A DESCRIPTIVE STUDY OF THE EFFECTS OF
SELECTED VARIABLES ON THE COMMUNICATIVE
SPEECH OF PRESCHOOL CHILDREN\

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Introduction

To whom do very young children talk? Why do they choose to talk to the people they choose to talk to? And why indeed do they take the trouble to talk to anyone at all? These three, deceptively simple questions are not, as they appear to be, distinct, but rather tend to emphasize different aspects of the same basic question which is the focus of the present investigation.

The question has to do with defining the communicative function of speech and our attempt to begin to answer it reflects an underlying functional behavioral approach to the problem. It suggests that the basic question can be rephrased as a hypothesis which states that early speech is a function of the extent to which the child's environment 'compels' the child to speak. The approach directs us to describe both the immediate and remote stimulus characteristics of the child's social environment in order to locate those aspects of it which exert discriminative control over the child's speech. In other words, we hope to be able to find those stimuli which tend to elicit, or cue, the emission of communicative speech due to the fact that when the child has spoken before in the presence of those classes of stimuli, speech has been positively reinforced.

Egocentric and communicative functions of speech

Speech can be characterized as serving either one of two functions, an egocentric or a social role. The literature on the function of speech in the very young child has been dominated by discussion of the first, the egocentric role of speech.
Many investigators such as Piaget\textsuperscript{1}, Kohlberg, Yaeger and Hjertholm\textsuperscript{2}, Vygotsky\textsuperscript{3}, Luria\textsuperscript{4}, and Flavell\textsuperscript{5} have been quite explicit in setting aside egocentric speech as a unitary class of behavior which functions systematically with situational demands for cognitive activity and their work has been concerned with studying its developmental course. However, some other investigators have not been explicit in differentiating egocentric from social speech and when referring to language acquisition, have in fact often meant only its non-social, cognitive function. To take just a few examples, all of which represent important areas of work, the studies in mediation by Kendler and Kendler\textsuperscript{6} certainly fall within the province of non-social egocentric speech. Huttenlocher and her colleagues\textsuperscript{7} work on the situational determinants of the syntactical structure of children's speech exemplifies another area mainly concerned with the non-social cognitive function of speech. And Bloom's extensive work\textsuperscript{8} on language acquisition, even with its insistence on considering all the contextual determinants of young children's utterances, has not generally made explicit the differentiation between the cognitive, non-social aspect of speech and its social or communicative function.

If one couples both the literature which deals explicitly as well as implicitly with the cognitive, non-social function of early language development, then it is clear that the bulk of the work in language acquisition has dealt with this function and not with its communicative function.

This overriding emphasis on egocentric speech is probably due to Piaget's influence, since having attributed such an important role to self-reference in the development of cognitive and intellectual functions, many investigators following him have felt it to be of primary importance in explaining very young children's overall language development as well. Indeed, although the consensus of the evidence from many sources\textsuperscript{9} has supported his idea that the role of egocentric, or private speech, has been critical in cognitive development, it has not been as widely agreed that egocentric speech necessarily comes prior to social speech in a
developmental sequence. In fact, it seems more plausible to consider the fact that since social forms of speech serve a communicative function, they develop concurrently alongside of private speech forms, and that therefore their development and separate function can be best examined in the light of other different controlling influences.

Influence of sociolinguistics on the study of communicative speech

Perhaps the most influential recent factor supplying a new impetus for the study of social or communicative speech has come from the emergence of the field of sociolinguistics which insists that the characteristics of the social environment systematically determine the forms of speech which are appropriate for use within various speech communities. Indeed it goes further, and insists that speech cannot be fully understood unless it is examined with reference to the social context in which it occurs. Some already classic examples of work in this area can be mentioned.

Labov\(^9\) in his work on Black English in older children has found that certain distinct features of the standard spoken language are either changed or omitted as a function of the social situation in which they are emitted (e.g., whether it is casual or formal); or as a function of the norms of the speech community of the speaker (i.e., children tend to speak like the adult members of their own community) or according to the speaker's "knowledge" of the prestige forms of the language. In the latter instance people tend to use the prestige forms or not, depending upon the person to whom they are speaking. Work on what has been variously described as speaking code, or speech mode, or register was originally carried out by Bernstein\(^10\) in which he characterized middle class and lower class speech as making use of elaborated or restricted codes and claimed that although lower class speakers confine themselves to the restricted code, middle class speakers use both on occasion. A final example is a study by Houston\(^11\) who found that black children in northern Florida were less communicative and more or less fluent depending upon
whether they were speaking in or out of school. She attributed this to a change in what she called speech register.

**Communicative speech studies with young children**

The influence from sociolinguistics has resulted in an increase in the number of studies of communicative speech with young children, and hopefully as this work continues we will develop a more complete picture of early speech. In a recent reassessment of the importance of social and egocentric speech Garvey and Hogan suggested on the basis of studying 3-1/2 to 5 yr. old children's conversations that the children were capable of genuine social behavior, that early forms of social speech entail a surprising level of interpersonal understanding, and that these forms are amenable to systematic study. Schacter found increases in socialized forms of speech in children from age 3 to 5 in free play periods in nursery school. Mueller, examining children's conversations, found that a number of variables added to predict successful communication of an utterance: listener attention; context, i.e., direct reply; form, i.e., command or question; content, i.e., utterances about listener's activity; and attention getting techniques. In addition he found that the indicators for failure of communication tended to be lack of clarity; speech fragments; content concerning the speaker's as opposed to the listener's activity; and lack of speaker attention to the listener. Keenan, in observations of twin 2-1/2 yr. old's conversations, has noted that the children tended to maintain extended sequences of exchanges, certainly reflecting a communicative rather than non-social aspect of speech. Other communicative speech studies have been task oriented. Alvyn found decreases in egocentric communications and increases in verbal exchange as children's ages increased from 6 to 12 yrs. And Glucksberg and Krauss have examined the development of success in communicating verbally in some ingenious experimental situations.

