Verbal Planning Functions in Children's Speech

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MACWHINNEY, BRIAN, and OSSER, HARRY. Verbal Planning Functions in Children's Speech. child development, 1977, 48, 978-985. This study sought to examine the role of communicative explicitness, sex, and social class upon children's utilization of a wide variety of hesitation phenomena. Speech samples were gathered from 20 British 5-year-olds under 3 conditions of elicitation. Occurrences of 13 varieties of hesitation phenomena were tabulated for each corpus and subjected to a multivariate test for equality of mean vectors for the 2 levels of sex and social class. Although there was a significant main effect for sex, there was no significant main effect for social class and only a weak interaction of sex with social class. The verbal planning functions of the several hesitation phenomena were examined by principal components analysis and interpreted in the light of textual relations. It was found that hesitations served 3 major functions: preplanning of verbalization not yet produced, coplanning of verbalization currently being articulated, and avoidance of superfluous verbalization.

Much contemporary research on hesitation phenomena in speech was derived from the work of Goldman-Eisler (1968), who argues that the analysis of speech pauses provides an external window upon the internal constructive processes of speech selection and organization. In some of the earlier studies of hesitation phenomena (Goldman-Eisler 1958a, 1958b; Lounsbury 1954), it was claimed that, once a speaker had begun a sentence, pauses only reflected lexical selection processes. This analysis was in accord with the information-theory view of sentence processing as a Markov process.

The advent of transformational grammar (Chomsky 1957) focused attention on the relations between hesitations and phrasal structure. Maclay and Osgood (1959) and Boomer (1965) found that pauses were related not only to lexical selection points, but also to grammatical junctures corresponding to phrasal units. More recently, Butterworth (1975) has pointed to the existence of macrorhythms in pause location correlated with idea units as well as clausal structure. This emphasis on ideational, syntactic, and lexical factors in decision making is in accord with current models of procedural semantics (Halliday 1973; Winograd 1973), semantic network systems (Anderson & Bower 1974; Kintsch 1974; Linde & Labov 1975), and the pragmatic theory of reference (Cole & Morgan 1975; Rommetveit 1974).

According to the pragmatic theory of reference, communications differ systematically in terms of levels of explicitness. Communications based on large amounts of shared knowledge can be rich in anaphora, ellipsis, and deixis. However, when the speaker cannot be sure that the hearer shares certain information with him, he must encode his intentions explicitly. When a communication is about concrete material, it is relatively easy to obtain a satisfactory level of explicitness, par-

ticularly when the perceptual display is available to both speaker and hearer (Glucksberg & Krauss 1967). However, when a communication is about abstract material, it becomes increasingly difficult to maintain a satisfactory level of explicitness. In terms of processing time, increased levels of abstraction and explicitness lead to increased demands on the real-time processing of the system of semantic options (Halliday 1973). Inexplicit utilization of the system is less time-consuming than explicit utilization, all other things being equal.

Goldman-Eisler (1968, pp. 50-59) has shown how pauses increase with tasks that demand high levels of explicitness. Thus, subjects spent over twice as much time pausing when required to explain the meaning of a picture as when simply required to describe the picture. Similar results were obtained by Levin, Silverman, and Ford (1967) with children for use of pauses and several other hesitation phenomena.

Bernstein (1962) extended Goldman-Eisler's (1968) finding on pauses and levels of abstraction to social class differences in explicitness. He found that, compared to middle-class adolescent boys, lower-class adolescent boys spent significantly less time pausing, used a significantly longer mean phrase length, and had a significantly shorter mean word length. Following Goldman-Eisler's interpretation of pauses as indicators of verbal planning time, Bernstein argued that the lower-class boys were spending less time planning, presumably because the speech sequences they were producing were heavily "preceded" and, therefore, highly accessible. In a related study, Hawkins (1973) analyzed silent pauses in the speech of lower- and middle-class boys and girls. He found that the total number of pauses was virtually the same for all groups. However, differences did show up when the length of each pause was classified. For example, the middle-class boys had significantly more pauses in the 2-3-sec category than the lower-class boys. Second, the lower-class girls showed significantly more short pauses—up to 1 sec—than the middle-class girls, who had significantly more intermediate pauses, from 1 sec on, than their lower-class counterparts. Hawkins argues that the fact that the middle-class children not only used significantly more "intermediate" length pauses than the lower-class children but also used more of them for within-clause lexical planning indicates that the middle-class children spent

more time on lexical decisions than the lower-class children.

