a television set. Therefore, the amazing language learning feats of children in extremely poor environments such as wards for the mentally retarded (see Lenneberg, 1969) become somewhat easier to understand. Although the primary linguistic data are very poor, children have techniques for making them maximally useful and minimally confusing.

General Discussion

The three central findings of the present experiments may be summarized as follows:

1. Mothers modified their speech to young children so that it was grammatically simpler and more redundant than their normal speech.
2. Mothers were less likely to modify their speech when addressing children whose responses they could not observe.
3. Children showed better attention and comprehension to simplified, redundant speech than to normal, adult speech.

These results lead to the conclusion that the corpus actually available to the child, the primary linguistic data on which he bases his hypotheses about the structure of language, is a biased subsample of normal adult speech. It is biased toward grammatical simplicity and semantic redundancy by (a) the adult's a priori expectations of the child's language comprehension abilities, (b) the feedback to the adult speaker of information about the child's attention and comprehension, and (c) the "filtering out" or "turning off" by the child of complex speech which is not affected by (a) or (b).

This conclusion makes it somewhat easier to understand how a child can accomplish the formidable task of learning his native language with such relative ease. With the help of responsive parents, he provides himself with a tractable and relatively consistent body of data from which to make his first generalizations

about language. Furthermore, the child has a regulatory system which automatically provides more complex data when his own grammar has accounted for the simpler sentences of the initial corpus.

It is likely, then, that a careful examination of the specific modifications which young children request from adults may provide some insights into the process of language learning. With this in mind, some of the specific findings of Experiments 1 and 2 will be discussed.

Potential Value of Grammatical Simplification

One striking feature of mothers' speech in the presence of young children was the reduction of the length of their utterances. Since run-on sentences were scored as two or more utterances, the shorter utterances which were produced in the Two-year-old Present condition were on the average less elaborated than utterances produced in other conditions. Elaboration can occur in several ways. One means of elaborating a sentence is to use compound verbs or subordinate clauses. The fact that Sentence Complexity was less for two-year-olds indicates that this was one factor which tended to reduce the Mean Length of Utterance. Shorter utterances could also result from decreased use of modifiers and other optional words. Incidence of Adjectives was significantly smaller in the Present condition in Experiment 2, indicating that this may have been another factor tending to reduce the Mean Length of Utterance scores. Whatever the specific changes leading to shorter utterances, it seems clear that in general these changes are correlated with grammatical simplicity.

This means that the surface structure, which the child hears, is related by a smaller number of steps to the base structure, which must be reached if the sentence is to be interpreted correctly. Further, the child's work in searching for the major units in a sentence is considerably lightened if there are fewer minor units to process. Finally, there are fewer inflections in a shorter sentence; this may improve the chances that the child will notice, remember, and induce the rules governing the inflections that do occur.

Mothers used fewer subordinate clauses and compound verbs when speaking to young children. If there are fewer clauses in a sentence, then the child is faced with fewer subject-verb and subject-verb-object relations to puzzle out. Also, related subjects and verbs would be more likely to follow one another directly if there are fewer clauses in a sentence. Thus the child might discover the subject-verb-object rule for sentence production with greater ease than if he is faced with sentences composed of many inter-embedded clauses. Evidence presented by Slobin and Welsh (1968) suggests that children do process sentences by searching out the subject and verb. If the subject or verb was somehow obscured in the sentences offered to their subject for imitation, she would treat the sentence as a word list. But she could extract a subject, verb, and object from a scrambled sentence if she could identify two nouns and a verb which had some semantically acceptable relationship.

Mean Pre-verb Length was shorter in speech addressed to

two-year-olds. Greater Mean Pre-verb Length can result from center-embedding or from left-branching; such sentences are known to be more difficult to process for children (Gaer, 1969) and for adults (Miller, 1962). Since the subject is normally the first element in an English sentence, greater Mean Pre-verb Length would often involve separation between the subject and the verb. This kind of sentence is probably both difficult and confusing to a child who is just mastering a subject-verb rule for forming sentences. Furthermore, considering the evidence that a meaningful verb is important in making it possible for children to process sentences (Herriot, 1968), sentences in which the verb is placed toward the end may be more difficult to understand.

About 16% of the utterances spoken to two-year-olds were simple phrases, which were not produced on the basis of a subject-verb rule. This is quite a high percentage for a child who will have to deduce subject-verb rules for producing sentences. Inspection of the protocols indicates that much of the increase in Incidence of Utterances without Verbs in the Two-year-old condition can be attributed to repetition of important phrases from preceding sentences, for example:

> Put the red truck in the box now. The red truck. No, the red truck. In the box. The red truck in the box.

The value of this kind of repetition for guiding the child's behavior is obvious. Grammatically, it may have yet another value. It gives information about the boundaries of units within utterances, since only complete units--noun phrases and

prepositional phrases, primarily--are repeated in this way. A major step in decoding a sentence is assigning a phrase structure to it. Information about the limits of subunits in the sentence is extremely valuable in this task. It is interesting to note that non-mothers very rarely produced Utterances without Verbs (2 to 6%). They preferred instead to maintain formal correctness in their speech.

Fewer third-person pronouns were used in speech to young children. Mothers repeated the subjects and objects of their sentences, rather than substituting pronouns for them. Thus the children were not required, in the early stages of rule formation, to deal with the difficulties of pronoun reference. Furthermore, it is possible that the existence of subject-verb relations in sentences in somewhat obscured when a pronoun is substituted for the subject noun phrase, which has a much more obvious semantic reference to an actor or to a topic. The difficulties would be especially great for a child who is not yet sure which pronouns refer to which classes of nouns.