Generally speaking then, there appears to be renewed interest in the study of communicative speech and concomitantly, a need for answers to some basic questions...
of definition as to just what is meant by communicative speech, i.e., what variables function as its determinants.

Between subject paradigm for studying communicative speech

Within the framework of a behavioral discriminative control model we decided to investigate the problem using two experimental paradigms. The first paradigm involves a between subject design and consists of tentatively defining communicative speech as a separate class of verbal behavior; then placing children in a setting in which this class of verbal behavior can be emitted; and finally examining its occurrence as a function of a number of independent variables, selected on the basis of both the literature and our own best guesses concerning the relative significance of these variables for controlling the emission of communicative speech in young children.

Our tentative definition of communicative speech i.e., the major dependent variable of the study, was the proportion of conversational speech which was directed toward another person and which was at the same time articulate and audible (the latter two criteria were taken as a further indication of communicative intent). In addition, we examined two other aspects of the children's conversational speech which we felt might be closely related to communicative speech. The first was the total number of words a child emitted during a conversation, and the second was a classification in terms of comprehensibility of all the spoken utterances a child emitted during a conversation. The reason for looking at comprehensibility was that it seemed likely that children who tended to exhibit more communicative speech would be those needing to be more comprehensible to a listener. Judgments of comprehensibility involved not only decisions as to whether utterances were incomprehensible, but also, when comprehensible, whether they could be understood alone, or if not, in what kind of context.

The setting we chose in which to examine the occurrence of communicative speech was a small playroom equipped with toys, in which the children were placed two at a
mother's speech on the child's speech. There is currently a growing literature on
this which centers mainly on describing how mothers' speech changes as a function of
the age and some of the speaking characteristics of the child. Snow\textsuperscript{19}, Vorster\textsuperscript{20},
and Drach\textsuperscript{21} have fairly consistently shown that mothers' speech to children is sim-
pler and shorter than their speech to adults and Baldwin\textsuperscript{22} and Moerk\textsuperscript{23} have found
that systematic changes in mothers' speech take place with the increasing age of the
child. Our own emphasis has been somewhat different, for we were interested in seeing
whether selected aspects of mothers' speech could account, at least in part, for
children's use of communicative speech. Accordingly, we examined the extent to which
each child's mother actively elicited verbal responses from the child during conver-
sations, the extent to which her questions were open-ended, and whether she responded
to her child's questions.

The third category of independent variables sampled aspects of the child's social
environment which were somewhat more remote. (Unfortunately they were, in addition,
somewhat more "remotely" measured, since they were based on interviews with mothers
rather than on direct observation.) They had to do with trying to characterize each
child's speaking environment at home in terms of how much and to whom it obligated
the child to speak.

Deciding to examine the "how much" aspect was the result of our underlying func-
tional behavioral model which would predict that the amount of speech generated, and
presumably reinforced, in one situation, would determine how likely it would be to
geneneralize to another. To measure this we simply counted the total number of people
each child had regular contact with at home. There has been only a beginning made,
although interesting, in quantifying the verbal home environments of children.
Friedlander, Jacobs, Davis, and Wetstone\textsuperscript{24} time sampled natural language environments
in the homes of two infants and found them very different, and Rebelsky and Hanks\textsuperscript{25}
measured the extent to which fathers spoke to infants and found it to be surprisingly
low.

The decision to measure to whom the children spoke was made as a result of studies
in the literature which suggest that certain characteristics of the child's social
background have differential effects on such aspects of speech as style, concreteness
and abstractness. Williams and Naremore\textsuperscript{26} found that social class affected speech mode such that lower class children's speech was more context centered and more personally oriented. Jones and McMillan\textsuperscript{27} also found differences between lower and middle class children in the length of communication units and the amount of context-bound meanings. Baldwin, McFarlane and Garvey\textsuperscript{28} found middle SES children to be more accurate in communicating descriptive information than lower SES children. In view of these findings which suggested to us that such variables might affect the communicativeness of speech as well as its comprehensibility, we characterized the children's closest and most significant speaking contacts at home in terms of whether they were children or adults or standard English or non-standard English speakers.

Within subject paradigm for studying communicative speech

The second experimental paradigm makes use of a within subject design which was yielded by the fact that the study was set up as an investigation of a total social network (Mitchell\textsuperscript{29}). It involved sampling a complete matrix of the conversations with each other of all the children in the closed social network of a nursery school class. The design enabled us to investigate the discriminative effect that different children having specific relationships with each speaker, exerted on a child's communicative speech during conversations. We had some indication from a study conducted by Salzinger, Hammer, Portnoy and Polgar\textsuperscript{30} that for adults, social distance determined the communicability of speech within a social network.

In order to measure the characteristics of peer audience which were likely to modify the extent of communicative speech emitted in conversation, the study sampled in an independent situation, the complete matrix of spoken interactions among the children in the network. It also measured how often each child in each pair had chosen to sit next to each other in school — hopefully an indicator of friendship; and whether the conversation involved speaking to a child of the same or different sex. These measures are closely akin to recently reported work by McGrew\textsuperscript{31} with young children in an area called proxemics.

