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The current status of the motherese hypothesis*

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ABSTRACT

Partially conflicting results from correlational studies of maternal speech style and its effects on child language learning motivate a comparative discussion of Newport, Gleitman & Gleitman (1977) and Furrow, Nelson & Benedict (1979), and a reanalysis of the original Newport *et al.* data. In the current analysis the data are from two groups of children equated for age, in response to the methodological questions raised by Furrow *et al.*; but, in line with the original Newport *et al.* analysis, linguistic differences between these age-equated children are handled by partial correlation. Under this new analysis the original results reported by Newport *et al.* are reproduced. In addition, however, most effects of the mother on the child's language growth are found to be restricted to a very young age group. Moreover, the new analysis suggests that increased complexity of maternal speech is positively correlated with child language growth in this age range. The findings are discussed in terms of a theoretical analysis of the Motherese Hypothesis; the

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conditions of both learner and environment in which 'simplified' data could aid a learner. Finally, the results of our past work, those of Furrow *et al.*, and those of the present analysis, are discussed as they fit into, and add to, current theorizing about the language acquisition process.

INTRODUCTION

It has almost never been disputed that language is acquired under direct influence of the learner's environment, since all children learn just the language they hear. For the same reason, it has never been in dispute that the way caretakers talk, and the circumstances under which they talk, affect learning. Since there is virtually no disagreement on these points, outsiders may find it odd that there is fierce contention in the literature on the effectiveness of maternal speech style – what we have called MOTHERESE (cf. Newport 1977, Newport, Gleitman & Gleitman 1977) (henceforth, NGG) – in guiding and organizing the learning. We have argued that the effects of maternal speech are significantly modulated by biases of the child learner about how to store and manipulate incoming information, and about the allowable structures and contents of a language. To this extent, the character of the learning is not a straightforward function of the linguistic environment. In contrast, many others, notably Furrow, Nelson & Benedict (1979) (henceforth, FNB), have argued that the effects of the caretaker are considerably broader and more straightforward than we have found.

In the present paper, after a brief introduction to the Motherese Hypothesis as currently conceived, we will compare the methods and findings of NGG and FNB, and present a new analysis of our past findings. This new analysis was suggested by certain difficulties with our past work pointed out by FNB, with which we agree. The new analytic procedures therefore mirror in many respects those performed by FNB with their own subjects. As we will show, however, with these new procedures the original results reported by NGG re-emerge largely as before; in contrast, the findings and interpretations from FNB are shown to be more difficult to use as a basis for theorizing about the Motherese Hypothesis. Finally, after these methodological issues and the data themselves have been presented, we will examine the logical problems for a Motherese Hypothesis and review the current status of our knowledge of language learning, in light of them.

The Motherese Hypothesis

It is easy to notice that mothers do not talk in the same way to very young children that they talk to, say, learned professors of linguistics (Newport (1977), and see Snow & Ferguson (1977) for a number of descriptions of motherese, and Hoff-Ginsburg & Shatz (1982) for a recent review). Maternal utterances are very short, usually consisting of a single clause; they are clearly enunciated; they almost never contain a true grammatical error (though, to

be sure, the style is often informal and hence some utterances consist, for example, of an isolated noun-phrase, rather than a whole subject and predicate); and, in content, they generally concern things and events that are in view, as opposed to, say, talk about absent rabbits or past birthday parties.

The Motherese Hypothesis is the hypothesis that these SPECIAL properties of caretaker speech play a causal role in acquisition. (See Snow (1972*b*), Cross (1977), and Pinker (1979), for explication, and Newport (1977), NGG, and Wexler & Culicover (1980) for criticisms of this general position.) The hypothesis is not that motherese is different in kind from ordinary talk among adults. It is important to keep in mind that the sentences of motherese are most often regulation English sentences – in fact more often than they are in the hurried and elliptical speech among adults. What differs in motherese is the restriction on the choices among the allowable structures and contents. In its strongest form, the Motherese Hypothesis is that these restrictive choices are the requirement for learning. In a weaker form, the hypothesis is that the more the caretaker restricts the sentence types and contents of the language in this fashion, the faster and less error-laden the learning will be.

Measuring maternal speech and its influence on language learning

The most obvious way to study maternal speech and its influence on the learner would appear to be correlational. This is because of the difficulties in manipulating the input speech, and also because of difficulties in gaining the co-operation of very young language learners in any situation where linguistically novel materials are presented.[1] The idea is to measure the rate and character of learning by exploiting the normal range of variation among the caretakers. If there is some ideal input to a learner, those mothers who use it the most consistently should have children who acquire the language the more quickly and the least errorfully, on average. This method was used to study syntactic aspects of maternal speech by both NGG and FNB. In detail, NGG measured various characteristics of maternal speech at a particular time; measured a variety of the structures and contents produced by their children, at two points in time; computed a growth score (language

[1] This is not to say these latter methods cannot be attempted at all. Our group of investigators has examined language learning as it occurs in experiments performed by nature, that is, in the presence of pathologies that render the child's environment deviant in various ways. (For partial reviews, see L. R. Gleitman 1981, Newport 1981, 1982.) In addition, we and others have performed some traditionally experimental studies, which include examining the effects of maternal speech style on responsiveness (Shipley, Smith & Gleitman 1969) and comprehension of the child (Sachs & Truswell 1978, Snow 1972*a*, Newport & Gleitman 1977), as well as examining the effects of experimentally controlled input in adults' learning of artificial languages in the laboratory (Morgan & Newport 1981). Training studies from K. E. Nelson (1976), Nelson, Carskaddon, & Bonvillian (1973), Cazden (1965), Feldman (1971), and Shatz & Hoff-Ginsburg (in prep.) have also been informative. None the less, there is some difficulty in achieving stable experimental results from young language learners owing to their difficulties with artificial materials, and perhaps their general disinclination to do as they are told.

at $Time_2$ – language at $Time_1$) for each measure of the child's speech; and then correlated mother's speech with child language growth to see which properties of maternal speech predicted which properties of the children's language growth.

Such correlational studies face a number of problems. First, they typically measure maternal speech style by asking about the FREQUENCY with which the various structures and contents appear in the maternal corpora. But there is some reason to wonder whether sheer statistical preponderances in the data base are important factors in learning (notice, for example, that formal studies of learnability, e.g. Wexler & Culicover (1980), take appearance of some structure under interpretable conditions, not frequency of appearance of that structure, to be the sufficient condition for its acquisition). None the less, there is some plausibility to the idea that the child will seize upon those forms and contents that are the most characteristic of the data base.

A more serious problem with the correlational method arises from the probable nonlinearity of the child's language learning curves. For language (as for many other domains of learning), learning rates may decelerate; that is, the less you know the faster you change, and the more you know the slower you change, as documented for certain measures of language growth by NGG. (It is important to note that ANY nonlinearity in growth curves – acceleration as well as deceleration – would yield the problem under discussion, for the same or related reasons; the example we now work out in more detail is the case of deceleration.) If learning rates decelerate, a child measured early in his development will show rapid growth, while a child first measured later in development will show less growth, all quite independent of what the caretaker is doing. In addition, the caretaker may adjust her speech style to what the learner knows at that particular developmental moment. As a consequence of these two facts, spurious correlations between mother and child may result, because of effects by the child on the mother, and effects by the child on the child, rather than because of effects by the mother on the child.

The difficulty of disentangling these problems is easily shown by taking an analogy from physical growth curves, where no one suspects that the caretaker's behaviour has much of an effect. For instance, we might measure the angle of regard from the caretaker when looking at her child. The smaller the child, the smaller the angle of regard from caretaker to child. As the child grows, the angle of regard increases. We would clearly be making a mistake if we assumed that it was the mother's looking down behaviour that caused the subsequent physical growth of the child, even though we shall obtain a massive correlation between maternal angle of regard and child height. This particular problem can be resolved by the computation of a growth score, correlating mother's angle of regard with the CHANGE in the child's height.

However, there is a worse problem in interpreting the causal role of maternal regard. Owing to the nonlinearity of physical growth (on average,

the smaller you are, the faster you will grow in the interval between measurements), the following outcome is sure to result: the MORE the mother looked down at her child at the first measurement, the GREATER the growth during the interval between measurements. We would surely not want to conclude that this 'Motherese looking' was 'simple regard' and thus caused the child to grow. The same possibility, that the maternal speech style is an effect, rather than a cause, of language growth, plagues interpretation of correlational studies of mother/child language.