Potential Value of Repetition

Repetition of complete sentences was about four times as frequent for two-year-olds as for ten-year-olds. Depending on the task, 3 to 8% of the utterances which two-year-olds heard, they heard a second time shortly afterwards. Short term memory limits the time available for processing input. Repetition of a sentence would give added processing time, thus increasing the child's chances of successfully processing the sentence. For instance, if a child had decoded the major components of a sentence

at first hearing, repetition would give him an opportunity to pay attention to more minor constructions such as modifiers and subordinate clauses. Perhaps the function of these unstressed constructions in long sentences first becomes obvious to the child only following repetition of the sentence.

Repetition of phrases was much more common in speech addressed to two-year-olds. As discussed above, the repetition of noun and prepositional phrases is clearly of value, assuming that one of the child's tasks is to assign a phrase structure to what he hears. Furthermore, the repetition of isolated subordinate clauses may give the child a greater chance to decode these less important parts of the sentence. Often when mothers repeated phrases they used a new frame for the repeated phrase, for example:

> Pick up the red one. Find the red one. Not the green one. I want the red one. Can you find the red one?

This is a valuable object lesson in the basic linguistic skill of rearranging units to form new utterances. Interestingly, it is quite similar to language games that children themselves play with their newly learned words (Weir, 1962).

In Experiment 1, 14% of mothers' utterances to two-year-olds in the Present condition were paraphrases of preceding utterances. This is more than twice as many paraphrases as in the Absent condition, and three times as many as provided for ten-year-olds. Some of this was undoubtedly due to the child's failure to comprehend the mother's first statement. Thus the mother was required to find a new way to say what she meant. Interestingly,

the mothers did not predict this need as readily as they predicted the need for Partial Repetition.

The ability to paraphrase represents another basic feature of language. The relationship between meaning and sound is arbitrary, and therefore several different sound signals can have the same meaning. Thus it makes no sense to memorize sentences; a speaker can always create new ones meaning the same thing without wasting effort or memory stores. Hearing adults paraphrase their own utterances could be a valuable demonstration of this basic feature of language to a child whose vocabulary and grammar are still so small that he has only one way to say most things. Furthermore, if the child has figured out the meaning of a sentence, he needs less time to interpret its paraphrase and can thus spend more time decoding grammatically less important units of the sentence.

Conclusions

The modifications which mothers produce for young children are valuable in at least two ways. The first value, no doubt intended by the speaker, is to keep his speech simple, interesting, and comprehensible to young children. The second value, unintended by the adult but potentially as important as the first, is that simplified speech is admirably designed to aid children in learning language.

In addition to being modified by the speaker, the corpus of primary linguistic data available to a child learning language is filtered by the child himself. The child receives (a) simplified input from which to deduce subject-verb-object relations,

(b) patterned input from which to deduce phrase structure, and (c) redundant input which facilitates deduction of morphological rules. In light of the simplicity and consistency of this input, estimates of the degree of sophistication of the child's innate language abilities may have to be scaled down somewhat. However, even with special help the child's task is formidable. The difficulty of language learning surely indicates that many of the operations are preprogrammed. For instance, even a large amount of input consisting solely of simple, subject-verb-object sentences would be of no value if the language learner were not preprogrammed to look for classes of words and for relations of the topic to the comment and of the actor to the acted-upon. Evidence presented here suggests, however, that the preprogramming consists primarily of techniques for modifying and selecting input, rather than of information about what the input will consist of or how it will be organized. Children are preprogrammed to be interested in others' speech, to desire and expect to understand that speech, to demand simple speech from responsive speakers, and to filter out complex speech from less responsive speakers. Thus they provide themselves with simple and tractable input, even when faced with uninterested adults and mechanical child care. Under conditions of devoted child care and interaction with responsive, intelligent adults children have available large amounts of simple, consistent, organized, and relevant linguistic information from which to formulate the rules of grammar.

Summary

The common view of developmental psycholinguists has been that language acquisition is a remarkably fast process which occurs with a minimum of environmental stimulation. In the present report an attempt was made to assess this view by characterizing the primary linguistic data actually available to successful language learners. It was found that the speech of middle class mothers was simpler and more redundant when they spoke to two-year-olds than when they spoke to ten-year-olds. Further, the children played some role in eliciting the speech modifications, since mothers did not modify their speech as much when talking to two-year-olds whose responses they could not observe. Task difficulty had no effect on the production of mothers' speech modifications, indicating that these modifications are not a response to children's general cognitive immaturity. Non-mothers performed almost as well as mothers in predicting the speech modifications which children require. Children were less attentive and less compliant when listening to unmodified adult speech. These responses to unmodified speech might be the means by which children elicit speech modifications from adult speakers.

Children who are learning language seem to be equipped with techniques for modifying and selecting their primary linguistic data. Thus they can learn language on the basis of a sample of speech which is simpler, more consistent, more redundant, and less confusing than normal adult speech.

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Appendix I

Cell means from Experiment 1, showing the scores for the Mothers of Two-year-olds and the Mothers of Ten-year-olds separately.