The decision to examine the discriminative effect of an audience was based on evidence in the literature documenting such an effect. In an interesting study by
Shatz and Gelman\textsuperscript{32} it was found that children as young as 4 modify their speech by shortening and simplifying it when they speak to children younger than themselves, much in the same way as do adults. The effect of an audience was also demonstrated by Maratsos\textsuperscript{33} who found that 3 to 5 yr. olds speech became more explicit when the listening child could not see what the speaking child was referring to.

In the present study therefore we planned to test the hypothesis that the closer the social relationship between two children, as measured by both spoken and non-verbal forms of interaction, the more a child when functioning as a listener in a conversation, will serve to elicit communicative speech from the speaker. Certainly, this relationship holds for adults; the question is whether the social behavior of different children exerts differential stimulus control over communicative speech in 3 yr. olds.

\textbf{Method}

\textbf{Subjects}

Ss consisted of 13 children, 5 boys and 8 girls, attending a cooperative nursery school in New York City.\textsuperscript{***} The school was staffed by one teacher, assisted in rotation by each of the mothers. The children were tested first in the fall and again in the spring. Nine of the children were present during both sessions. Two were present only in the fall and two others only in the spring. At the beginning of the study the children ranged in age from 33 to 45 months with a mean age of 38 months. The group was heterogeneous with respect to race, socio-economic status, and ethnic group. Although English was spoken in all the homes, only in seven of them was standard english usage predominant.

\textbf{Procedure}

Data were collected during an initial (fall) and a final (spring) period of the school year, during which time two investigators were present on a daily basis. Variables representing the children's speech and interaction were derived from several sources of data:
1) Conversations between the children in an experimental playroom --

Tape recordings of each child's conversation with each other child in the group were made twice, once in the fall and once in the spring. The recording sessions took place in a 10 x 12 foot playroom draped like a circus tent and provided with a standard array of toys.

Recordings were made on a Stereo Tandberg tape recorder. Each child wore a microphone around the neck. In order to help distinguish between the two speakers, each of them was assigned either a high or low tone at the beginning of the recording session. Using two hand-manipulated switches, $E$ activated the appropriate identifying tone during the speech of each child and the signal was fed onto a second track on the tape recorder. At the same time a second $E$ took running notes on what the children were playing with.

Prior to their first introduction into the tent, all the children were read a story about "Happy-the-Clown" from a specially prepared, colorfully illustrated book. The children were then invited to come into "Happy's tent" in pairs, "to play with Happy's toys." A papier maché puppet clown was present in the room and introduced as "Happy." The $Es$ were seated and their speech was limited to replies to the childrens' questions and occasional guiding comments.

Each session lasted 7 minutes, at the end of which the children were allowed to select a few small trinkets and invited to "come back and see Happy again another time."

Transcripts of each of the 7-minute conversations were processed to yield a number of dependent variables.

The first variable was a total number of words each child spoke during any one conversation. (For analysis this variable was transformed to the $\log_{10}$ total number of words.)

The next variable was the proportion of each child's total number of words which was communicative. The coding of the transcripts for communicative speech
was based on a content analysis in which communicative speech consisted of words clearly addressed to another person which were sufficiently articulated and audible. How well the speech was understood, or whether it was responded to by the listener, were not used as criteria. Speech which reflected only the child's own play activity was classified as non-communicative. Both grammatical forms and surrounding context were used to help classify the speech. The transcripts were coded by at least two coders who were trained until reliability was almost perfect.

The third variable was a multi-category classification of the comprehensibility of each child's speech. A two-step procedure was used to so classify the speech. First the children's speech in each transcript was divided into units, each of which consisted essentially of the specification of a single topic coupled with something said about the topic. Changes in topic, or changes in what was being said about the topic, or changes in the syntactical structure which signalled changes in topic were used to mark the boundaries of each unit. Long pauses and intonation contours were used to help unitize the speech. Secondly, each unit was then rated for comprehensibility in terms of the following categories: a) - the unit was comprehensible on its own (e.g., "I like Happy-the-Clown,"); b) - in order for the unit to be comprehended, the immediate physical environmental stimuli had to be taken into account (e.g., "It took off!", where it refers to a toy rocket); c) - in order for the unit to be comprehended the speech of another person had to be taken into account (these were primarily answers to questions where the form wouldn't be such as to enable the unit to stand alone.); d) - in order for the unit to be comprehended the child's own prior speech had to be taken into account (e.g., "It's under the table. It really is."); and e and f) - incomprehensible units where the meaning of the unit was either ambiguous or entirely incomprehensible, and none of the available context could resolve the classification. The number of units assigned to each category was expressed as a proportion of the total number of units a child used during a conversation. (In the analysis the
proportions were transformed to 2 arc sin \( \sqrt{\text{proportion}} \).

2) Observation of spoken interactions between the children in the classroom ---

During both fall and spring periods, daily 2-minute observations were made of each child during free play in the classroom or playground. The observations consisted of recording all the occasions on which a child spoke and who the listeners were for each speech event. The observers were trained until the reliability of the observations was very high.

The main independent variable, the rate of spoken interactions with peers, was derived from these data and expressed as the number of spoken interactions directed toward each other child in the group divided by the number of minutes the speaker was observed when the listener was also present in school. (For the analysis this rate was transformed by means of square root.)