NGG handled this problem by statistically equating their child subjects on each of the measures of child language, at the first interview. This was done by computing a correlation between mother at $Time_1$ and child change from $Time_1$ to $Time_2$, but then partialling out the effects of the child's initial age and language score on each of the measures taken ($r_{xy \cdot ab}$). This in effect removes correlations between mother and child growth that are effects of the child on the mother (mothers use more motherese to younger children) and of the child on the child (language growth is faster in younger than in older children).[2] Luckily, some variation in maternal usage remains, above and beyond that attributable to the child's current age and language. And also luckily, some variation in child growth rate, on various measures, remains, above and beyond that variation attributable to where the child fell at first measurement on the language learning curves.

[2] To be more precise, the partialling procedure removes from the correlation between mother and child growth that portion due to the effects of the child on the mother and of the child on the child, IN SO FAR AS THE LATTER ARE TAPPED BY OUR MEASURES, AND IN SO FAR AS THE LATTER ARE THEMSELVES LINEAR RELATIONS. That is, most importantly, the Pearson product moment partial correlation procedure assumes that all relations measured are linear, and therefore in particular that the relations between the child's initial age or language scores and the child's growth from $Time_1$ to $Time_2$, and between the mother's speech at $Time_1$ and the child's initial age and language scores, are linear. These assumptions regarding our data are not unreasonable. (Note that we previously suggested that growth curves are NONLINEAR, but this translates into a LINEAR relation between initial state and rate of subsequent growth). However, although the assumptions are not unreasonable, they could be untrue. We have dealt with this possibility as follows:

(1) One may in principle avoid assumptions of linearity by using nonparametric, rather than parametric, correlational procedures. Unfortunately, at the time at which these investigations were conducted (although this may be changed in the future), no probability distribution had ever been computed for Spearman rho partial correlations (or any other rank-order partial correlations), and there was therefore no way of evaluating their significance. We therefore considered this an unsatisfactory alternative.

(2) We visually inspected scattergrams of the actual data points over which the partial correlations were conducted in NGG (that is, scattergrams of the residuals). These appeared to be linear enough to justify some confidence in the assumptions.

(3) Most important, if the assumptions are untrue, they largely work against our own interpretations and in favour of FNB's, rather than the reverse. That is, if the relations are either partly or wholly nonlinear, the partialling procedure will remove less of the contaminating variance than would be desirable. This in turn would lead to LARGER (partial) correlations between maternal speech and child language growth, a result more in line with the Motherese Hypothesis (and, as we understand them, the hypotheses entertained by FNB) than with our own.

In short, NGG created, by statistical manipulation, a set of children who were identical at the first measurement on the measures taken. They then computed measures of growth rate for each such child on each such measure, and correlated these with the maternal usages at the first measurement time. The question could now be asked: how did the differing maternal usages at $Time_1$ affect the child growth rates during the interval from $Time_1$ to $Time_2$ (in NGG's study, a six month interval)?[3]

However, FNB raised some plausible objections to the method and to the data on which the computations were performed, objections with which we agree. They argued that NGG's method and analysis implicitly assumed that the effects of the various maternal contents and structures on the child were the same at varying developmental moments. This is because the partialling procedure of NGG, which statistically rather than actually equates children over a range of ages and linguistic abilities, may be insensitive to effects of mothers on children that occur only within a particular developmental period. Of course this would not be a problem if the children studied were within a narrow range of ages and linguistic abilities, within which effects of maternal speech might reasonably be presumed to be constant. But the children NGG in fact studied ranged from one to two years of age and from beginning to considerably more advanced language abilities.

FNB's objections are quite plausible. There is no reason to believe that the effects of maternal speech on language learning must be the same over this wide range of ages and linguistic abilities. It is entirely possible that, say, imperative sentences are good for the learner when he knows the declarative structure; but bad for him if he does not. Correlations over such a range, even if the children are statistically equated, will not pick up that variance in the mother's speech which is related to the variance in language growth of only a subset of the children (namely, those who are at the right developmental moment to exploit some particular characteristic of the environment).[4]

[3] Of course there are further difficulties in interpreting such correlations between mother and child as effects of the mother on the child, as is the case with any interpretation of causality from correlational data. We only mean to claim that we have eliminated one known hindrance to such interpretations. Further hindrances we ignore only by claiming that partial correlations contribute to a plausible, but by no means certain, argument for maternal effects on child growth. Similar provisos are pointed out by FNB.

[4] We must make clear that the problem is not in statistically equating children who are not actually equal, since the partialling procedure only equates children to the extent that their ages and language abilities correlate with (i.e. influence) their mothers' speech styles and their own growth rates. Whatever variance exists between children that is uncorrelated with maternal speech style and growth rate remains; similarly, whatever variance exists between maternal speech styles that is uncorrelated with differences between children remains. The problem is that, after the partialling procedure is done, a correlation computed between these remaining variances would not pick up relationships between maternal speech and accelerated or decelerated growth by just one subrange of children.

As should now be clear, the problem in the NGG study was not with partial correlations. The problem was that these were conducted over a relatively broad age span, within which specific factors of motherese that affect the learner might have changed. If this span is narrowed, the partialling does not have this possibly obscuring effect. On the contrary, the failure to partial out (somehow) learning-curve differences among the children (i.e. under certain circumstances, doing simple correlations) may obscure the chances of disentangling cause and effect in the relationship between maternal speech and child language development.

The Furrow, Nelson & Benedict study

Subjects and procedures of the FNB study

FNB accepted our initial arguments, that simple correlations between unequal children and their (therefore possibly also unequal) mothers might yield spurious correlations. But their remedy was different from ours. Rather than relying on partial correlations, they equated learners in a new way. They chose the reasonable stratagem of selecting children who were apparently identical at the first measurement, which seemed to preclude the need to partial out differences among them. They then argued that simple correlations between the mothers' speech at $Time_1$ and the children's language abilities at $Time_2$ could now be interpreted just as our own (partial) correlations with growth scores were interpreted: as effects of maternal usage on child progress.

FNB chose as their subjects children whose age was the same at the first measurement (1;6 years) and most of whose MLUs were also the same, namely 1·0. There are two reasons why this choice of the youngest and least sophisticated learners is reasonable. First, it is easier to make the claim that the children are 'the same' by using Time Zero. This is because the various linguistic structures and contents thereafter develop at quite differing rates across children, making it virtually impossible to find subjects one can be at all confident are 'the same'. The second, perhaps weaker, reason is that if any learning group would seem to be the most central for the Motherese Hypothesis, it is that initial age group.

FNB claimed to find a large number of effects of maternal simplification on child language acquisition that NGG did not find. FNB argued that this was because of NGG's failure to examine effects within narrow developmental ranges. However, a number of problems of sample size and constitution make the FNB findings less than definitive. One problem is the small sample of utterances (100 per mother, and 100 per child) that formed the basis for the analysis (in contrast, the data in NGG are based on an average of 513 utterances for each mother and on as many child utterances as were produced in an hour's session, or up to about 300). In addition, the number of dyads studied by FNB was small. There were 6 dyads for which the child's MLU was 1·0 and the age of the child 1;6 (as opposed to 15 dyads studied by NGG,

see below). FNB also included in their analyses data provided by a seventh subject of the same age, but who had an MLU of roughly 1·4 at the first measurement, introducing a serious contaminant into the obtained correlations. Since this outlier contributes a large proportion of the obtained data – $\frac{1}{7}$ – and since the sample size was very small, there are some difficulties in evaluating these findings. Another difficulty stemming from the small sample size is the further finding from FNB that most of the variance on certain of their most important measures was due almost entirely to two of the seven subjects (*ibid.*: 431).

The most serious consequence of having small samples and performing large numbers of correlations is that the obtained correlations may be a result of measurement error. NGG had indeed worried about the reliability of correlational findings for their sample of 15, and performed a split-half correlational analysis on their findings (see below). Those correlations which maintain themselves on split-halves of the data, as well as on the overall analysis, can at least be taken as reliable on the subjects studied. (There is of course still a question of the reliability of the findings on yet further subject groups.) In contrast, FNB present no analysis of the internal reliability of their findings.