MEASURE	CONDITION	MOTHERS OF 2-YEAR-OLDS		MOTHERS OF 10-YEAR-OLDS	
		Absent	Present	Absent	Present
Quantity of Speech	2-year-old	471.6	1697.9	381.8	1198.6
	10-year-old	365.8	769.6	414.3	947.5
Quantity of Speech in Story Task	2-year-old	273.2	470.2	309.6	431.6
	10-year-old	247.4	309.1	346.7	480.9
Mean Length of Utterance	2-year-old	9.125	6.541	10.554	6.652
	10-year-old	12.667	10.132	9.824	9.135
Sentence Complexity	2-year-old	0.389	0.179	0.558	0.200
	10-year-old	0.647	0.509	0.440	0.419
Mean Pre-verb Length	2-year-old	2.589	2.106	2.782	1.981
	10-year-old	2.563	2.444	2.626	2.453
Mean Pre-verb Length in Story Task	2-year-old	2.640	2.308	2.778	2.228
	10-year-old	2.466	2.511	2.742	2.464
Incidence of Imperatives	2-year-old	0.073	0.182	0.043	0.146
	10-year-old	0.066	0.107	0.073	0.133
Utterances without Verbs	2-year-old	0.054	0.170	0.094	0.161
	10-year-old	0.038	0.156	0.048	0.085
Incidence of Contractions	2-year-old	0.017	0.037	0.040	0.037
	10-year-old	0.031	0.035	0.032	0.031
First-person Pronouns	2-year-old	0.018	0.021	0.024	0.025
	10-year-old	0.017	0.025	0.018	0.021
Second-person Pronouns	2-year-old	0.022	0.034	0.019	0.046
	10-year-old	0.012	0.037	0.014	0.033
Third-person Pronouns	2-year-old	0.046	0.037	0.053	0.042
	10-year-old	0.069	0.050	0.055	0.052
Third-person Pronouns in Story Task	2-year-old	0.057	0.055	0.058	0.060
	10-year-old	0.078	0.069	0.056	0.066
Complete Repetitions	2-year-old	0.011	0.030	0.005	0.027
	10-year-old	0.002	0.010	0.005	0.004
Partial Repetitions	2-year-old	0.335	0.161	0.233	0.154
	10-year-old	0.162	0.105	0.114	0.104
Semantic Repetitions	2-year-old	0.080	0.133	0.039	0.139
	10-year-old	0.036	0.055	0.028	0.042

Appendix II

Summary tables for the three-way analyses of variance from Experiment 1 in which significant effects occurred.

Quantity of Speech

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	197462	0.63	ns
Subjects Within Groups	22	314425		
Presence	1	13321717	70.08	.01
Groups X Presence	1	117649	0.62	ns
Presence X Within Groups	16	190101		
Age	1	2353979	15.64	.01
Groups X Age	1	997376	6.63	.05
Age X Within Groups	16	150490		
Presence X Age	1	1835158	7.68	.05
Groups X Presence X Age	1	435821	1.83	ns
Presence X Age X Within Groups	10	238341		

Quantity of Speech in Story Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	108514	0.71	ns
Subjects Within Groups	22	152350		
Presence	1	397683	20.13	.01
Groups X Presence	1	9	0.00	ns
Presence X Within Groups	16	19759		
Age	1	15130	0.73	ns
Groups X Age	1	111930	5.43	.05
Age X Within Groups	16	20601		
Presence X Age	1	22718	0.69	ns
Groups X Presence X Age	1	32619	0.99	ns
Presence X Age X Within Groups	10	32829		

Mean Length of Utterance

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	7.93	1.10	ns
Subjects Within Groups	22	7.18		
Presence	1	141.40	14.34	.01
Groups X Presence	1	0.42	0.04	ns
Presence X Within Groups	16	9.86		
Age	1	118.42	34.06	.01
Groups X Age	1	43.41	12.48	.01
Age X Within Groups	16	3.48		
Presence X Age	1	15.97	2.50	ns
Groups X Presence X Age	1	15.03	2.35	ns
Presence X Age X Within Groups	10	6.39		

Appendix II, continued

Sentence Complexity

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0174	0.23	ns
Subjects Within Groups	22	0.0755		
Presence	1	0.7926	18.31	.01
Groups X Presence	1	0.0015	0.04	ns
Presence X Within Groups	16	0.0433		
Age	1	0.7133	24.63	.01
Groups X Age	1	0.3559	12.29	.01
Age X Within Groups	16	0.0289		
Presence X Age	1	0.2518	4.96	.05
Groups X Presence X Age	1	0.1046	2.06	ns
Presence X Age X Within Groups	10	0.0507		

Mean Pre-verb Length

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0290	0.15	ns
Subjects Within Groups	22	0.1917		
Presence	1	3.7272	32.13	.01
Groups X Presence	1	0.2066	1.29	ns
Presence X Within Groups	16	0.1160		
Age	1	0.5916	3.16	ns
Groups X Age	1	0.0000	0.00	ns
Age X Within Groups	16	0.1872		
Presence X Age	1	1.4736	11.99	.01
Groups X Presence X Age	1	0.1035	0.84	ns
Presence X Age X Within Groups	10	0.1228		

Mean Pre-verb Length in Story Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.1238	0.41	ns
Subjects Within Groups	22	0.3041		
Presence	1	1.8676	9.47	.01
Groups X Presence	1	0.4396	2.23	ns
Presence X Within Groups	16	0.1973		
Age	1	0.0777	0.28	ns
Groups X Age	1	0.0438	0.16	ns
Age X Within Groups	16	0.2787		
Presence X Age	1	0.6286	1.65	ns
Groups X Presence X Age	1	0.0165	0.04	ns
Presence X Age X Within Groups	10	0.3804		

Appendix II, continued

Incidence of Imperatives

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0018	0.19	ns
Subjects Within Groups	22	0.0092		
Presence	1	0.1466	19.81	.01
Groups X Presence	1	0.0002	0.03	ns
Presence X Within Groups	16	0.0074		
Age	1	0.0065	1.41	ns
Groups X Age	1	0.0144	3.13	ns
Age X Within Groups	16	0.0046		
Presence X Age	1	0.0185	2.02	ns
Groups X Presence X Age	1	0.0010	0.11	ns
Presence X Age X Within Groups	10	0.0092		

Incidence of Utterances without Verbs

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0014	0.11	ns
Subjects Within Groups	22	0.0128		
Presence	1	0.1694	29.21	.01
Groups X Presence	1	0.0254	4.38	ns
Presence X Within Groups	16	0.0058		
Age	1	0.0349	6.12	.05
Groups X Age	1	0.0125	2.19	ns
Age X Within Groups	16	0.0057		
Presence X Age	1	0.0012	0.06	ns
Groups X Presence X Age	1	0.0015	0.07	ns
Presence X Age X Within Groups	10	0.0200		