3) Sociometric seating choices in the classroom ---

Each day diagrams were made of the children's seating choices during snack, story time, and informal games involving the group. Each child's choice of each other child was expressed as the proportion of opportunities each child actually availed him or herself of to sit next to another child. Since these proportions were taken to express the measure of friendship between the pairs of children they were used only for the within subject analysis.

4) Conversations between each child and his/her mother ---

Following the fall period, tape recordings were made of the conversation of each child with his or her own mother. These were recorded under the same conditions as the children's conversations with each other. The children were instructed to, "show mommy Happy's toys."

The transcripts yielded three measures of the mothers' speech: The first was a measure representing the total extent to which the mother tried to elicit a response from her child and consisted of a count of all questions and mands, mands being both the use of the imperative form as well as attention mands; the second
was a count of all the mother's open-ended questions; and the third measure was the proportion of her child's questions that she answered. (The latter proportion was transformed by 2 arcsin \( \sqrt{\text{proportion}} \).

The three variables representing the effect of the mother's speech were used only for the between subject analysis.

5) Interviews with mothers about home speech influences

Each mother was asked to describe the child's living arrangements at home and the resultant opportunities for speech available with parents, caretakers, siblings, friends, and other relatives. Persons within the child's speaking environment were classified both in terms of closeness to the child as well as in terms of characteristics which might affect their speech, such as class, economic status, ethnic group, and whether they spoke a standard or non-standard English dialect.

These interviews were coded so as to yield the following variables: The first was the total number of persons each child comes into fairly regular contact with in the household. It included as well as the immediate family, close friends, caretakers, extended family, and family friends. An additional four variables were based only on the children's significantly close contacts, i.e., primary caretakers and persons the child shares living space with. The first indicated on a scale of 1 to 3 whether there were more children than adults among the child's significant standard English speaking contacts (\( A + C \ SE \)); the second whether there were more children than adults for significantly close non-English speakers (\( A + C \ NSE \)); the third whether there were more standard English speakers than non-standard English speakers among the child's adult significant contacts (\( NSE + SE \ A \)); and the fourth whether there were more standard English than non-standard English speakers among the child's significant child contacts (\( NSE + SE \ C \)).

6) Sex

The children were classified for the within subject analysis in terms of whether they were conversing with a child of the same or opposite sex.
Results

The results are presented in terms of three different analyses. The first is a between subject analysis which examines the relationship between a group of three variables representing measures of conversational speech with three classes of variables representing, respectively, spoken interactions with peers in school, indices of the mothers' speech in conversation with her child, and the spoken contacts characteristic of the children at home.

The second is a multiple regression analysis which measures the relative amount of the effect of three pre-specified indices of the three classes of variables, i.e., peer interaction, mother's speech, and spoken contacts at home, on the two conversational speech indices of total speech and communicative speech.

The third analysis is a within subject analysis which utilizes correlation to investigate whether the social relationship between a listening child and a speaking child modifies the speech of the speaker during conversation.

Between Subject Analysis

This analysis examines the relationship between the children's conversational speech and a number of different speech-eliciting situations in which the children have been reinforced for speaking to other people.

The means and standard deviations for the three dependent variables representing conversational speech, i.e., total number of words emitted during conversations, proportion of communicative speech, and proportions of different categories of comprehensibility of the children's speech, are shown in Table 1. For the group as a whole, these measures seem to be stable over the course of the year.

[Insert Table 1 about here]

Correlations were used to estimate the relationship between the pre-selected independent variables of spoken interaction with peers, the effects of mother's speech, and spoken contacts at home with the major dependent speech variables of total speech, communicative speech, and comprehensibility. These data are shown in
Table 2. They are displayed separately for fall and spring data in order to have some idea of the consistency with which the relationships hold up.

[Insert Table 2 about here]

**Total Speech**

Examination of the correlations in Table 2 representing relationships with total speech output show that the most striking relationships are with spoken interactions with peers ($r = .82$ for the conversations in the fall and $r = .54$ for those in the spring); with the measure representing the extent to which the children's mothers elicit responding, i.e., her questions plus mands ($r = .50$ in the fall and .60 in the spring); and with the total number of people having regular contacts with the child at home ($r = .58$ in the fall and .53 in the spring). In addition, the number of open-ended questions the mother uses with her child may have a positive relationship with total speech ($r = .30$ in the fall and .66 in the spring) although because of the difference in effect for fall and spring it is tenuous.

**Communicative Speech**

Turning to a consideration of the relationship of communicative speech with total speech it should first be noted (see Table 1) that communicative speech accounts for an average of 66% of the children's total speech in the fall and 70% in the spring. In addition, communicative speech is highly correlated with total speech ($r = .87$ for the fall data and .70 for the spring data). (See Table 2.)

Further examination of the determinants of communicative speech in Table 2 shows that, like total word output, it is related most to spoken interactions with peers ($r = .78$ in the fall and .45 in the spring); somewhat less to the extent to which the mother tries to elicit responses, i.e., her questions plus mands, ($r = .49$ for the fall and .31 for the spring); and similarly related to the children's total contacts in the home ($r = .34$ in the fall and .49 in the spring). One additional correlation should be noted. If more of the children among the speaker's most significant home contacts speak Standard English, rather than Non-standard English, the
speakers show higher proportions of communicative speech \( r = .65 \) in the fall and \( .33 \) in the spring).