Most important of all is the fact that FNB's subjects were not really 'the same' in their initial level of language development. To be sure, their subjects were mostly equal in productive language but, as FNB themselves point out (*ibid.*: 435), they varied in their stage of receptive language development, on measures developed by one of the authors (Benedict 1976). The trouble is that these differences in level of receptive language were predictive of the child's rate of productive growth by the second measurement (a nine-month interval, i.e. the second measurement was at 2;3). As the authors again note, this leaves open the possibility that the obtained simple correlations between maternal speech and child language growth may be due to the relationships of both to a third variable, namely the child's comprehension abilities. Thus FNB's attempt to find subjects who were equal at first measurement, so that one could obtain mother/child correlations that are interpretable without statistical manipulation, was not altogether successful.[5] In particular, the

[5] After the time this paper went to press, a relevant new study of mothers' speech and child language growth was published (Barnes, Gutfreund, Satterly & Wells 1983). Because of the timing, we are unable to address this study in detail. However, one brief comment is in order here. Like FNB, Barnes *et al.* attempted to equate their child subjects at Time$_1$ by selecting children who were in fact identical in relevant ways. (In their case, they chose speech samples which were all as close as possible to the time when the child's MLU equalled 1·5.) However, like FNB, Barnes *et al.* did not succeed in this aim. They report that their subjects in fact varied in MLU from 1·0 to 2·21, and moreover varied in age from 1;6 to 2;9. Perhaps even more seriously than FNB's results, then, the Barnes *et al.* results on the relations between maternal speech and child language growth may in fact be due to the relationships of both to the child's initial language and age.

comprehension-score differences among FNB's subjects suggest that MLU is not a sufficiently sensitive measure of the current language status of one-word speakers. Therefore, it is an inadequate measure on which to equalize one-word speakers.[6]

In sum, various difficulties of FNB's study provide some impetus for further replication. But more than these limitations, it is the very great plausibility of the FNB objections to our prior study, and their sophisticated work with seven new children, that cries out for further replication. As we will now show, certain differences between the results achieved by these authors and our own, and differences in the interpretation of these findings, provide yet another impetus for further replication and analysis.

FNB's findings and interpretations

Table 1 presents the simple correlations obtained by FNB (*ibid.*: 433). Table 2 presents the original findings from NGG. It should be obvious that the tabulated findings are not directly comparable. As can be seen, not all the measures are the same, and as we have stated the NGG findings are from learners who range over a much larger developmental period (but whose age and initial language level have been statistically equated by the double partialling procedure). But some results are much the same even so, as a comparative inspection of the tables shows.

On the other hand, FNB obtained many significant correlations that we did not, as is also clear from a comparison of these tables. Many of their correlations are quite puzzling. For example (Table 1), they found that mothers who used more copulas and more contractions to their offspring had children who came to say fewer noun-phrases per utterance than the offspring of mothers who used fewer copulas or contractions. If such an effect is real, what could be its explanation? Contractions have to do with auxiliary verb

[6] More precisely, the investigators measured comprehension when the subjects were aged 1;5, and then again when they were 1;7. The body of the measures used for the correlations were collected at 1;6. The children were alike in comprehension (as well as MLU) at 1;5, but differed from each other at 1;7. Therefore a claim that comprehension differences did not affect the results at 1;6 is plausible; but just as plausible is the possibility that they did affect them. We ourselves used production MLU (and its various subcomponents) as measures of the language status of our subjects. However, since there was indeed variation among our subjects in MLU, it is likely that MLU correlated with other indices (e.g. comprehension), and thus that when we partialled out MLU or its subcomponents, we were also partialling out other aspects of language status. In contrast, when MLU does NOT vary among subjects (as was the case for FNB's one-word speakers), one should be less confident that it alone is a sufficient measure of language status, and therefore that its equality across subjects reflects relevant equality for correlational purposes. It has been shown (Braine 1976, Bloom 1973, and other sources) that there are major differences in current language among children, during the relatively lengthy one-word period. The differential comprehension progress of the FNB subjects during the period 1;5–1;7 may very well be a reflex of this underlying difference – that is, where the subjects were, within the one-word stage, at 1;5 and 1;6.

TABLE 1. *Simple correlations between maternal speech at 1;6 and child speech at 2;3*[a]

Maternal speech	Child language			
	Aux/VP	MLU	Vb/utt	NP/utt
Declaratives	−0·03	−0·25	−0·28	−0·22
Yes/no-questions	0·85**	0·72*	0·64	0·58
Imperatives	−0·47	0·06	0·02	0·34
Wh-questions	−0·30	−0·37	−0·33	−0·48
Words(MLU)	−0·38	−0·69*	−0·70*	−0·68*
S-nodes/utt	−0·55	−0·53	−0·60	−0·46
Interjections	0·64	0·57	0·67*	0·43
Pronouns	−0·58	−0·75*	−0·81**	−0·62
Noun/pronoun ratio	0·60	0·72*	0·74*	0·55
Verbs	−0·66	−0·71*	−0·78**	−0·55
Copulas	−0·58	−0·85**	−0·90**	−0·77**
Tense	−0·09	−0·46	−0·47	−0·63
Contractions	−0·21	−0·65	−0·58	−0·84**

[a] Adapted from FNB (*ibid.*: 433).
* $P < 0{\cdot}05$.
** $P < 0{\cdot}025$.

TABLE 2. *Double-partial correlations between maternal speech and child language growth, partialling out initial child age and language*[a]

Maternal speech	Child language growth ($Time_2 - Time_1$)				
	Aux/VP	Infl/NP	MLU	Vb/utt	NP/utt
Declaratives	0·25	0·01	0·10	0·16	0·02
Yes/no-questions	0·88***	−0·05	0·50+	0·35	0·16
Imperatives	−0·55*	−0·52+	−0·38	−0·29	0·19
Wh-questions	−0·36	−0·07	−0·29	−0·02	−0·24
Deixis	−0·09	0·58*	0·13	−0·12	−0·08
Expansion	0·51+	0·14	0·23	0·03	−0·16
Repetition	−0·58*	−0·51+	−0·50+	−0·05	−0·27
MLU	0·34	0·10	0·14	0·38	0·22
S-nodes/utt	0·21	−0·05	0·37	0·05	0·31
Interjections	0·53+	0·22	0·42	−0·08	0·11

[a] Taken from NGG (*ibid.*: 132).
\+ $P < 0{\cdot}10$.
* $P < 0{\cdot}05$.
*** $P < 0{\cdot}001$.

structure; why should they affect the growth of noun-phrases but not of auxiliaries? Similarly, why should copulas affect the growth of noun-phrases? As another example of the same point, they found that the greater the proportion of interjections (e.g. *Mm-hmm*) from mothers, the more verbs their offspring used in their utterances.

FNB did make an attempt to interpret their findings. This is in line with a serious attitude towards explaining the learning effects. To say merely that whatever the child seems to be influenced by was the 'simple input' would be to beg the questions that are at issue. Rather, the authors proceeded by the sensible means of seeking external support (apart from the correlational findings) for the view that these effective properties of maternal speech are the linguistically or experientially simple ones. But in our view their attempts were not always successful. We turn now to the specific effects reported by FNB (Table 1), and their interpretations.

Sentence type. To begin with, FNB found that a preponderance of maternal *yes/no*-questions clearly speeds the acquisition of verbal auxiliaries by the learner. NGG had reported the same effect. Thus both Tables 1 and 2 reveal highly significant correlations between this feature of the mother's speech and subsequent child growth. As we will discuss later, this massive and stable correlational effect is predictable on theoretical grounds, and dovetails well with a variety of further findings about language acquisition. However, the remaining findings were less convincingly related to any linguistic or acquisitional theory, as we will now try to show.

Syntactic simplicity. FNB claimed that a number of the correlations in Table 1 are predictable from 'formal grammatical theory'. Their source was an account of the so-called Standard Theory (Chomsky 1965), written by Jacobs & Rosenbaum (1968). Based on their reading of this work, FNB claim that English grammar represents only nouns and verbals in 'deep structure', all further content being inserted by transformation. Based on such a hypothesis about the grammar, FNB next conjectured that those elements introduced in deep structure are the simplest, while those introduced by transformations are more complex.

One difficulty with this line of argument is that the Jacobs & Rosenbaum analysis differs in several major and relevant ways from the Standard Theory as it was usually described: for example, most versions of Standard Theory never in fact introduced surface lexical elements by transformation. Moreover, linguistic findings of the last 15 years have overwhelmed and defeated transformational grammars of this general sort, which have yielded to far more persuasive and richer recent linguistic descriptions. (For discussion see, for example, Chomsky (1981), Bresnan (1978, 1982), and Gazdar (1981).) Interpretation of empirical findings in learning against grammatical theories must be in terms of current knowledge of the latter, not early attempts that by now have been rejected.