Bernstein (1972) has placed these, and other, results within the context of his sociolinguistic theory of socialization. The cornerstone of this theory is the contrast between the "elaborated" code of the middle class and the "restricted" code of the lower class. Bernstein holds that middle-class speakers use language abstractly, analytically, and explicitly, whereas lower-class speakers use language to establish group solidarity through inexplicit, ritualized (preceded), concrete communications.

Two theses arise out of the last 2 decades of research on hesitation phenomena. First, it appears that the number and distribution of pauses are dependent upon the extent to which the communication must be explicit. Second, it appears that there are social class differences in England in the use of pause phenomena.

However, it should be noted that Bernstein's hypothesis refers not only to the use of silent pauses, but to all hesitations involved in verbal planning, whereas Hawkins (1973) has shown that class differences in verbal planning are not picked up by all hesitation measures. It may be the case that the two classes differ in their choice of hesitation phenomena, while not differing in the total amount of verbal planning they utilize. A similar argument can be made for task differences. Some verbal tasks may involve more of one type of hesitation than another. However, the total amount of verbal planning might be constant across all tasks. Thus, it may well be the case that there are no overall verbal planning function differences between the two social classes.

The present study is designed to examine these objections to earlier demonstrations of a relation between social class and verbal planning functions. It examines 15 categories of hesitation phenomena in the speech of children who, according to Bernstein's theory, would be likely to take up either the elaborated or the restricted code as their primary mode of communication. The speech was elicited by three verbal tasks. The tasks were designed to require different levels of explicitness. Thus, the study attempts to evaluate Bernstein's hypothesis against a wider array of tasks and measures than has been examined in previous research.

Method

Subjects.—The subjects were 20 children in the same class in an infant school in the suburbs of London. There were 10 lower-class children (whose fathers were generally semiskilled workers) and 10 middle-class children (whose fathers were generally professionals). There was an equal number of boys and girls in each group. The average age for the lower-class group was 57 months, with a range of 51-62 months, and for the middle-class group the average age was 55 months, with a range of 51-59 months.

Procedures

IQ testing.—Each child was given the Stanford-Bmet test. The IQ scores of the four sex and social class combinations were closely matched.

Speech tasks.—The children were given three communicative tasks.

Picture task: Three paintings by the French primitive painter Trotin were presented to the child, and he was asked to describe them. The task was designed to tap the child's ability to describe objects and their spatial relations.

Game task: The child was told by the experimenter that he did not know how to play certain children's games (e.g., hide-and-seek) and the child was asked to explain how the game is played. The task was designed to tap the child's ability to explain the logical and hierarchical relationships between objects and events.

Conversation task: The child was asked to respond to a number of questions about his day-to-day experiences (e.g., Do you go shopping with your mother? What do you do together?). The task was designed to tap the child's ability to narrate events in temporal sequence.

These tasks were selected to require different degrees of explicitness in encoding. The game task was assumed to tap more "interpretive" processes than the others. The picture task and the conversation task differed from each other in that the former provided the speaker with visual support for his verbal performance, whereas the latter was without this support. However, the conversation task was simpler in one respect in that in the picture task the child was being asked to encode rather novel material, as the content of the pictures was somewhat strange to the children. The experimenter (H. O.) spent a week in the school before beginning the experiment.

Data Measurement Techniques

Pause measurement.—The total corpus contained over 21,000 words. A polygraph printout gave pitch and amplitude traces for the whole corpus. Pauses could be recognized as low spots or valleys in the pitch and amplitude traces. It was possible to measure the pauses to an accuracy of ±30 msec. Pauses below the limit of 250 msec were not included in the analysis, since these short pauses are principally artifacts of certain articulatory movements.

Hesitation types.—Fifteen measures were taken for each of the 20 children on each of the three tasks. The first two of these measures were time measurements:

1. *Seconds of unfilled pausing:* The number of seconds spent in unfilled pausing. The unfilled pause is defined as a period of more than 250 msec of nonvocalization occurring within the flow of vocalization.

2. *Seconds of initial pausing:* The number of seconds spent in initial unfilled pausing. Initial pauses occur between the end of the experimenter's probe and the beginning of the child's response. If the child pauses, but fails to orient to the experimenter's question, the resulting pause is judged to be noninitial.

The next 11 measures simply record the number of times a phenomenon occurred.

3. *Unfilled pauses:* As defined under (1) above.

4. *Initial pauses:* As defined under (2) above.

5. *Filled pauses:* Examples of this hesitation phenomenon include fillers such as /mm/, /Am/, and /A/, and the words "well" and "you know" when they are not used to convey a particular meaning.