**Incomprehensibility**

The correlations in Table 2 with incomprehensibility show its relationship both to the other conversational speech measures as well as its relationship to the three classes of independent variables of the study. Incomprehensibility does not seem to be a function of the extent to which the children speak with peers \( r = -.34 \) for the fall and \(-.19\) for the spring); nor is incomprehensibility related to how much the child's mother tries to elicit responses during conversations, i.e., her questions plus mands, \( r = -.38 \) for the fall and \( r = .16 \) for the spring). Nor is incomprehensibility at all related to total home contacts \( r = -.04 \) and \(-.09\) for fall and spring respectively). It is possibly a function of having more standard english speaking children among the child's most significant home contacts \( r = -.69 \) for the fall and \( r = -.24 \) for the spring) although the lack of consistency from fall to spring makes the relationship tenuous.

The interesting finding here is seen in how incomprehensibility relates to the two other dependent speech variables of total speech and communicative speech. Although there is apparently no relationship between incomprehensibility and total speech \( r = -.39 \) and \(-.04\) for fall and spring) incomprehensibility does seem to be a function of communicative speech \( r = -.69 \) and \(-.61\) for fall and spring) implying that only when the children make an attempt to communicate with each other do they try to make their speech more comprehensible.

**Comprehensibility**

Since comprehensibility seems to be characteristic of communicativeness, we examined the four different types of comprehensible units (i.e., excluding those units which were incomprehensible) in some detail. Since they do not occur at all equally in the children's speech — see Table 1 — the mean proportions for fall and spring respectively of (a)-type units are \( .22 \) and \(.19\); of (b)-type units are \( .22 \) and \(.23\);
of (c)-type units are .09 and .13; and of (d)-type units are .04 and .05), the relationships between them and other variables which we are reporting can not be taken to be equally reliable or valid. Results concerning these relationships therefore must be interpreted tentatively. Correlations between categories of comprehensibility with other conversational speech variables and with the independent variables of the study are to be found in Table 3.

[Insert Table 3 about here]

It is of interest to note that the occurrence of (a)-type units which need no additional context to be understood are highly and positively related to communicative speech (r = .81 and .61 for fall and spring data) and total speech, although the latter relationship is not as consistent (r = .79 and .30 for fall and spring). In addition (a)-type units appear to be a function of both of the independent variables of spoken peer interaction (r = .60 and .36) and to a lesser extent a function of total home contacts (r = .47 and .44). They are not clearly related to mother's speech. The occurrence of (b)-type units which require physical context to be clearly understood are also positively related to total words (r = .34 and .61) and communicative speech (r = .58 and .33). In addition they seem to be positively although not strongly related to mother's speech (r = .35 and .37), and may be a function of the children's having standard English speaking children among their most significant home contacts (r = .50 and .28). Both (c)-type units which require another person's speech as context and (d)-type units which require more of the child's own speech to be understood reverse these relationships and show negative relationships with total speech, communicative speech, peer interactions, mother's speech and home contacts. Most of these units, although understandable, are fragmentary and relate to the other variables much like incomprehensible speech. However, in interpreting them it should be kept in mind that their incidence is very low in the entire sample of units.
Multiple Regression Analysis

A major hypothesis of the study posits that the extent to which each independent variable accounts for the children's communicative speech depends upon the strength of its discriminative stimulus control, which is determined by how immediately relevant each variable is to the conversational situation in which the children speak to each other. In order of immediacy of discriminative control, we would expect therefore that the spoken interaction with peers would be strongest, the effect of the child's mother's speech during conversations next, and the overall home contacts, least of the three. In addition it seems likely that two of the variables, i.e., the extent to which the mother elicits responding and the total contacts in the child's home, would tend to increase the total output of all kinds of speech, regardless of whether it is communicative or not. Therefore, we might expect these variables to add less to the relationship with communicative speech than with total speech output during the conversations with peers.

To test this we used a multiple regression model to account for both total word output and communicative speech as a increasing function of the three variables. For total word output in the fall the initial $R^2$ between total speech and peer interaction was .68. The addition of the partial correlation of total speech with the most remote of the three variables, total contacts, yielded no significant increase in effect. However, the addition of the partial correlation for total speech with mothers' total effect significantly increased the $R^2$ to .83. Correcting for chance using a shrinkage formula, $R^2$ becomes .76 representing an increase of 8%. For the spring data on total speech output, the effect was not as strong, but the addition of the two independent variables changed the initial $R^2$ in the same way. The initial $R^2$ between total speech and peer spoken interaction was .29 and when one added the partial correlation with mother's effect, this significantly increased the relationship to $R^2 = .56$. Again correcting for chance, the shrunken $R^2$ becomes .37 representing an increase of 8%. The addition of the variable of total contacts in the home was not significant.
Using the same procedure to account for the proportion of communicative speech, we found, for the fall data, that the initial $R^2$ between communicative speech and peer contacts was .61 which significantly increased to $R^2 = .76$ when the partial correlation with mother's total effect was added. Correcting this $R^2$ for chance, the shrunken $R^2$ becomes .66 representing an increase in effect of 5%. Again the addition of total contacts in the home, the most remotely related variable, did not account for any more of the relationship.

The spring data showed an initial $R^2$ between communicative speech and peer interaction which was not significant so the other variables were not added.

In general then the results of this analysis indicate that conversational speech is best accounted for by the added contributions in order, of peer spoken interaction and the effect of the extent to which mothers elicit verbal responses during conversations. Furthermore, the independent added effect of the mother's speech is somewhat larger for total speech output (i.e., 0%) than for communicative speech (i.e., 5%).