Most important, however, even accepting FNB's view of the grammar, the findings are not easily understood on this basis. After all, as Table 1 shows, the mother's use of verbs (on FNB's supposition, deep-structure elements) correlates NEGATIVELY with acquisition of MLU and verbs. In contrast, the mother's use of auxiliaries in *yes/no*-questions (on their supposition, NOT deep-structure elements) correlates POSITIVELY with child learning of the auxiliaries. At the same time, other elements alleged not to be in deep structures (the pronouns, copulas and contractions) correlate NEGATIVELY with child learning. These facts taken together show that there is no consistent way of predicting the learning rate from the mother's use of the deep-structure elements – if these are, as alleged, the nouns and the verbals only.

In summary, FNB's results are not predicted by the grammar to which they subscribe. In some cases, their correlations make no obvious sense (e.g. the mother's use of copulas is negatively correlated with the child's acquisition of noun-phrases). In other cases, the sign of the correlations is inexplicable (e.g. the mother's use of verbs correlates NEGATIVELY with the child's acquisition of verbs). These puzzling findings have no external support from linguistic theories in any of their various renditions, nor to our knowledge, from features of language behaviour.

Semantic simplicity. FNB argued that their findings may be in tune with semantic simplicity. They remarked that 'abstract' language may be harder than 'concrete' language for a cognitively immature learner. A topic they took up from this perspective is the apparent finding that the use of pronouns by the mother is negatively correlated with certain growth measures (see again Table 1).[7] They believe that the difficulty is caused by the deictic property (variable reference) of the pronouns – that these have no physical distinctiveness and are low in imageability. But this argument is weak. For one thing, such non-imageable words as *fun* and *bad* appear in earliest maternal speech and are not notoriously hard to learn. In addition, deictic terms are not generally hard to learn (deictic *this* and *here* are among the earliest vocabulary items, for many English speakers), and deictic usage by the mother is one of

[7] The authors also contend that pronouns are syntactically more complex than nouns, 'because they need more transformations before translation into surface structure'. However, the idea that pronouns are inserted by transformation has not been seriously entertained by linguists for quite some time (cf. Bach 1970, Dougherty 1969, Lasnik 1976). Another argument for the syntactic complexity of the pronouns offered by FNB is that pronouns mark case, gender, and number 'in fairly regular fashion'. But why should pronouns' regular marking of these properties present special difficulties, as opposed to nouns, whose case, gender and number is variably (often covertly) marked in English? Should there be more trouble learning nouns in languages which mark case, gender and number 'in fairly regular fashion'? The developmental findings, in fact, are that regularly inflected nouns (as in Turkish) as well as the inflections themselves are easy to learn; as opposed to irregularly inflected nouns and their inflections (as in Serbo-Croatian). For the evidence and discussion see Slobin (1982).

the few properties that correlates positively and significantly with language growth in our own studies (NGG, see Table 2).

In pursuit of a similar semantic claim, FNB offered the idea that verbs in the mother's speech are 'less concrete' than nouns and therefore make trouble for the young learners. This is FNB's interpretation for the significant negative correlation they obtained between maternal use of verbs and child's rate of using verbs in his or her own speech (that is, apparently, the more the mother uses verbs, the less the child learns about them; see Table 1). This interpretation seems rather odd. After all, looking at the other side of this conjecture, it seems to be the claim that to teach verbs it is good not to present them. In that case, the motherese interpretation has no explanation for how verbs would finally be learned. More important, the claim that verbs are less concrete than nouns seems no more than an unexplicated assertion (though to be sure, as the authors note, the assertion is often made in the psychological literature).[8]

Most generally, the semantic conjectures from FNB come down to the possibility that motherese is a 'here and now' language, one that traffics in present dogs and ducks rather than Christmases past and absent cats. This is quite possibly the fact of the matter, but no finding from the FNB study, or any other study we know of, suggests either THAT such a property of the maternal speech aids the learning, or HOW it would do so. (Not incidentally, forthcoming results from Landau & Gleitman about a blind learner's successful acquisition of such sight-related terms as *look*, *picture* and *green* suggest that the notion of 'here and now' begs the questions it is designed to answer.

Brevity. Next, FNB pointed to a set of correlations between brevity of the mother's sentences and the child's language learning as instances of the relationship between simple speech style and child learning. In particular, the maternal variables they interpret in this regard are INTERJECTIONS, whose frequency correlates positively with child language growth, and MEAN NUMBER OF WORDS PER UTTERANCE, which correlates negatively with child language growth (see Table 1). However, there are some difficulties here. For example, interjections are utterances like *yes*, *mm-hmm*, and the like, as well as isolated phrases. Moreover, interjections correlate with growth in verbs. But how

[8] In contrast, such investigators as Gentner (1982) have provided a possible explanation, and some supporting empirical data, for why nouns might be easier to learn than verbs. Gentner argues that verbs conflate semantic elements variably, over the languages of the world, while nouns in all languages categorize the world about equivalently (i.e. no language would likely divide the *dog* concept into say, dogs bigger than a breadbox and dogs smaller, with a word for each of these two categories). Hence, according to Gentner, the child's pre-existing categorizations of objects, but not actions, could form a secure basis for early lexical learning. But notice that Gentner's explanation rests ON INNATE PROPERTIES OF THE CHILD LEARNER (his pre-existing dispositions to carve up the world into just certain conceptual categories), NOT ON PROPERTIES OF THE DATA PRESENTED.

could *mm-hmm* help one learn verbs, since it contains no verb? Some reanalysis, separating verb-phrase fragments from interjections, might clarify this issue one way or the other, but in the present form of the data the conjecture from FNB is quite puzzling. As for maternal utterance length, we will return to the issue of relations between brevity and language learning in a later discussion. For now, suffice it to say that there are reasons to question the stability of the relationship FNB have obtained, and theoretical reasons to claim that a restriction of sentential complexity might make the learning HARDER rather than easier.

Intelligibility. FNB offer a final argument for the role of 'input simplicity'. This has to do with the phonological clarity of the mother's speech. However, FNB have not directly measured phonological clarity of the maternal speech. A finding that they attempted to relate to this issue is a negative correlation between language growth and maternal use of contractions. But we believe this issue is a very complex one.

Strictly speaking, there is nothing unintelligible about a contraction, from the physical point of view. What is complex about it is that it conflates, within a single lexical item, a pair of formatives which are in other parts of the language two separate lexical items. For example, *can't* is not hard to hear; the problem is that it is not formationally simple, but rather must be analysed as *can*+*not*. As Gleitman & Wanner (1982) have discussed (and named the Three Bears Hypothesis), learners seem to have strong biases about the semantic elements that can and cannot be conflated in a single word, and biases in general towards representing formatives as separate words. (For discussion, see the many citations in Gleitman & Wanner, and, particularly, Slobin (1973, in press), Newport & Supalla (1980), and Peters (1981).) The explanation of this correlation, then, if it is stable, depends on properties of the CHILD (who abjures certain conflations) rather than on surface, physical properties of the incoming stimulation from the mother.

Summary of the FNB explanations. In our view, FNB have not succeeded in the search for independent justifications for why their significant correlations were just the ones they were. Thus there is no reason, independent of the correlations themselves, to think that their effective inputs are those that are simple AS STIMULI. If the effects are genuine, further explanation of the initial state and (representational and/or inductive) biases in the learner will be necessary to explain why these particular kinds of data were 'the simple ones for learning'. In contrast, as we remarked and will discuss further, the more restricted correlations found by NGG fit in nicely with what is currently known of a psycholinguistically crucial distinction: the open class/closed class subdivision of the basic linguistic vocabulary, and the syntactic functions these two classes subserve.

A replication of Furrow, Nelson & Benedict (1979)

In sum, our overall reaction to FNB's discussion is that there are as many explanations as there are correlations, few of them tight or compelling. But before going further, it is essential to ask whether FNB's findings are stable. We turn immediately, then, to a replication of FNB, accomplished through a reanalysis of our own data.

METHOD

In response to the problems inherent in the NGG analysis (see above), we now divided our original subject population into groups within which chronological age was very close, and re-did the correlational analyses within each of these age-equated groups. These reanalyses answer to FNB's general methodological complaint and to our own analysis of the problems inherent in what we did previously, as described above.

Subjects

Originally, NGG had three subject groups. Group I consisted of 3 individuals ranging in age from 12 to 15 months at the first measurement. This group, both very small and younger than the FNB group, has been discarded for the current analysis. Group II consisted of six individuals, ranging in age from 18 to 21 months. (Note that Group II subjects are approximately the same in chronological age as the FNB subjects; however, they differ from the FNB subjects in MLU; see below.) Group III consisted of six individuals, chosen to range from 24 to 27 months but (as the sample turned out) ranging from 24 to 25 months at the first measurement. For groups II and III, half were first-born and half later-born; all were female. All had mothers who were full-time caretakers. The subjects were upper middle class, from academic and professional families. Notice, then, that each group is approximately the same size as FNB's single group.