Incidence of Contractions

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0006	1.31	ns
Subjects Within Groups	22	0.0005		
Presence	1	0.0006	3.17	ns
Groups X Presence	1	0.0012	6.59	.05
Presence X Within Groups	16	0.0002		
Age	1	0.0000	0.01	ns
Groups X Age	1	0.0009	4.39	ns
Age X Within Groups	16	0.0002		
Presence X Age	1	0.0003	0.72	ns
Groups X Presence X Age	1	0.0005	1.28	ns
Presence X Age X Within Groups	10	0.0004		

Appendix II, continued

Incidence of Second-person Pronouns

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0001	0.19	ns
Subjects Within Groups	22	0.0003		
Presence	1	0.0104	51.72	.01
Groups X Presence	1	0.0001	0.44	ns
Presence X Within Groups	16	0.0002		
Age	1	0.0010	5.85	.05
Groups X Age	1	0.0002	1.01	ns
Age X Within Groups	16	0.0002		
Presence X Age	1	0.0001	0.29	ns
Groups X Presence X Age	1	0.0007	3.65	ns
Presence X Age X Within Groups	10	0.0002		

Incidence of Third-person Pronouns

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0000	0.01	ns
Subjects Within Groups	22	0.0005		
Presence	1	0.0025	14.31	.01
Groups X Presence	1	0.0003	1.57	ns
Presence X Within Groups	16	0.0002		
Age	1	0.0034	14.88	.01
Groups X Age	1	0.0009	4.02	ns
Age X Within Groups	16	0.0002		
Presence X Age	1	0.0000	0.00	ns
Groups X Presence X Age	1	0.0005	1.34	ns
Presence X Age X Within Groups	10	0.0004		

Incidence of Complete Repetitions

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0002	0.49	ns
Subjects Within Groups	22	0.0004		
Presence	1	0.0035	39.96	.01
Groups X Presence	1	0.0000	0.48	ns
Presence X Within Groups	16	0.0001		
Age	1	0.0038	13.53	.01
Groups X Age	1	0.0001	0.23	ns
Age X Within Groups	16	0.0003		
Presence X Age	1	0.0018	4.05	ns
Groups X Presence X Age	1	0.0003	0.57	ns
Presence X Age X Within Groups	10	0.0004		

Appendix II, continued

Incidence of Partial Repetitions

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0376	2.49	ns
Subjects Within Groups	22	0.0151		
Presence	1	0.1528	10.19	.01
Groups X Presence	1	0.0306	2.04	ns
Presence X Within Groups	16	0.0150		
Age	1	0.2378	25.57	.01
Groups X Age	1	0.0056	0.60	ns
Age X Within Groups	16	0.0093		
Presence X Age	1	0.0521	4.23	ns
Groups X Presence X Age	1	0.0034	0.28	ns
Presence X Age A Within Groups	10	0.0123		

Incidence of Semantic Repetitions

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.0047	2.16	ns
Subjects Within Groups	22	0.0022		
Presence	1	0.0525	43.75	.01
Groups X Presence	1	0.0029	2.42	ns
Presence X Within Groups	16	0.0012		
Age	1	0.0785	71.36	.01
Groups X Age	1	0.0002	0.18	ns
Age X Within Groups	16	0.0011		
Presence X Age	1	0.0218	5.72	.05
Groups X Presence X Age	1	0.0041	1.08	ns
Presence X Age X Within Groups	10	0.0038		

Appendix III

Summary tables for the two-way analyses of variance from Experiment 2 in which significant effects occurred.

Quantity of Speech in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	7600	0.48	ns
Difficulty X Within Groups	10	15754		
Presence	1	259014	7.46	.05
Presence X Within Groups	10	34739		
Presence X Difficulty	1	8640	0.06	ns
Presence X Difficulty X Within Groups	9	152920		

Quantity of Speech in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	2651270	14.24	.01
Difficulty X Within Groups	9	186260		
Presence	1	677112	7.04	.05
Presence X Within Groups	9	96241		
Presence X Difficulty	1	4941	0.11	ns
Presence X Difficulty X Within Groups	7	43410		

Mean Length of Utterance in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.3356	0.18	ns
Difficulty X Within Groups	10	1.8709		
Presence	1	66.3211	60.42	.01
Presence X Within Groups	10	1.0976		
Presence X Difficulty	1	0.1443	0.07	ns
Presence X Difficulty X Within Groups	9	2.1106		

Appendix III, continued

Mean Length of Utterance in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	1.1049	2.75	ns
Difficulty X Within Groups	9	0.3695		
Presence	1	138.0855	56.42	.01
Presence X Within Groups	9	2.4476		
Presence X Difficulty	1	0.0184	0.02	ns
Presence X Difficulty X Within Groups	7	0.8744		

Sentence Complexity in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.0275	8.09	.05
Difficulty X Within Groups	9	0.0034		
Presence	1	0.0623	4.87	ns
Presence X Within Groups	9	0.0128		
Presence X Difficulty	1	0.0001	0.00	ns
Presence X Difficulty X Within Groups	7	0.1598		

Mean Pre-verb Length in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.3464	16.73	.01
Difficulty X Within Groups	10	0.0207		
Presence	1	0.3882	2.29	ns
Presence X Within Groups	10	0.1695		
Presence X Difficulty	1	0.0623	0.03	ns
Presence X Difficulty X Within Groups	9	0.2142		

Appendix III, continued

Mean Pre-verb Length in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.4254	1.94	ns
Difficulty X Within Groups	9	0.2197		
Presence	1	0.5081	19.32	.01
Presence X Within Groups	9	0.0263		
Presence X Difficulty	1	0.2691	2.74	ns
Presence X Difficulty X Within Groups	7	0.0982		

Incidence of Questions in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.0091	1.66	ns
Difficulty X Within Groups	9	0.0055		
Presence	1	0.0335	6.57	.05
Presence X Within Groups	9	0.0051		
Presence X Difficulty	1	0.0002	0.10	ns
Presence X Difficulty X Within Groups	7	0.0021		