Within Subject Analysis

The question of whether the characteristics of individual children exert discriminative control over (i.e., modify) the speech of children who are talking to them is examined in this analysis.

Correlations were computed for each child speaking to each other child for selected pairs of speech variables and social interaction variables.

The speech variables were the same as those used in the between subject analysis. They consisted of a measure of the total number of words each child spoke in conversation with each other child; the proportion of communicative speech each child spoke in conversation with each other child; and the proportion of incomprehensible utterances each child emitted in conversation with each other child.

The social interaction variables consisted of the proportion of spoken interactions each child directed at each other child during free play; the proportion
of occasions each child chose to sit next to each other child in class; and whether the experimental conversation was taking place with a child of the same or opposite sex.

Correlations among the social interaction variables are displayed in Table 4 for data representing the fall, spring, and both periods. These show a substantial degree of relationship among all three variables, and most particularly between the spoken interactions with peers and seating choices (r = .61, .73, .67). This indicates that children who choose to sit next to specific other children also tend to speak to them in free play situations. The correlations also indicate that it is more likely that children will talk to other children of the same sex rather than of the opposite sex (r = -.40, -.44, -.42), and that they are more likely to choose to sit next to children of the same sex than those of the opposite sex (r = -.35, -.56, -.46).

We then examined the relationship between these social interaction variables and the speech the children emit to each other during the experimental conversations with each other. The correlations among the pairs of conversational speech variables and social interaction variables are to be found in Table 5. Although the three social interaction variables were shown to be substantially related, including the verbal interaction variable as well, there does not seem to be any strong relationship of these variables with the characteristics of the way the children converse with each other.

Specifically we did not find that the sex of the child who was being spoken to made any difference in the speaker's total conversational speech output, the proportion of speech during a conversation which was communicative, or how incomprehensible it was.

Both a given child's spoken interactions with each of his/her peers and a given child's seating choices were unrelated to how much that child spoke to other
children during conversations. And finally, neither the child's spoken interactions with peers nor his/her seating choices were at all related to whether the child's speech in conversations was communicative or whether it was incomprehensible.

Among the conversational speech variables themselves there was no relationship found between the total amount of speech emitted during a conversation and how comprehensible or communicative it was. That is, how much a child chose to talk to another child did not determine how communicative and comprehensible the speech would be.

However, it was found that if a child talked communicatively to another child during a conversation then the child's speech became proportionately more comprehensible. The correlations between the proportion of speech which was communicative and the proportion of speech which was incomprehensible were \( r = -.62, -.25, -.49 \). (See Table 5)

In general then, the within subject analysis indicated that in conversational speech the children's total speech output, the proportion of communicative speech, and the proportion of incomprehensibility during speech emitted in conversation did not change as a function of each child's social relationship with specific other children.

Only for speech directed at other children in open free play situations did the social relationship with the listeners have a positive effect.

During conversations it appears that only when a child attempts to communicate to another child, regardless of his/her social relationship with that child, does the characteristics of the child's speech change such that it becomes less incomprehensible.

**Discussion**

The answers provided by this study to the questions posed initially concerning the function of communicative speech, must be taken as suggestive rather than definitive, due to the nature of the network design of the study which prohibits the
use of a substantial number of subjects. Nevertheless, a number of relationships appear among the variables measuring conversational speech and the other selected variables of the study which make sense in terms of the discriminative control model which we used to yield a functional account of the emission of communicative speech in very young children.

Essentially, the model predicts that the extent to which any variable will account for the communicative speech of children conversing with their peers has to do with how immediately relevant it is (i.e., how easily it can be generalized) to the situation in which the child is talking.

Before going on to summarize our conclusions, some of the problems with the study must be mentioned, as well as the attempts we made (and didn't make) to cope with them. Two characteristics of the study were sources of major methodological difficulty.

The first, as was mentioned, was the network design. Although it has the distinct advantage of sampling an entire matrix and thereby enabling us to analyze the relationships between variables within each of the subjects — a procedure well suited to test the effects of listeners on speakers in conversations —, at the same time it produces extreme dependencies between estimates of the variables, since each subject provides a number of correlated rather than independent measurements. The results therefore may be typical only of this particular network of subjects. To cope with this difficulty one would have to either expand the network to include substantially more subjects — a procedure which is frightening to contemplate — or to replicate the study a few times on new small matrices. We did neither, but instead attempted some replication by sampling the network twice, which in fact merely gave us some notion of how stable our estimates were for this particular network and did not really tackle the problem of generalizing to larger populations.

The other major source of methodological difficulty came from the fact that the study utilized correlational procedures to estimate relationships among many dif-
different variables -- many more variables, in fact, than subjects -- thus increasing the possibility that the relationships were a function of chance. In order to cope with this problem and avoid the all-too-common "fishing expedition," we carefully preselected, by means of literature surveys and our own hunches, those variables which we felt would be predictive of communicative speech, and then instead of searching our resulting correlation matrices for high correlations, we looked only at the relationships we had expected to yield results -- and reported only those. In accordance with this approach, the variables used in the multiple regression analysis, as well as predictions of the order in which the variables would contribute to the prediction of speech, were dictated by the discriminative control model before we ran the analysis.

Other problems were problems of measurement of the extremely diverse kinds of variables used in the study. Some of these, like observational procedures and content analyses, were handled by rigorous training of experimenters and coders to achieve reasonably reliable estimates. Others are more difficult to handle and include problems of scaling variables for which the underlying metrical relationships are unknown, such as home contacts for example. Also there are special problems with the shape of distributions yielded by data obtained from very young subjects whose developmental levels (e.g., in speech output) differ enormously.