Procedure

The subjects were visited in their homes. The mothers were told that the language development of their children was under investigation, and that the method was simply for the mother to chat with, and play with, her child during this hour. The investigator's involvement was generally restricted to note-taking. In practice, conversation between investigator and mother, as well as child and mother, took place during these sessions. Because half our aim was to detail the differences between maternal speech to the child and to adults, the investigator made sure to initiate informal conversation with the mother, when it did not occur spontaneously. The investigator returned to each home six months later, and instituted the same procedure. Following

the second sessions, the mothers were informed that their own speech, as well as that of the child, had been under investigation, and that the actual purpose of the study had to do with investigating effects of maternal speech on child language growth. We then solicited permission to use all the data that had been collected, with knowledge of these purposes. In each case, permission was granted.

Measurement of the child and mother speech. Maternal utterances were separated into those addressed to the experimenter and those addressed to the child. Each set was coded for intelligibility, well-formedness, sentence length, structural complexity (indexed as number of sentence-nodes per utterance and derivational length), psycholinguistic complexity (explicitness with which the surface form preserves the underlying structure), sentence type (declarative, imperative, etc), frequency of self-repetition, and frequency of expansion. Only utterances addressed to the child are of present relevance.

Child speech was coded for syntactic complexity, estimated through mean length of utterance (MLU), mean noun-phrase frequency and length, mean verb-phrase frequency and length, inflection of noun-phrases (plural and possessive marking), and auxiliary structure (modals and aspect marking) for both the first session and the succeeding one six months later. Finally, 'growth scores' were obtained by computing the difference between the first and second interviews on each of these measures. (See NGG for the complete description and examples of the coding scheme.)

Some of these measures showed virtually no variance over the groups (e.g. mothers' ungrammaticality); others were largely redundant with each other on these groups (e.g. sentence type and psycholinguistic complexity). These nonvarying and redundant measures are not reported below. The means,

TABLE 3. *Means, ranges and standard deviations for measures of child speech*

	$Time_1$			$Time_2$ minus $Time_1$		
Child speech	Mean	Range	S.D.	Mean	Range	S.D.
			Age group II (18·5 to 21·3 months)			
Auxiliaries/verb-phrase	0·01	0·00–0·06	0·02	0·15	0·03–0·36	0·16
Inflections/noun-phrase	0·04	0·00–0·11	0·05	0·09	−0·02–0·19	0·09
MLU	1·52	1·05–3·32	0·88	0·86	0·25–2·18	0·73
Verbs/utterance	0·21	0·00–0·47	0·17	0·35	0·30–0·45	0·05
Noun-phrases/utterance	0·94	0·80–1·14	0·13	0·22	−0·23–0·55	0·20
			Age group III (23·9 to 24·8 months)			
Auxiliaries/verb-phrase	0·09	0·00–0·31	0·14	0·27	−0·12–0·49	0·17
Inflections/noun-phrase	0·15	0·04–0·27	0·08	0·05	−0·10–0·19	0·08
MLU	1·98	1·16–3·46	0·82	1·40	0·32–2·15	0·64
Verbs/utterance	0·31	0·06–0·65	0·21	0·35	0·07–0·55	0·16
Noun-phrases/utterance	1·11	0·84–1·47	0·23	0·37	−0·07–0·70	0·23

TABLE 4. *Means for measures of maternal speech*

Maternal speech	Age group II	Age group III
Declaratives*	0·27	0·34
Yes/no-questions*	0·21	0·20
Imperatives*	0·20	0·16
Wh-questions*	0·14	0·13
Deixis*	0·17	0·17
Expansion	0·07	0·08
Repetition	0·28	0·15
MLU	5·13	5·57
S-nodes/utterance	1·16	1·21
Interjections	0·14	0·14
Unintelligible	0·04	0·03

[*] Two passes were made in coding the maternal speech. First, the utterances were divided into full sentences vs. other (interjections, ungrammatical sentences, fragments, idioms, and unintelligible and incomplete sentences). Each of these categories was scored in terms of PERCENTAGE OF ALL UTTERANCES which fell into the category. Here, we omit mention of categories for which there was no variance (e.g. idioms) and those for which there were no obtained data (i.e. there were virtually no ungrammatical sentences). The full sentences were then submitted to further analyses, which were scored in terms of PERCENTAGE OF FULL SENTENCES which fell into the category. These latter categories are starred (and proportions of these within each age group add up to 100%, except for rounding errors). MLU was also computed on full sentences only.

ranges, and standard deviations for our subject groups on all the remaining measures are presented in Tables 3 and 4.

Analysis

We have already described our prior methods of analysis; for full details, the reader is referred again to NGG. We discuss here only the new analyses, which involved performing simple and partial correlations between maternal speech and child language growth, now computed separately for age groups II and III.

Simple correlations. To compare our results with those of FNB, we first performed simple correlations between each of the measures of maternal speech and each of the measures of child language growth. The results are shown in Table 5. As in the FNB study (compare Table 5 with Table 1), there are many significant correlations, scattered across the child and mother measures. However, there are many reasons to be wary of these outcomes. One problem has to do with their reliability, given the small speech samples on which each analysis was performed, and the small number of subjects now contributing to each cell. As opposed to our original study with 15 subjects, there are in the present analysis six subjects in each of the two groups. Note,

TABLE 5. *Simple correlations between maternal speech and child language growth*

Maternal speech	Child growth ($Time_2 - Time_1$) Aux/VP	Infl/NP	MLU	Vb/utt	NP/utt
			Age group II		
Declaratives	0·23	0·12	0·17	0·84+	−0·10
Yes/no-questions	0·73*	0·08	0·24	−0·09	0·28
Imperatives	−0·60+	−0·50	−0·27	−0·42	−0·24
Wh-questions	−0·71+	−0·17	−0·63+	−0·33	−0·43
Deixis	0·72+	0·80*	0·51	−0·59	0·82*
Expansion	0·81*	0·27	0·51	0·15	0·44
Repetition	−0·74*	−0·49	−0·62+	−0·39	−0·51
MLU	0·82*	0·14	0·09	−0·01	0·22
S-nodes/utt	0·89*	0·37	0·52	−0·34	0·66+
Interjections	0·75*	0·30	0·77*	0·18	0·61+
Unintelligible	−0·69+	−0·67	−0·12	0·83+	−0·63+
			Age group III		
Declaratives	0·19	−0·70*	−0·33	−0·34	0·08
Yes/no-questions	0·62+	0·01	−0·22	−0·28	−0·45
Imperatives	−0·57+	−0·31	0·07	0·13	0·51
Wh-questions	−0·11	0·37	0·03	0·38	−0·42
Deixis	−0·18	0·48	0·36	0·12	0·24
Expansion	0·59	−0·06	−0·12	−0·47	−0·26
Repetition	0·02	0·51	0·44	0·74*	0·02
MLU	−0·46	−0·45	−0·72+	−0·31	−0·68+
S-nodes/utt	−0·23	−0·24	−0·84*	−0·67+	−0·98**
Interjections	0·15	0·26	−0·27	−0·59	−0·32
Unintelligible	−0·04	0·27	0·33	−0·08	0·54

\+ $P < 0·10$.
* $P < 0·05$.
** $P < 0·01$.

however, that this is about the same number of subjects tested by FNB, and that we had a larger sample of utterances – ranging from about 100 to 300 per child and ranging from about 250 to 850 per mother. In short, our sample is on the average more than twice as large for the children and more than five times as large for their mothers.

Considering the sizeable number of correlations reported – 55 for each of our two age groups – one might well expect a number of substantial correlations by chance alone, given the shaky data base (small number of subjects, although many data points for each) from which they were derived. Under the circumstances, some way of estimating the reliability of these correlations seemed essential. To this end, we employed the same procedure used in NGG, namely what we called a 'split-half' analysis. In the present

study this was performed separately for each of the two age groups. We began by dividing the data into two halves by separating the odd pages of the coding sheets from the even pages. We then computed each measure on each half of the data, and then computed the (simple) correlations between maternal speech measures and child growth measures on each of these two halves separately. The next step was to compare the correlations obtained on these two halves with those obtained on the overall analysis (that is, with both odd and even pages of the coding sheets combined). Our criterion was conservative. Only if the correlations obtained on each of the two halves were at approximately the same level of statistical significance as those of the overall analysis did we consider them reliable; otherwise, we viewed the overall correlations as at best unreliable, at worst artifacts of measurement error.