Incidence of Adjectives in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.0094	9.00	.05
Difficulty X Within Groups	10	0.0011		
Presence	1	0.0050	11.10	.01
Presence X Within Groups	10	0.0004		
Presence X Difficulty	1	0.0003	0.30	ns
Presence X Difficulty X Within Groups	9	0.0010		

Appendix III, continued

Incidence of Adjectives in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.0001	0.22	ns
Difficulty X Within Groups	9	0.0004		
Presence	1	0.0244	29.91	.01
Presence X Within Groups	9	0.0008		
Presence X Difficulty	1	0.0005	0.48	ns
Presence X Difficulty X Within Groups	7	0.0011		

Incidence of Third-person Pronouns in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.0054	11.02	.01
Difficulty X Within Groups	10	0.0005		
Presence	1	0.0004	1.50	ns
Presence X Within Groups	10	0.0003		
Presence X Difficulty	1	0.0001	0.09	ns
Presence X Difficulty X Within Groups	9	0.0007		

Incidence of Complete Repetitions in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.0018	2.19	ns
Difficulty X Within Groups	10	0.0008		
Presence	1	0.0242	9.34	.05
Presence X Within Groups	10	0.0026		
Presence X Difficulty	1	0.0051	1.26	ns
Presence X Difficulty X Within Groups	9	0.0040		

Appendix III, continued

Incidence of Complete Repetitions in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.0008	0.75	ns
Difficulty X Within Groups	9	0.0011		
Presence	1	0.0143	5.50	.05
Presence X Within Groups	9	0.0026		
Presence X Difficulty	1	0.0044	1.50	ns
Presence X Difficulty X Within Groups	7	0.0029		

Incidence of Partial Repetitions in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	32			
Difficulty	1	0.0038	0.89	ns
Difficulty X Within Groups	10	0.0039		
Presence	1	0.2546	13.88	.01
Presence X Within Groups	10	0.0177		
Presence X Difficulty	1	0.0272	10.11	.05
Presence X Difficulty X Within Groups	9	0.0027		

Incidence of Partial Repetitions in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Between Subjects	11			
Within Subjects	28			
Difficulty	1	0.0325	2.85	ns
Difficulty X Within Groups	9	0.0114		
Presence	1	0.0740	7.96	.05
Presence X Within Groups	9	0.0093		
Presence X Difficulty	1	0.0021	0.36	ns
Presence X Difficulty X Within Groups	7	0.0059		

Appendix IV

Summary table for the three-way analysis of variance from Experiment 2 which showed a significant Groups effect.

Mean Length of Utterance in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	13.5250	5.18	.05
Subjects Within Groups	10	2.6104		
Difficulty	1	0.3356	0.18	ns
Groups X Difficulty	1	2.1817	1.19	ns
Difficulty X Within Groups	9	1.8364		
Presence	1	66.3211	161.72	.01
Groups X Presence	1	7.2856	17.77	.01
Presence X Within Groups	9	0.4101		
Presence X Difficulty	1	0.1443	0.06	ns
Groups X Presence X Difficulty	1	0.2441	0.10	ns
Presence X Difficulty X Within Groups	8	2.3439		

Appendix V

Summary tables for the two-way analyses of variance from Experiment 3 which showed significant effects.

Quantity of Speech in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	1949296	15.87	.01
Subjects Within Groups	16	122831		
Difficulty	1	3409496	62.92	.01
Groups X Difficulty	1	329680	6.08	.05
Difficulty X Within Groups	14	54183		

Mean Length of Utterance in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	56.93	7.10	.05
Subjects Within Groups	16	8.02		
Difficulty	1	16.09	4.56	.05
Groups X Difficulty	1	17.41	4.93	.05
Difficulty X Within Groups	16	3.53		

Mean Length of Utterance in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	2.97	0.31	ns
Subjects Within Groups	16	9.47		
Difficulty	1	4.89	8.15	.05
Groups X Difficulty	1	1.63	2.72	ns
Difficulty X Within Groups	14	0.60		

Incidence of Imperatives in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.04	0.58	ns
Subjects Within Groups	16	0.07		
Difficulty	1	0.01	0.79	ns
Groups X Difficulty	1	0.03	4.67	.05
Difficulty X Within Groups	16	0.01		

Appendix V, continued

Incidence of Utterances without Verbs in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.27	13.21	.01
Subjects Within Groups	16	0.02		
Difficulty	1	0.02	1.89	ns
Groups X Difficulty	1	0.01	1.65	ns
Difficulty X Within Groups	16	0.01		

Incidence of Utterances without Verbs in the Pattern-construction Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.05	6.09	.05
Subjects Within Groups	16	0.01		
Difficulty	1	0.00	0.29	ns
Groups X Difficulty	1	0.01	1.55	ns
Difficulty X Within Groups	14	0.00		

Incidence of Adjectives in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.00	0.17	ns
Subjects Within Groups	16	0.00		
Difficulty	1	0.00	8.26	.05
Groups X Difficulty	1	0.00	1.12	ns
Difficulty X Within Groups	16	0.00		

Incidence of Partial Repetitions in the Block-selection Task

Source of Variation	Degrees of Freedom	Mean Square	F	p
Groups	1	0.06	2.69	ns
Subjects Within Groups	16	0.02		
Difficulty	1	0.03	13.04	.01
Groups X Difficulty	1	0.00	0.24	ns
Difficulty X Within Groups	16	0.00		

Appendix VI

The two versions of the story used for scoring attention in Experiment 4.

Unmodified Version

"It's so much fun to take a walk in the country when it's warm and the sun is shining. I feel so happy that I could sing and dance." Little Oscar the lively cat was walking in the country looking for a lovely big tree which he could sit under to take a nap. He was bouncing along, saying "Hello" to the butterflies and smelling the daisies, when he noticed a little rabbit standing behind a bush.