Despite these problems the study yielded a number of interesting and reasonable findings.

Placed in a situation in which children are able to converse with a peer or not, as they please, 3 to 4 year old children on the average tend to devote a substantial proportion (over 60%) of their speech to communicative speech.

The extent to which children engage in communicative speech during conversations appears primarily to be a function of how much they engage in spoken interactions with peers during free play situations. In other words, it may well be a function of a social type of play activity.
To a somewhat lesser degree, communicative speech is also a function of the overall extent to which their mother tends to elicit responses from them during conversations, and is related, although not independently, to the extent of the children's network of speaking contacts at home. In addition, if the child's closest home contacts consist of more standard English speaking children than non-standard English speaking children, this tends to account for an increased proportion of communicative speech in peer conversations.

There is a strong positive relationship between the proportion of communicative speech and the total amount of speech the children emit. Therefore, the somewhat less strong relationship between communicative speech and the more remote (i.e., less immediately relevant than peer interaction) variables of mother's effect and total home speaking contacts may be partly accounted for by their stronger relationship with total speech. In this respect we might also note that mother's use of open-ended questions relates a good deal more strongly to total speech output than communicative speech. The main effect of these variables might be to increase the total amount of children's speech regardless of whether it is communicative or not.

Communicative speech tends to be characterized by less incomprehensibility. Since incomprehensibility is unrelated to total speech output it would seem therefore to be a function of speech which is emitted only when the children are trying to talk to each other.

The high proportion of clearly comprehensible speech units requiring no additional context to be understood, seems to relate mainly to the proportion of communicative speech and somewhat less to total speech.

The high proportion of speech units requiring the context of another person's speech relates negatively to total speech output, indicating that children who don't converse much confine their speech to answers to questions.

All of the foregoing results describe relationships with variables accounting for the general characteristics of the children's conversational speech, regardless of who the child is speaking to.
Turning to the discriminative control exerted by peer listeners in the immediate situation, we found some highly suggestive findings which must be viewed carefully since these data are much less reliable than the between subject data.

It seems that for children of this age, the characteristics of their conversational speech did not vary as a function of their social relationship with each of the other children to whom they were talking.

Only for speech directed at other children in open free play situations did the children's social relationships with the listener have a positive effect.

For conversational speech the listener exerted discriminative control only by virtue of the fact that if the speaker attempted to communicate with him or her regardless of the listener's social relationship to the speaker, the speaker's speech became proportionately more comprehensible.
References


Footnotes

9 This research was supported by NIH Grant ME 21431; GRS Research Foundation for Mental Hygiene, New York State Psychiatric Institute 3303 - E 239 G; The Grant Foundation, Inc., New York City. We would also like to thank Richard Sanders for his help in collecting the data and George Fein for his help in analyzing it.

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Table 1
Means for Total Number of Words, Proportion of Communicative Speech, and Proportions Representing Different Categories of Comprehensibility for Fall and Spring Data

<table>
<thead>
<tr>
<th></th>
<th>Fall</th>
<th></th>
<th>Spring</th>
<th></th>
</tr>
</thead>
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<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Range</td>
<td>M</td>
</tr>
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<td>Total # Words</td>
<td>106</td>
<td>90</td>
<td>6 - 252</td>
<td>111</td>
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<tr>
<td>Proportion Communicative Speech</td>
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<td>.15</td>
<td>.36 - .81</td>
<td>.70</td>
</tr>
<tr>
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<td>.22</td>
<td>.10</td>
<td>.10 - .35</td>
<td>.19</td>
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<tr>
<td>Proportion (b) units</td>
<td>.22</td>
<td>.08</td>
<td>.06 - .38</td>
<td>.23</td>
</tr>
<tr>
<td>Proportion (c) units</td>
<td>.09</td>
<td>.05</td>
<td>.03 - .20</td>
<td>.13</td>
</tr>
<tr>
<td>Proportion (d) units</td>
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<td>.03</td>
<td>0 - .10</td>
<td>.05</td>
</tr>
<tr>
<td>Proportion (e + f) units</td>
<td>.40</td>
<td>.16</td>
<td>.24 - .73</td>
<td>.32</td>
</tr>
</tbody>
</table>

(a) units which are comprehensible with no additional context
(b) units which are comprehensible only with physical context provided
(c) units which are comprehensible only in the context of another person's speech
(d) units which are comprehensible only in the context of more of the child's own speech
(e + f) units which are either ambiguous or totally incomprehensible
Table 2

Correlations between Total Number of Words, Proportion of Communicative Speech, and Proportion of Incomprehensible Speech with Selected Variables