6. *Drawls:* Drawls are marked prolongations of a speech sound without any pause in articulation, as in "gamesss."

7. *Initial segment phonological repetitions:* Here the repeated or stuttered material is less than a word in length and is usually only the first segment of a word, as in "b-b-boy." In the present data, any repetition of segments always includes the initial segment, except for one case of internal repetition: "ba-na-na-nas."

8. *Word-included phonological repetitions:* This phenomenon is like phenomenon (7) above in that there is a repeated string of segments shorter than a word, always including the initial consonant. However, the repetition also includes the word immediately preceding the initial segments, as in "I c- I can't."

9. *Word repetitions:* This phenomenon involves repetition of a word without change and for

no grammatical purpose, as in "I want some some more."

10. *Several-word repetitions:* This is identical to (9) except that several words are repeated. Example: "I want some more some more ice cream."

11. Sentence incompletions: Sentence incompletions involve a string of words which is intelligible, but which does not form a complete phrase or sentence, due to a sudden truncation before completion. Utterances obeying the standard rules for ellipsis are excluded from this category. Example: "That's a. ... Where does that go?"

12. Retraced false starts: False starts involve the correction of one or more words through substitution, deletion, or addition of material. Typically, the entire phenomenon consists of three parts: (a) the material to be corrected, (b) an editing signal which marks the end of the material to be retraced, and (c) the retracing correction which follows the editing signal and continues with the train of speech. This editing signal may come from at least one of five distinct categories: unfilled pause, filled pause, glottal stop, corrective word (e.g., "rather"), or raised pitch and volume.

13. Phonological corrections: This is the shortest form of retraced false start and never extends beyond the length of a word in these corpora. Example: "musital . . . musical."

The final two measures were of the numbers of words and sentences produced:

14. Words.

15. Sentences.

In total there were 15 measures taken for each child on each task.

Results

No significant differences among the pattern of results on the three verbal tasks were identified. For this reason, the data were merged across tasks.

The basic design involved a two-factor analysis of multivariance with two levels of the sex factor, two levels of the social class factor, 15 linguistic variables, and the IQ measure. Because one of the four sex x social class cells was empty for initial segment phonological repetition and for phonological correction, it was necessary to merge these variables with other functionally similar correlated variables. Since initial segment phonological repetition correlated with word-included phonological repetition at a level of .45, these two measures were merged into a general measure labeled phonological repetitions. Similarly, phonological corrections

were merged with retraced false starts into a general measure labeled retraced false starts. The 15 linguistic variables were thus reduced to the 13 found in tables 1, 2, and 3.

A second correlation matrix for these 13 variables and the IQ measure was obtained together with a set of principal components. The raw scores were corrected for the overall output factor by applying weights from the first principle component. Using the corrected values,, a third correlation matrix was obtained. Since the univariate effects of IQ within each of the multivariate tests were not significant, and since the design had closely matched the IQs for each of the four sex and social class combinations, further analysis was confined to the 13 linguistic variables alone. Finally, a fourth correlation matrix and set of principal components was obtained for the 13 linguistic variables. The values for each of the 13 variables were again corrected by this new first principal component.

Using these corrected values, the multivariate test of equality of mean vectors yielded the following multivariate F ratios: for the main effects of sex, $F(13,4) = 7.72$, $p < .03$; for the main effects of social class, $F(13,4) = 0.72$, $p < .71$; and for the interaction of sex and social class, $F(13,4) = 4.30$, $p < .08$. Although the interaction of sex x social class is not statistically significant at the $p < .05$ level, the effect is strong enough to warrant further consideration.

The variables whose production differs significantly *(p < .05)* between sexes are seconds of initial pausing, unfilled pauses, filled pauses, word repetitions, and retraced false starts. Table 1 lists the cell means of all the variables after the correction for output. This table shows that boys produced more unfilled pauses, filled pauses, word repetitions, and retraced false starts than girls. However, girls produced more seconds of initial pausing than boys.