"Hello, who are you?" said Oscar to the rabbit.

"My name is Rodifer. What are you doing in my part of the woods?" said Rodifer the rabbit.

"I'm just walking through, enjoying the flowers and the trees. Would you like to come take a walk with me?" said Oscar.

"No, I can't," said Rodifer.

"Oh, do come," said Oscar. "It's such a lovely day for a walk. It's always much more fun to take a walk with a friend than alone. Why won't you come? Don't you like me?"

"It's not that I don't like you," answered Rodifer, "but you see I can't leave this bush."

"Why not?"

"Well," said Rodifer, "I'll come out and show you if you promise not to laugh."

"If there's something wrong, I'll try to help," said Oscar. "I certainly won't laugh at you."

Appendix VI, continued

So Rodifer stepped out from behind the bush, and Oscar saw why he had been standing there. He had the head of a rabbit, but he had the body of a duck. And Oscar had never seen anything so funny in all his life.

"Ho ha he ho," he laughed, "you're the funniest thing I've ever seen."

"You promised you would't laugh," said Rodifer, getting very mad. But Oscar couldn't stop. He giggled, and he chuckled, and he chortled, and he howled. Just as he was about to stop laughing, he looked at Rodifer again, and started laughing some more. By this time Rodifer was so angry at Oscar that he almost started to cry.

"You promised. You said you wouldn't laugh. Everybody laughs at me. It's not my fault I'm half duck," said Rodifer. Poor Oscar felt very bad. He hadn't wanted to make Rodifer unhappy. So he said, "I'm sorry. I won't laugh any more. If you tell me how you got to be half duck, maybe I can help you change back into all rabbit."

So Rodifer told him the whole story, of how he'd been out looking for carrots one day and had tripped a magician by mistake. The magician fell down and spilled his basket of charms, so he got very mad at poor Rodifer. The magician picked up his wand and said, "Hollivus pollivus mitivus tuck, change this rabbit into a duck!" and poor little Rodifer was suddenly half duck.

"That's terrible," said Oscar. "Where does this magician live? We'll just go to his house and make him change you back." So off they went, down the road to the magician's house. As they got

Appendix VI, continued

closer and closer, Oscar got more and more afraid. He wasn't at all sure of how he was going to convince the magician to change Rodifer back. In fact, he was afraid he might get changed into something awful himself. But he'd promised to help his friend, so when they got up to the house he snuck up to the window to see if the magician was at home. Sure enough, there he was at the kitchen table, sound asleep after eating a big lunch. And on the table next to him was a magic wand. "Aha," thought Oscar, "if I can steal that magic wand, maybe I can break the spell on Rodifer myself. Then I won't even have to wake the magician up." So very quietly he reached in to window and picked up the wand and took it back to where Rodifer was waiting. He held the wand up and closed his eyes tight and said, "Hollivus pollivus titivus tuck, this little rabbit's no longer a duck!" When he opened his eyes, there was Rodifer dancing around with his own rabbit feet and rabbit tail and rabbit fur all back where it belonged. Of course, they were both very happy, and Oscar shouted, "Rodifer, look at me, I'm a big magician now, I'm the biggest magician in the whole world." And quick as a flash Oscar was as big as a tree and Rodifer, who was just a normal-sized rabbit, barely reached up to his ankle. What was even worse, they had awakened the magician, who came running out of his house very, very angry.

"Well," said the magician, "I see that you've stolen my wand and gotten yourself into a little trouble. Let's just see if you can get yourself out."

"I don't know how," said Oscar. "Can you change me back to

Appendix VI, continued

normal size, please?"

"I will if you give me back my wand," said the magician. So Oscar gave him back his wand and the magician said, "Hingerly mingerly gingerly more, let everything be as it was before!" And Oscar was back to normal size. But then the magician swung his wand around in a circle and said, in a terrible voice, "Little cats, little rabbits, don't like them at all. I only like animals if they're very small." And suddenly Rodifer and Oscar felt themselves getting very tiny. They were so tiny they only reached up to the magician's knee. "Oh, this is awful," thought Oscar. "Look what I've done now. We'll never get back to normal." Oscar and Rodifer crawled off into the woods, before the magician could do anything else to them. They sat together under a tree saying, "What are we going to do? What are we going to do?" They were both so very tired from their long day that they fell asleep under the tree.

But when Oscar woke up, he wasn't under a tree at all. He was home in his very own bed. And he was just the right size, not too big and not too small. He looked around for Rodifer, but Rodifer wasn't there. He looked around for the magician, but the magician wasn't there either. "I wonder," thought Oscar, "I wonder, was that all a dream?"

Appendix VI, continued

Simplified Version

"It's so much fun to walk in the country. It's warm and the sun is shining. I feel so happy. I could sing and dance." Little Oscar the lively cat was walking in the country. Oscar was looking for a lovely big tree. He wanted to sit under a big tree and take a nap. He went bouncing along. He said "Hello" to the butterflies. He smelled the daisies. Suddenly he noticed a little rabbit standing behind a bush.

"Hello, who are you?" said Oscar to the rabbit.

"My name is Rodifer. What are you doing in my part of the woods?" said Rodifer the rabbit.

"I'm just walking through. I'm enjoying the flowers and the trees. Would you like to come take a walk with me?" said Oscar.

"No, I can't," said Rodifer.

"Oh, do come," said Oscar. "It's such a lovely day for a walk. It's always more fun to walk with a friend than alone. Why won't you come? Don't you like me?"

"It's not that I don't like you," answered Rodifer. "I just can't leave this bush."

"Why not?"

"Promise not to laugh, and I'll come out and show you," said Rodifer.

"Is something wrong?" said Oscar. "I'll try to help you. I certainly won't laugh at you."

So Rodifer stepped out from behind the bush, and Oscar saw what was wrong. Rodifer had the head of a rabbit, but he had the body of a duck. And Oscar had never seen anything so funny in all

his life.