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<tr>
<th></th>
<th>Log Total Words</th>
<th></th>
<th></th>
<th>Communic. Speech</th>
<th></th>
<th></th>
<th>Incomprehensibility</th>
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<td>spring</td>
<td>both</td>
<td></td>
<td>fall</td>
<td>spring</td>
<td>both</td>
<td></td>
<td>fall</td>
</tr>
<tr>
<td>Log Total # Words</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion Communicative Speech</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spoken Interactions with Peers</td>
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<td>.71</td>
<td></td>
<td>.78</td>
<td>.45</td>
<td>.64</td>
<td></td>
<td>-.34</td>
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<td>Mothers' Questions plus Mands</td>
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<td>.60</td>
<td>.55</td>
<td></td>
<td>.49</td>
<td>.31</td>
<td>.41</td>
<td></td>
<td>-.38</td>
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<tr>
<td>Mothers' Open Questions</td>
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<td>.66</td>
<td>.59</td>
<td></td>
<td>.15</td>
<td>.17</td>
<td>.16</td>
<td></td>
<td>.06</td>
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<tr>
<td>Mothers' Prop. Questions Answered</td>
<td>.09</td>
<td>.52</td>
<td>.32</td>
<td></td>
<td>.16</td>
<td>.11</td>
<td>.14</td>
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<td>-.29</td>
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<tr>
<td>Total Contacts at Home</td>
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<td>.53</td>
<td>.55</td>
<td></td>
<td>.34</td>
<td>.49</td>
<td>.42</td>
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<tr>
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<td>.18</td>
<td>.13</td>
<td></td>
<td>.01</td>
<td>.00</td>
<td>.01</td>
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<td>.00</td>
</tr>
<tr>
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<td>.02</td>
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<td>-.02</td>
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<td>.21</td>
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<tr>
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<td></td>
<td>.29</td>
<td>.31</td>
<td>.30</td>
<td>-.64</td>
<td>-.17</td>
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<tr>
<td>Significant Contacts NSE → SE C</td>
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<td>.29</td>
<td>.29</td>
<td></td>
<td>.65</td>
<td>.33</td>
<td>.51</td>
<td>-.69</td>
<td>-.24</td>
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Table 3

Correlations between Four Different Categories of Comprehensible Units with Total Number of Words, Proportion of Communicative Speech, and Selected Variables Representing Spoken Interaction with Peers, Mothers' Effect, and Social Contacts at Home

<table>
<thead>
<tr>
<th></th>
<th>(a) Clearly comprehensible units</th>
<th>(b) Units requiring physical context</th>
<th>(c) Units requiring other person's speech</th>
<th>(d) Units requiring more of own speech</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fall</td>
<td>spring</td>
<td>both</td>
<td>fall</td>
</tr>
<tr>
<td>Total Words</td>
<td>.79</td>
<td>.30</td>
<td>.60</td>
<td>.34</td>
</tr>
<tr>
<td>Communicative Speech</td>
<td>.81</td>
<td>.61</td>
<td>.73</td>
<td>.50</td>
</tr>
<tr>
<td>Spoken Peer Interaction</td>
<td>.60</td>
<td>.36</td>
<td>.49</td>
<td>.14</td>
</tr>
<tr>
<td>Questions &amp; Nanc's (Mother)</td>
<td>.39</td>
<td>-.01</td>
<td>.20</td>
<td>.35</td>
</tr>
<tr>
<td>Open Questions (Mother)</td>
<td>.00</td>
<td>-.13</td>
<td>-.07</td>
<td>.11</td>
</tr>
<tr>
<td>Prop. Answers (Mother)</td>
<td>-.18</td>
<td>-.26</td>
<td>-.22</td>
<td>.22</td>
</tr>
<tr>
<td>Total Contacts (Home)</td>
<td>.47</td>
<td>.44</td>
<td>.46</td>
<td>-.13</td>
</tr>
<tr>
<td>Sig. Cont. A → C SE</td>
<td>.05</td>
<td>.37</td>
<td>.22</td>
<td>.27</td>
</tr>
<tr>
<td>Sig. Cont. A → C NSE</td>
<td>-.08</td>
<td>-.55</td>
<td>-.33</td>
<td>.11</td>
</tr>
<tr>
<td>Sig. Cont. NSE → SE A</td>
<td>-.08</td>
<td>-.14</td>
<td>-.11</td>
<td>.23</td>
</tr>
<tr>
<td>Sig. Cont. NSE → SE C</td>
<td>.33</td>
<td>-.08</td>
<td>.13</td>
<td>.50</td>
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</table>
Table 4

Average Correlations Computed Within Subjects between Spoken Interactions with Peers, Seating Choices, and Same Sex-Different Sex

<table>
<thead>
<tr>
<th></th>
<th>Seating Choice</th>
<th>Same Sex-Diff. Sex</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>fall</td>
<td>spring</td>
</tr>
<tr>
<td>Spoken Interactions</td>
<td>.61</td>
<td>.73</td>
</tr>
<tr>
<td>Seating Choice</td>
<td>-.35</td>
<td>-.56</td>
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</table>
Table 5

Average Correlations Computed Within Subjects* between Total Words, Proportion of Communicative Speech, and Proportion of Incomprehensible Speech with Selected Social Variables

<table>
<thead>
<tr>
<th></th>
<th>Log Total # Words</th>
<th>Communicative Speech</th>
<th>Incomprehensible Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fall</td>
<td>spring</td>
<td>both</td>
</tr>
<tr>
<td>Communicative Speech</td>
<td>.34</td>
<td>.00</td>
<td>.28</td>
</tr>
<tr>
<td>Prop. Incomp. Speech</td>
<td>-.40</td>
<td>.26</td>
<td>-.11</td>
</tr>
<tr>
<td>Sp. Int. with Peers</td>
<td>.36</td>
<td>.20</td>
<td>.22</td>
</tr>
<tr>
<td>Seating Choices</td>
<td>.20</td>
<td>.32</td>
<td>.27</td>
</tr>
<tr>
<td>Same Sex-Diff. Sex</td>
<td>-.12</td>
<td>-.07</td>
<td>-.06</td>
</tr>
</tbody>
</table>

*Children who did not speak to a number of other children are omitted from this table.