In the case of the univariate F ratios associated with the interaction, only filled pauses and retraced false starts show values significant at $p < .05$. The value for words at $p < .06$ is just outside the acceptable range for significance. As can be seen in the cell means in table 1, the values on the measures of filled pauses, retraced false starts, and words are nearly identical for both sexes of the middle class. However, in comparison to the middle class, the lower-class girls produced far less

TABLE 1

OBSERVED CELL MEANS

	Seconds of Unfilled Pausing	Seconds of Initial Pausing	Unfilled Pauses	Initial Pauses	Filled Pauses	Drawls	Phonological Repetitions
Middle-class girls.	31.39	52.54	5.39	52.83	8.96	5.09	0.67
Middle-class boys.	30.71	39.53	6.47	50.09	8.72	4.22	1.55
Lower-class girls . .	18.24	48.85	3.37	45.71	1.22	0.17	0.73
Lower-class boys .	30.93	31.01	7.50	44.82	13.28	2.11	0.73

	Word Repetitions	Several-Word Repetitions	Sentence Incom-pletion	Retraced False Starts	Words	Sentences	
Middle-class girls .	4.38	1.14	0.25	2.18	62.16	28.78	
Middle-class boys .	9.03	2.64	0.58	2.45	58.17	26.53	
Lower-class girls . .	3.31	1.67	0.23	1.36	40.71	19.83	
Lower-class boys .	8.50	1.93	0.46	4.09	82.65	25.46	

on these measures, while the lower-class boys produced far more.

The sample correlation matrix is printed in table 2 and the rotated (VARIMAX) factor matrix is printed in table 3. The first three components in the rotated factor matrix of table 3 account for 97% of the total variance. The first of these components shows high absolute weights for seconds of unfilled pausing, unfilled pauses, filled pauses, sentence in-completions, retraced false starts, and words. The functional similarities between these variables indicate that this first component represents the contribution of speech planning and speech monitoring processes occurring during the articulation of an utterance. In the interests of brevity, this function will be referred to as coplanning.

The second component, with heaviest weights on seconds of initial pausing and initial pauses, appears to represent the contribution of speech planning processes occurring before the beginning of articulation. This second verbal planning function will be referred to as preplanning.

The third component has high weights for seconds of initial pausing and word repetitions, but these weights are in opposite directions. Looking at some of the variables with lesser weights, we find that several-word repetitions, filled pauses, and retraced false starts have moderate positive weights, while drawls has a moderate negative weight. Thus, in this component, hesitation phenomena which gain time through silence or drawling are contrasted with those gaining time through repe-

tition of material or insertion of meaningless material. Thus, this third component may be characterized as involving the avoidance of superflous verbalization in planning and monitoring occurring during production of an utterance. The last four components account for little of the total variance and will receive no further consideration.

The 151 recorded retraced false starts were quite clearly involved in attempts to in-crease explicitness. The total of 151 included 18 number corrections, 10 person corrections, 12 gender corrections, 5 count to mass correc-tions, 13 pronoun to noun corrections (i.e., "Mommy" for "I"), 8 additions of adjectives to nouns, 8 additions of conjunctions, and 3 deletions. In addition, there were 20 topicalization sequences such as "sand, we all play sand." The other 54 retracings involved 16 changes within categories (i.e., "sand" for "water") and 38 shifts within subcategories (i.e., "ice cream" for "jello"). The important point is that, without exception, these retracings increased the explicitness of the element being retraced.

Word repetitions, on the other hand, involve by their very nature no increase in ex-plicitness. What is interesting is the fact that common words were most often repeated. Thus, of the 171 repetitions from all the chil-dren, 22% were of subject personal pronouns, 22% of the conjunction "and," 16% of articles, 8% of prepositions, and 7% of deictic pronouns. Together, these categories constituted only slightly over a dozen lexical items, but accounted for 75% of all word repetitions. Since the selection of such common words

TABLE 2

SAMPLE CORRELATION MATRIX

	Seconds of Unfilled Pausing	Seconds of Initial Pausing	Unfilled Pauses	Initial Pauses	Filled Pauses	Drawls	Phonological Repetitions	Word Repetitions	Several-Word Repetitions	Sentence Incom-pletion	Retraced False Starts	Words	Sentences
Seconds of unfilled pausing:													
Seconds of initial pausing													
Unfilled pauses .													
Initial pauses. . .													
Filled pauses													
Drawls													
Phonological repetitions . Word repetitions	1.00	1.00 .36		1.00 .04									
Several-word repetitions	.62 .90	.58 .15	1.00	.38 -									
Sentence incompletion. .	.39 .57	.75 .13 -	.24 .61	.1 6 .09	1.00 .25	1.00 .03							
Retraced false starts -----------	.45 .48	. 3 6 -	.16 .61	- . 1 0	.11 .25	- . 2 1 -	1.00	1.00 .65					
Words	.17 .40	. 1 9 .34	.39 .58	.15 - . 2 3	.26 .50	. 2 5 .09	.23 .42	.25 .34	1.00 .45				
Sentences	.80 .39	- . 1 6	.91 .61	- . 1 5	.31 .52	- . 4 0 -	.68 .75	.20 -	.51 .40	1.00 .63	1.00	1.00	
	.66 .60	.10 .42	.83 .63	.04	.31	. 0 2 .19	.71 .54	. 0 8	.08	.77 .58	.76 .35	.66	1.00