"Ho ha he ho," he laughed, "you are the funniest thing in the world."

"You promised you wouldn't laugh," said Rodifer. Rodifer was getting very mad. But Oscar could not stop. He giggled, and he chuckled, and he chortled, and he howled. Oscar almost stopped laughing, then he looked at Rodifer again, and he started laughing some more. By this time, Rodifer was very angry at Oscar. Rodifer almost started to cry.

"You promised. You said you wouldn't laugh. Everybody laughs at me. It's not my fault I'm half duck," said Rodifer. Poor Oscar felt very bad. He hadn't wanted to make Rodifer unhappy. He said, "I'm sorry. I won't laugh any more. Tell me how you got to be half duck. Maybe I can help you change back into all rabbit."

So Rodifer told him the whole story. One day he'd been out looking for carrots. A magician had tripped over him. The magician fell down and spilled his basket of charms. He got very mad at poor Rodifer. So the magician picked up his wand and said, "Hollivus pollivus titivus tuck, change this rabbit into a duck!" Suddenly, poor little Rodifer was half duck.

"That's terrible," said Oscar. "Where does this magician live? We'll just go to his house, and I'll make him change you back." So they went down the road to the magician's house. They got closer and closer, and Oscar got more and more afraid. He didn't know what to do. How could he convince the magician to change Rodifer back? What if the magician changed him into something awful? But Oscar had promised to help his friend. They got

Appendix VI, continued

to the house. Oscar snuck up to the window to see if the magician was at home. The magician was there, sound asleep at the kitchen table after eating a big lunch. And his magic wand was on the table next to him. "Aha," thought Oscar, "I'll steal that wand. Then I can break the spell on Rodifer myself. I won't even wake the magician up." So Oscar reached in the window. He picked up the magic wand. He took it back to Rodifer in the front yard. Then Oscar held up the wand. He closed his eyes tight, and he said, "Hollivus pollivus titivus tuck, this little rabbit's no longer a duck!" Oscar opened his eyes. He saw Rodifer dancing around, with his own rabbit feet and rabbit tail and rabbit fur. Everything was back where it belonged. They were both very happy. Oscar shouted, "Rodifer, look at me. I'm a big magician now. I'm the biggest magician in the whole world." Quick as a flash, Oscar was as big as a tree, and Rodifer barely reached up to his ankle. Even worse, they had awakened the magician. The magician came running out of his house towards them. He was very very angry.

"Well," said the magician, "so you've stolen my wand. You've gotten yourself into a little trouble. Can you get yourself out?"

"I can't," said Oscar. "I don't know how. Can you change me back to normal size, please?"

"I'll change you back," said the magician. "But first, I must have my wand." So Oscar gave the magician his wand. The magician said, "Hingerly mingerly gingerly more, let everything be as it was before!" And Oscar was back to normal size. Then the magician swung his wand around in a circle. This time he said, in a terrible voice, "Little cats, little rabbits, don't like them at all. I

Appendix VI, continued

only like animals if they're very small!" Suddenly, Oscar and Rodifer felt themselves getting very tiny. The magician could hardly see them any more. They only reached up to his knee. "Oh," thought Oscar, "this is awful. What have I done now? We will never be normal size again." Oscar and Rodifer crawled off into the woods. They wanted to get as far away as possible from the angry magician. They sat together under a tree, saying, "What are we going to do? What are we going to do?" Both Rodifer and Oscar were very very tired. Soon they both fell asleep under the tree.

But when Oscar woke up, he wasn't under a tree at all. He was home in his very own bed. And he was just the right size, not too big and not too small. He looked around for Rodifer. Rodifer wasn't there. He looked around for the magician. The magician wasn't there either. "I wonder," thought Oscar, "I wonder, was that all a dream?"

Appendix VII

The two versions of the object-placement directions used for scoring comprehension in Experiment 4.

Unmodified Version

On the bottom of the picture, right in front of you, near your left hand, is a lake. You can tell that it's a lake because it's blue and it has waves in it. I'd like you to look at the toys and to find some boats to put on the lake. Among the other toys are four boats which belong on the lake. Boats are meant to sail across lakes and rivers and seas, so put these boats on the lake. Be sure to find all four boats. There are two sailboats which are red and white. Put them on the lake. Now find the other red and white boat. It is a tugboat. It is used to tug big big ships when they come into a little river. There is also a green and white boat. It is a ferry boat, and is used for carrying people and cars across lakes and rivers. People can drive their cars right onto the ferry boat and go across the water that way.

Now, if all the boats are on the lake, look for the road which goes around the lake. Curving right around the lake there is a grey road with a black line down the middle. A road is meant for cars to drive on, so find the cars and put them on the road. There are lots and lots of cars. Be sure to find them all. There are two racing cars, a red racing car and a green racing car. Then there's a big red truck, like a fire engine. And there's a blue car. Put all the cars on the road. Use both parts of the road. There's a curvy part that goes around the lake, and there's a straight part that goes off to the right, near your right hand.

Appendix VII, continued

Use both parts of the road so there is room for all the cars. Find the little station wagon with the boat on top, and put it on the road. Don't forget the yellow convertible car. There should be six cars on the road. Count them--one, two, three, four, five, six.

Now there's one more thing to put on the bottom of the picture. Look at the very bottom, on the other side of the road from the lake. Do you see the yellow stripes there? That's an airfield. The stripes mean that planes can land there before they drive up to the airport. Look for an airplane, a yellow airplane, and put it on the airfield. The airfield, where the planes should go, is on the yellow stripes at the very bottom of the picture, near your right hand.