Because we will argue below that there are further problems with the simple correlational procedure in any case, and because the presentation of the full outcomes of the split-half analysis would be cumbersome, we present here only a crucial subset of the outcomes for illustration. Table 6 presents a subset of the overall simple correlations taken from Table 5, namely the correlations between maternal complexity and child growth in MLU, verbs per utterance, and noun-phrases per utterance, for age group III. These are the items on which FNB based the claim that simple input enhanced learning rate. As the table shows, we like FNB obtained numerous significant negative correlations on the overall analysis – that is, the simpler the mothers' speech, the more rapidly their children appeared to acquire the language. However, in Table 6 we also present the outcome of the split-half analysis for just these correlations.

As can be seen in Table 6, none of these correlations is reliable on the two split-halves. In all cases, a significant overall correlation shows up on the split-half as at best a significant correlation on one half but a nonsignificant (often approximately zero) correlation on the other half. This outcome

TABLE 6. *Overall correlations and their split-half correlations for maternal speech complexity and child language growth*

Maternal speech		Child language growth ($Time_2 - Time_1$) MLU	Vb/utt	NP/utt
MLU	Overall	−0·72+	−0·31	−0·68+
	Odd	−0·55	−0·15	−0·72+
	Even	−0·76*	−0·41	−0·54
S-nodes/utt	Overall	−0·84*	−0·67+	−0·98**
	Odd	0·09	−0·15	−0·08
	Even	−0·83*	−0·75*	−0·92**

\+ $P < 0·01$.
* $P < 0·05$.
** $P < 0·001$.

TABLE 7. *Partial correlations between maternal speech and child language growth (partialling out initial child language)*

Maternal speech	Child language growth ($Time_2 - Time_1$)				
	Aux/VP	Infl/NP	MLU	Vb/utt	NP/utt
			Age group II		
Declaratives	0·66	0·23	0·28	0·98*	−0·14
Yes/no-questions	0·72	0·10	0·43	−0·02	0·48
Imperatives	−0·71	−0·61	−0·54	−0·89*	−0·27
Wh-questions	−0·82+	−0·20	−0·76	−0·51	−0·44
Deixis	0·81+	0·84+	0·65	−0·73	0·85
Expansion	0·85+	0·30	0·73	0·39	0·53
Repetition	−0·94*	−0·58	−0·86+	−0·73	−0·51
MLU	0·85+	0·21	0·46	0·11	0·61
S-nodes/utt	0·90*	0·37	0·72	−0·39	0·81+
Interjections	0·82+	0·31	0·87+	0·32	0·60
Unintelligible	−0·92*	−0·68	−0·31	0·99*	−0·85+
			Age group III		
Declaratives	0·48	−0·73	0·12	0·17	0·75
Yes/no-questions	0·91*	−0·26	0·92*	0·66	0·28
Imperatives	−0·69	−0·03	−0·58	−0·34	0·19
Wh-questions	−0·04	0·73	0·07	0·21	−0·37
Deixis	−0·65	0·26	−0·34	−0·42	−0·79
Expansion	0·59	−0·53	0·21	−0·15	−0·15
Repetition	−0·14	0·66	0·30	0·58	−0·08
MLU	0·12	0·50	−0·51	−0·24	−0·23
S-nodes/utt	0·58	0·26	−0·60	−0·49	−0·95*
Interjections	0·32	−0·15	0·15	−0·23	−0·25
Unintelligible	−0·41	−0·28	−0·06	−0·22	−0·08

+ $P < 0·10$.
* $P < 0·05$.

suggests that all of these overall correlations are unreliable and may thus be artifacts of measurement error. They therefore can hardly be taken as a proper basis for theorizing about the Motherese Hypothesis. Note that FNB performed no similar statistical test for the reliability of their findings, which were based on seven subjects, with fewer measurements of each.[9]

In any case, we do not believe that simple correlations between maternal

[9] We should note that it was not generally the case, either in the simple correlations presented here or the partial correlations presented later, that the split-half analysis resulted in such widely discrepant correlations for the two halves of the data or in such a large proportion of overall correlations which must therefore be discarded as unreliable. Nevertheless, as the present subset illustrates, this does sometimes happen, underscoring the necessity of the procedure for assessing the internal reliability of the overall correlations.

TABLE 8. *Partial correlations between maternal speech and child language growth (partialling out initial child language), but omitting unreliable correlations*[a]

Maternal speech	Child language growth ($Time_2 - Time_1$)				
	Aux/VP	Infl/NP	MLU	Vb/utt	NP/utt
			Age group II		
Declaratives	0·66	0·23	0·28	0·98*	−0·14
Yes/no-questions	0·72	0·10	0·43	−0·02	0·48
Imperatives	−0·71	−0·61	−0·54		−0·27
Wh-questions		−0·20	−0·76	−0·51	−0·44
Deixis			0·65	−0·73	
Expansion	0·85+	0·30	0·73	0·39	0·53
Repetition	−0·94*	−0·58	−0·86+	−0·73	−0·51
MLU	0·85+	0·21	0·46	0·11	0·61
S-nodes/utt	0·90*	0·37	0·72	−0·39	
Interjections	0·82+	0·31	0·87+	0·32	0·60
Unintelligible		−0·68	−0·31	0·99*	
			Age group III		
Declaratives	0·48	−0·73	0·12	0·17	0·75
Yes/no-questions	0·91*	−0·26	0·92*	0·66	0·28
Imperatives	−0·69	−0·03	−0·58	−0·34	0·19
Wh-questions	−0·04	0·73	0·07	0·21	−0·37
Deixis	−0·65	0·26	−0·34	−0·42	−0·79
Expansion	0·59	−0·53	0·21	−0·15	−0·15
Repetition	−0·14	0·66	0·30	0·58	−0·08
MLU	0·12	0·50	−0·51	−0·24	−0·23
S-nodes/utt	0·58	0·26	−0·60	−0·49	
Interjections	0·32	−0·15	0·15	−0·23	−0·25
Unintelligible	−0·41	−0·28	−0·06	−0·22	−0·08

+ $P < 0·10$.
* $P < 0·05$.
[a] 'Unreliable correlations' are those which were significant or marginally significant on the overall analysis but which were insignificant on one or both of the split halves.

speech and child language growth are the appropriate measures through which to address the hypothesis. We therefore turn to a presentation of the partial correlations.

Partial correlations. Simple correlations between maternal speech and child language growth may be contaminated by a third variable – the child's initial state (in both age and linguistic abilities). Therefore, we here present and discuss partial correlations, in which maternal speech measures are correlated with child growth scores, while removing the variance attributable to the child's initial age and language.

In contrast to NGG, we now performed these correlations on two separate

age groups, within which age varied only slightly. We therefore partialled out only the child's initial score on each language measure. (FNB could not perform such a partialling, as their only measure of child's initial stage – MLU – did not vary. As already mentioned, this measure did not guarantee initial equality of the subject population since FNB's subjects did in fact vary on comprehension measures, which in turn correlated with the growth scores). Table 7 presents the overall partial correlations for each of the two age groups, without taking into account their reliability as assessed by a split-half analysis. Many of these correlations are sizeable and reach statistical significance. But again, this may be because the small sample size and limited number of utterances for each mother and child may lead to large but unreliable findings. Table 8 therefore presents these same correlations, but without those for which the two split-halves did not lead to similarly significant outcomes. In detail, we have omitted overall correlations with $P < 0{\cdot}10$, if these did not survive the split-half procedure at the same level of significance; and we have omitted significant overall correlations if their split halves did not reach at least the marginal – $P < 0{\cdot}10$ – level of significance.

RESULTS

As a preliminary to discussion, note that many of the simple correlations fall away when partialled to correct for variability in the children at the initial measurement (compare Table 5 with Table 7). But note further that still more correlations fall away when the partial correlations are submitted to the split-half analysis (compare Table 7 with Table 8). This is the first suggestion that there is real difficulty – not just theoretical difficulty – in relying too heavily on findings from any single analysis of correlation results, from just a few individuals.