TABLE 3

ROTATED FACTOR MATRIX

FACTOR LOADINGS

VARIABLES							
Seconds of unfilled pausing	-.74	.34	-.13	.17	.35	.28	-.22
Seconds of initial pausing	.06	.48	-.74	.08	.36	-.01	-.12
Unfilled pauses	-.86	.17	.16	.22	.12	.30	-.20
Initial pauses	.00	.96	-.06	-.04	.22	-.03	-.06
Filled pauses	-.81	-.04	.23	-.24	.35	.10	-.07
Drawls	.12	.29	.15	.07	.91	.11	.11
Phonological repetitions	-.24	-.04	.08	.91	.07	.22	-.18
Word repetitions	.28	.13	.81	.15	.02	.43	.04
Several-word repetitions	-.23	-.06	.26	.25	-.12	.88	.02
Sentence incompletion	-.70	.15	-.09	.50	.00	.35	-.06
Retracted false starts	.80	.18	.33	.27	.26	.01	.02
Words	-.88	-.15	.09	.22	-.04	.03	-.27
Sentences .... ,	-.48	,12	-.13	.23	.16	-.03	-.81

should not constitute a major search task, it appears that words are repeated not because of uncertainties about their own production, but in order to gain time for other decisions. In the case of several-word repetitions, the situation is similar. Commonly repeated structures are: subject personal pronoun + verb; preposition + article; and conjunction + personal pronoun.

Discussion

The first major result of this study has been the identification of three major planning functions: preplanning, coplanning, and avoidance of superfluous verbalization. These styles in verbal planning reflect basic differences in cognitive processing. Underlying all three planning functions, however, is one central commonality—verbal planning takes time. While the speaker is trying to figure out what to say and how to say it, the conversation moves on. Given this inevitable forward movement in time and his own problems in formulating his utterance, the speaker may do one of two things. He may attempt to fully formulate what he is going to say before he says it. Alternatively, he may start talking and hope to be able to figure out his utterance in medias res. Whether he pauses initially or attempts to patch together an ongoing sentence, he has a further option. He may either use superfluous verbalization to cover his pauses and errors or he may simply remain silent. The principal components analysis in this experiment indicates that the 13 hesitation phenomena examined in this study can be grouped into these three functional

categories: coplanning, preplanning, and avoidance of superfluous verbalization. The association of retraced false starts with Co-planning and of word repetitions, several-word repetitions, and filled pauses with preplanning echoes the relations found by Mac-lay and Osgood (1959) between, on the one hand, false starts and "lexical" words and, on the other hand, between repetitions and filled pauses and "function" words.

The second major result of this study has been the finding that, for 5-year-olds, differences in verbal planning functions are more related to sex than to social class. Boys were found to do more coplanning, while girls made greater use of preplanning. Moreover, boys showed more use of superfluous verbalizations than girl's. These differences extended to both social classes. It is important to note that the interaction effect between social class and sex was strongest for filled pauses, retraced false starts, and words, which were the central variables in the coplanning component. Whereas both sexes of the middle class produced roughly equal amounts of filled pauses, retraced false starts and words, there were great differences for these measures within the lower class. In effect, the girls illustrated highly preplanned speech and the boys illustrated highly coplanned speech. If the interaction effect were to be ignored, a fairly clear picture of care and explicitness among girls as opposed to wordiness, carelessness, and lack of planning among boys would arise from these data. However, this basic picture might eventually require modification, if the interaction effect were found to be of significant proportions.

It appears then that sex has a greater effect than social class in determining differential use of hesitation phenomena in British 5-year-olds. It is important to recognize that Bernstein's theory is primarily a theory of class differences. Although the 1972 reformulation recognizes the existence of differences in explicitness between older boys and girls in the lower class, the theory still implies that class differences should be more important than sex differences in determining verbal planning functions. This relative importance of class versus sex is not confirmed in the present data. Moreover, Bernstein has suggested that sex differences between lower-class boys and girls in verbal planning would first emerge in adolescence. However, the present data, like those of Hawkins (1973), show these differences in 5-year-olds.

At the very least, these data indicate the need for studies of a large variety of hesitation phenomena as used in maximally diverse communicative situations by widely different children of different age groups. Until such studies have been conducted, all hypothesized relations between social class, explicitness, and hesitations remain quite tentative.

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