Very good, now we've got the plane and the cars and the boats where they belong, the boats on the lake, the cars on the road, and the plane on the airfield. Now look up near the top of the picture. Do you see a farm up there? There is a pink farmhouse, right near the road, with trees on either side of it. Point to the farmhouse. Right behind the farmhouse there is a black barn with a big pink door. Look for the black barn. Point to it. The black barn has a fence around it, and right in front of the barn but inside the fence is the barnyard. The barnyard is the place where some of the farm animals live. The fence is there so they can't run away. Pigs live in the barnyard. See if you can find some pigs to put in the barnyard. There should be five of them. There are two brown ones. Find them. Now find the two white ones. Now find the yellow one. Put all the pigs in the barnyard, right in front of the barn but inside the fence. Count them to make

Appendix VII, continued

sure you have them all--one, two, three, four, five.

Now look at the rest of the farm. There are two more parts to the farm. There is a brown part with a fence around it. Can you point to that? Then there is the green part with trees around it, next to the farmhouse. The green part is a field where grass grows, with trees and flowers. This is where the cows live. Cows stay there all day eating grass. Find some cows to put in the field. There are four--two brown ones and two white ones. Find the four cows and put them in the field so they can eat the grass. Find two brown cows and two white cows to put in the green field which has trees all around it.

Now there are two men and some horses left. The two men are cowboys. They ride horses so they can look after the cows. Find the two big horses that have saddles on them, and put the men on them. The horses with the red saddles are called cowponies because they are the horses that cowboys ride. When you get the men on the horses, put the horses in the light brown field. Do you see the light brown field with the dark brown fence around it? It's called a corral. Put all the horses there. Put the two big horses with men on them there, in the brown field. Then find the other five horses. These horses are smaller. They are really ponies, becasue they are still young. Put them all together with the big horses in the brown field which is next to the barn. There should be seven of them all together. Count them--one, two, three, four, five, six, seven.

Appendix VII, continued

Simplified Version

Look for the lake in the picture. The lake is at the bottom of the picture, near your left hand. The lake is blue, and it has waves in it. Find the lake. Now look at the toys. Find some boats. Boats belong on a lake. Find some boats to put on the lake. Boats go across lakes and rivers. Find a boat to go across this lake. There are four boats. Can you find all four boats? There are two sailboats. Find the two sailboats. There are two red and white sailboats. Find them. Put the sailboats on the lake. There is another red and white boat. Find the other red and white boat. It is a tugboat. Find the red and white tugboat. Now there is one more boat for you to find. Find the green and white boat. There is a green and white ferryboat. Find the green and white ferryboat. The ferryboat belongs on the lake too. Find it and put it on the lake. Put the green and white boat on the lake.

You've put all the boats on the lake. Now look for a road. There is a road in the picture. The road goes around the lake. The road is grey, and it has a black line down the middle of it. Find the grey road with the black line. Now find some cars. Put some cars on the road. Look for some cars. There are lots of cars there. Put the cars on the road. Find the red racing car. Put the red racing car on the road. Now find the green racing car. Put the green racing car on the road. There's a big red truck. The big red truck looks like a fire engine. Find the big red truck and put it on the road. Find the blue car. Put the blue car on the road. There are two parts to the road. Put cars on both parts

Appendix VII, continued

of the road. Put cars on the curved part, near the lake, and put cars on the straight part, near your right hand. Put cars on the whole road. Find the station wagon with the boat on top. Put the station wagon on the road. Put the station wagon with the other cars on the road. There is a little yellow convertible car there. Put the yellow convertible on the road. You have six cars on the road. Count the cars--one, two, three, four, five, six.

Look now at the very bottom of the picture. There are some yellow stripes at the very bottom of the picture. Do you see the yellow stripes? There are some yellow stripes just across the road from the lake. Find the yellow stripes. The yellow stripes are an airfield. Find the airplane and put it in the airfield. Find the yellow airplane and put it in the airfield. The airfield is near your right hand at the very bottom of the picture. You put the plane at the very bottom of the picture, near your right hand, in the airfield.

Very good. The boats are where they belong, in the lake. The cars are where they belong, on the road. The plane is where it belongs, in the airfield. Now look for a farm in the picture. Do you see a farm in the picture. The farm is near the top of the picture. The farm is above the road. There is a pink farmhouse near the road. Find the pink farmhouse. Point to the pink farmhouse. Now look behind the farmhouse. Behind the farmhouse is the barn. The barn is black. The barn has a pink door. Point to the black barn with the pink door. The black barn has a fence around it. Inside the fence is the barnyard. Animals live in the

Appendix VII, continued

barnyard. Pigs live in the barnyard. Find some pigs. Put some pigs in the barnyard. There are five pigs. Put five pigs in the barnyard. Put two brown pigs in the barnyard. Put two white pigs in the barnyard. Put one yellow pig in the barnyard. Put five pigs in the barnyard. Find five pigs. Put them in the barnyard. Count the pigs--one, two, three, four, five. You should have five pigs in the barnyard.

Now look at the rest of the farm. There is a brown part to the farm. The brown part has a fence around it. Point to the brown part. There is also a green part to the farm. The green part is a field where grass grows. The green field has green trees around it. The green field has grass growing in it. Cows eat grass. Put some cows in the green field so they can eat the grass. Find two brown cows and put them in the green field. Find two white cows and put them in the green field. Put four cows in the green field to eat the grass.

Now you have a few toys left. You have some horses left, and you have some men left. The two men are cowboys. Cowboys ride horses. Find the two biggest horses. The two biggest horses have saddles on them. The horses have red saddles. The red saddles are for the men to sit on. Put the two men on the two horses with saddles. Now put the horses in the light brown field. The light brown field has a dark brown fence around it. Put the two horses with the men in the light brown field with the dark brown fence around it. Now find the other five horses. The other five horses are smaller. They are still young horses. They are ponies. Put the five ponies with the two big horses in the brown field. The

Appendix VII, continued

brown field is next to the black barn. Put all the horses in the brown field next to the black barn. You will have seven horses in the brown field. Count the seven horses--one, two, three, four, five, six, seven.