However, the same point is made most tellingly by looking at the outcomes themselves. One of these is surely 'garbage'. We achieve, much to our chagrin, a POSITIVE, 0·99 correlation between maternal UNINTELLIGIBILITY and child growth in verbs per utterance, in the younger age group (Table 8, Group II). As we stated earlier, when a larger number of correlations are done on a very few subjects, spurious correlations are likely to show up here and there. Since FNB used less stringent statistical procedures, again on a very small sample of subjects and fewer data points, they obtained a larger number of such uninterpretable results (e.g. the mother's use of copulas impairs the child's learning about noun-phrases).

Since the present analysis yields one such correlation, which does not reflect what we know of the real world of learners and tutors, some question arises about whether one should interpret the other correlations (Table 8) with great seriousness. Our own view is that correlational effects from a small number of subjects, whose precise initial states cannot really be determined very

satisfactorily, should be approached most gingerly. However, correlational data of this sort CAN support theorizing if the following minimal requirements are met: (*a*) they should cohere with what is known on other grounds about language and its learning; (*b*) they should partial out known contaminants to do with initial variance in the subject population; (*c*) they should be internally reliable, using conservative criteria for evaluating reliability; but (*d*) even so, they should be taken as *pro tem.* and suggestive only, because of the enormous difficulty of interpreting them causally. With these provisos in mind, we turn now to considering the remaining results.

Stage dependence of the correlational findings. Inspection of Table 8 supports a prediction made by FNB, namely that the effects of maternal characteristics may vary with the language stage of the child learner. As the table shows, almost all of the correlations are limited to the younger group (including the uninterpretable one). The one major exception has to do with the effect of maternal *yes/no*-questions on auxiliary growth, which is insignificant in the younger group, but reliably significant in the older group.

To the extent that such results hold up under further experimental review, they may suggest that selected features of the environment exert their major influences only relatively early in the learning period (despite the fact that learning the relevant structures is not complete for quite some time beyond this). Such a finding would make sense if, for example, the child's analysis of the environmental input were relatively superficial (and therefore unusually input-dependent) in the early stages of learning, but structurally and organizationally deeper (and therefore much less superficially input-dependent) in later stages of learning. Alternatively, the stage-dependent finding may be an artifact of differing variances of the measures in the two age groups, or differing relevance of our particular language indices at the two points in learning. Further research, and particularly research using quite different, less superficial, measures of the environment and of learning, will be required to disentangle these issues.

But in so far as this general effect can be assumed to be a stable one, its most important implication is worth stating here. As our findings have shown (and see particularly Newport (1977) for a fuller analysis in this regard), the mother's usage does not change dramatically during the child's learning period from one to three years. At all times, for example, *yes/no*-questions with subject/auxiliary inversion appear as a major segment of the maternal corpora. And at all times, the various functors appear in their requisite places in the maternal utterances. Yet, as we now seem to see, the child exploits some of this material at one age but not at another. This is the reverse of the so-called 'fine tuning' hypothesis, namely that mothers change their usage as the child learns, in correspondence with the changing needs of an environmentally driven learning procedure (see Cross (1977) for a position that uses fine tuning to explain language learning; and Pinker (1979) for discussion). As we now

see, it is most importantly the CHILD who changes (in the material he attends to and exploits), rather than the MOTHER (in how she speaks). As usual, we must look to properties of the child learner, more than to specific properties of his environment, to explain the learning (see Newport (1982) for a general discussion of the effects of learners on language design).

Major correlational effects. Table 8 reveals that there is an effect of maternal *yes/no*-questions on the child's growth in auxiliaries and (as an artifact of this), his MLU, for Group III only. As stated above, the remaining significant and reliable correlations are for Group II only. In that latter group we find a marginally significant effect of maternal expansions on the child's growth in verbal auxiliaries. Further, there is a significant positive effect of maternal complexity, measured as S-nodes per utterance, on the child's growth in auxiliaries; and a marginal effect of maternal complexity on the same auxiliary variable, when complexity is measured in terms of maternal MLU (the same measure that FNB call WORDS in Table 1). Thus the results are the same in major respects as in the original analysis of NGG (Table 2): the mother's effects are primarily on the child's growth in the FUNCTOR or closed-class vocabulary; and primarily the mother's closed-class usage has effects on the child's growth. Many other features of the mother's usage have no measurable effect on any measure of the child's growth; and many aspects of child growth are affected by no measured feature of the mother's usage. A single new effect in the new analysis that crosscuts this major distinction, again for Group II only, is a significant relation between maternal declarative sentences and the child's growth on verbs per utterance. All of these major effects will be discussed below.

Subsidiary effects. The remaining results in Table 8 again reproduce those of NGG and require little additional discussion. As before, we find a stable effect of interjections (e.g. *mhmm*) on the child's use of auxiliaries and their artifact, MLU. (Notice that these are the same measures on which we repeatedly find environmental effects.) NGG related this finding to a general, if vague, notion of 'reinforcement'. But we did not find the original results terribly interesting for understanding language learning: the question is how, even given reinforcement, the child manages to generalize always and only from old grammatical sentences to new grammatical sentences. Finally, there is a negative correlation between maternal repetition (a measure not taken by FNB) and the child's acquisition of the usual materials (auxiliaries and MLU measures); for discussion, and evidence that this correlation is a secondary effect of the types of sentences that get repeated, see NGG.

Two correlations that we suspect are real fail to reach significance in Table 8, though they did in the original NGG analysis. One is the negative effect of imperatives on auxiliary growth. The other is the positive effect of maternal deixis on the child's learning of the noun-phrase inflection (plural). It is sufficient here to note that certain effects had to fall away when the pool of

subjects contributing to each analysis became smaller. On theoretical grounds we are inclined to believe that these original results are real, despite our present failure to replicate them here, and believe they will show up again in future investigations.

DISCUSSION

Explaining the learning effects from the maternal corpus

The overall finding from our new analysis is that, when we have responded in our procedures to the legitimate objections of FNB, the original results of NGG are largely reproduced. The one major proviso is that the bulk of the learning effects appear to be confined to the younger of the two age groups. In contrast, we did not in these new analyses reproduce any of the results of FNB, except where their findings replicate our own. We believe that the additional outcomes in the FNB study, a scattered and puzzling set of correlations between mother and child, derive from their failure to institute appropriate statistical procedures and cross-checks, as we have argued at some length above. Then how can we account for the fact that FNB sometimes reproduce our own results? It should be obvious that less conservative and more conservative statistical procedures will have the same outcome on those phenomena which are robust and stable; they will differ on unstable phenomena arising from measurement error, in that the less conservative procedures may take these to be genuine outcomes, while the most conservative procedures will eliminate them as measurement artifacts. Given the concordance that does exist across these three analyses, we now turn to a general explanation for the stable findings that reappear in all of them.

There are two properties of the maternal corpus that, according to both NGG and FNB, seem to play crucial roles in the learning process. These have to do with COMPLEXITY and SALIENCE of the data presented. To be sure, other postulated properties (e.g. semantic transparency; see above) have been put forward, but on insecure or arguable interpretations, and without stable effects across the three correlational studies. We now examine the logic of the Motherese Hypothesis by reviewing its claims about complexity and salience, and relating these to the obtained correlational data and to the theoretical literature on language acquisition.

Complexity

The crucial component of the Motherese Hypothesis is that the child learns best from the simplest data. For example, FNB interpret almost all the measures of maternal speech as measures of its complexity, and argue that the least complex speech best supports the learner. But as we have discussed, it is not really obvious why, for example, maternal pronouns and noun-to-verb ratios should be considered as making any contribution to complexity. In

contrast, there is a *prima facie* case that the longer the mother's sentences in words, and the more propositions these sentences contain (S-nodes per utterance), the more complex that speech in terms of known language descriptions. Therefore we assessed the relation between maternal complexity and language growth using these two measures of the mother.

NGG found no relation between complexity and learning on these measures (Table 2). But in our reanalysis there is a significant correlation between maternal S-nodes per utterance and child growth, and a marginally significant correlation between maternal MLU and child growth, for the younger group only (see Table 8). Note that these new correlations are POSITIVE. In contrast, using simple correlations, FNB obtained NEGATIVE correlations with these same measures (and so did we, for simple correlations in our older age group, as shown in Table 5). Given the obvious caveats about different subjects and different statistical techniques, we can say little more than that the empirical relation between input simplicity and language acquisition is far from settled. But there is a prior theoretical question. Suppose you have a theory that emphasizes the role of learning from the environment. Should you predict that the learner is best served by simple input data (as FNB seem to find), or should you predict that complex data are better for the young learner (as our reanalysis seems to indicate)?

The most explicit language-learning theories we have available (Wexler & Culicover 1980, Chomsky 1981) do not depend on the ordering of the input data at all. However, all such explicit analyses that we know of require that, for success, the learner must hear data of at least moderate complexity early in the learning sequence. Basically, this is because simple sentences fail to exhibit all aspects of the syntactic structure. For example, the movement transformations of the Extended Standard Theory, as well as of earlier versions of transformational theory, are structure-dependent; that is, movement is from clause-position to clause-positions, not from string-position to string-positions (except as string-positions are artifacts of the clause-positions). An example is the subject/auxiliary inversion of *yes/no*-questions, in which the auxiliary of the main clause (not the first auxiliary) moves to the front of that clause (not to the front of the string). This explains why adults say *In the summer, do you go to camp?* rather than *Do in the summer you go to camp?* and why they say *Is the man who is here a fool?* rather than *Is the man who here is a fool?* If the learner is exposed only to the simplest sentences, he has no way of choosing between the string hypothesis and the clause hypothesis, as both will derive correct simple sentences. On logical grounds, then, the complex sentences should be more informative to the learner than the simple ones. This is precisely the result our reanalysis achieves, and FOR PRECISELY THOSE STRUCTURES (NAMELY, AUXILIARIES) ON WHICH THE ARGUMENT IS BASED (again, see Table 8). The only alternative to this is to assume that, although the child may receive only simple sentences, he is innately biased

towards the clause hypothesis (that is, towards structure-dependence); in this case, neither simple sentences nor complex sentences would be more informative, since the child does not arrive at the correct conclusion on the basis of input data at all. For the appropriate description of the facts, and the theoretical position just sketched about the learning problem, see Chomsky (1975), who proposes the second of these two alternatives.

Related discussions that predict the same general type of finding (that is, a beneficial effect of increased complexity) are from Wexler & Culicover (1980). Their work formally models a device that will acquire a transformational grammar of roughly the Chomsky (1965) variety in finite time. A major problem they faced was that the learner would not know how to attach moved constituents so as to form the derived phrase structures after a transformation had applied. This problem formally disappears only if highly complex sentences are available as data – namely, those in which successive movement transformations that apply to already moved constituents establish the composition of the latter.

The main lesson we draw from these theorists is this: it is relatively easy to show that the language is learnable if the input includes complex sentences; it is awesomely harder to show learnability if the input is restricted to the simplest sentences. This position should not really come as a surprise. To learn a system whose structures are wide-ranging and various, it is commonsensical to suppose that data which mirror this range are the most helpful. Data drawn from only part of the range might distort the conjectures the learner will make about the whole range. On these logical grounds, we are not surprised that our reanalysis suggests that mothers who produce a greater range of data from the language have children who discover the appropriate rules more speedily. If this effect is stable (an issue certainly in doubt, for our own and others' correlational data, as we have repeatedly stressed), it is in direct opposition to the usual Motherese Hypothesis; namely, that the simplest input speeds language learning.[10] But whatever the outcomes of the

[10] More precisely, the Motherese Hypothesis says that the child receives simple input first and more complex input later. One might suppose, therefore, that the difficulties mentioned are not genuine difficulties, since the child will eventually get complex input. However, the problem with getting complex data only later is that the rule may already have been formulated incorrectly by the time the relevant complex data have appeared. Moreover, some errors which the child could make in formulating rules on the basis of simple data only (e.g. formulating subject–aux inversion in terms of ANY auxiliary, rather than the main-clause auxiliary only) could be repaired only by NEGATIVE data (i.e. feedback when the child produces an ungrammatical utterance that it is ungrammatical). This is because such an incorrect formulation of the rule will unfortunately predict all the positive instances the child will hear (since they are all instances of some auxiliary being moved), so that positive instances will never tell him that his rule is formulated incorrectly. However, there is no evidence that children receive negative data either often or systematically; nor – much more importantly – MARKED in such a way that it could be distinguished from corrections of other matters, such as truth or morality (Brown &

various correlational studies, all investigators will have to face the question of WHETHER simple data could in principle aid the learner rather than hinder him, and explicate how they could do so, in detail. The intuitive argument that simple must be helpful is, on reflection, far from self-evident.

Salience, canonical form and the closed class.

Another important issue addressed by the various correlational studies concerns why some characteristics of maternal speech, and not others, have effects on learning rate. There is some – perhaps a good deal – of selectivity in the learner; for example, the child learns the functors (e.g. *the*, *and*, *-ed*) rather late even though these are the most frequent lexical items in the mother's speech. To the extent that the child differs from a tape recorder (which must take in exactly the information offered to it), part of the explanation of language learning is thrown back on the child himself. What are his internal dispositions, such that he accepts and analyses certain materials, but rejects or ignores others? Given the various findings under discussion, we must suppose that a number of such selection mechanisms (what NGG have called LEARNING FILTERS) intervene between input and output all along the line throughout the course of language learning. To the extent that the children select what material is salient, it is they and not their caretakers who are the prime movers of the acquisition process.

An important example concerns canonical sentences. The maternal declaratives – the surface structures closest to canonical form – do not have consistent measurable effects, over the three correlational studies, on the appropriate aspects of learning (only a single correlation, of maternal declaratives on child growth in verbs per utterance, occurs in the present study, for Group II, and even this one fails to appear in either of the other two studies). This relative ineffectiveness of 'basic' sentences is hard to explain on conjectures that the learner requires the simple declaratives, early in learning, as the rock on which to build the syntactic system (cf. Pinker & Lebeaux 1982). In contrast, a particular derived structure (the subject/aux inverted *yes/no*-question) shows a massive correlational effect in ALL THREE of the correlational studies. This one large and stable fact shows that simplicity in a grammar (which should favour the declaratives, on almost any grammatical theory) does not directly describe simplicity for the learner; rather, simplicity

Hanlon 1970, Wexler & Culicover 1980). Moreover, there is no evidence that children ever produce such incorrect forms of subject–aux inversion, negative data or not. These facts taken together thus suggest either that the child receives and uses complex data from the beginning; or that he is innately built with a predisposition towards structure-dependent rules, so that the incorrect formulations are not considered; or that he is innately built to avoid formulating movement rules at all until complex data are available. All of these alternatives are at odds with a Motherese Hypothesis, which expects that simple data will be the most helpful at the earliest stages, and that the environment, rather than the native predispositions of the child, organizes his learning.

for the learner is 'something else' (something that will predict the effect of the *yes/no*-questions).

This problem seems complicated enough. But one more feature of the learning makes it more mysterious yet: though the learner profits FROM the *yes/no*-questions, what he first accomplishes (presumably, on the basis of analysis of the *yes/no*-questions) is reconstruction of the canonical form – which never appears in the questions. That is, the child first utters both declaratives and questions with medial auxiliary structure (*You will pass the salt*, but also *What you will pass?*), though the latter virtually never occurs in the input in this way (Bellugi 1967).

These complex findings submit only to an equally complex explanation. Our own position is as follows. (1) Only certain items are environmentally influenced materials – the so-called CLOSED-CLASS items, and the structures in which they participate. (2) These items are learned from input which displays them in ways that match the information storage and manipulation biases of the learner. (3) 'What is learned' depends on the child's bias towards reconstructing 'canonical form' in the language being learned. We detail this position below. As will be clear from the exposition, these three components closely interlock, and together form a plausible generalization about the language learning process.

Special status of the closed class. As we have stated, the main stable correlational effects are limited to effects of and on the closed-class subcomponent of the language. In the original NGG study, this distinction appears categorically: the only significant effects are for closed-class materials (columns 1 and 2, Table 2) and their artifact, MLU (since closed-class items contributed to MLU, an effect for closed-class materials will also often show up as an effect for MLU; see column 3, Table 2). There are no effects for open-class materials (columns 4 and 5, Table 2). In the present analysis (Table 8), if we disregard the spurious negative effect of maternal intelligibility on child language growth, there is only a single exception to this general distinction. In the light of this contrast, it will be worthwhile here to consider the open-class/closed-class distinction more closely.

Closed-class items, roughly, are the inflections and functors, those items that can occur unstressed in the languages of the world. These include the determiners, certain pronominals, complementizers, certain prepositions and postpositions, certain time adverbials, case markers, tense and aspect markers, and so forth. In English in particular, these items are likely also to be contractable (for discussion, see Zwicky 1976). Just how this closed class (and its distinction from the open class) should be formally characterized is still a matter of some debate (see Chomsky & Halle 1968, Kean 1979, Bradley, Garrett & Zurif 1979). But even in advance of a secure formal characterization, it has become obvious in recent years that the distinction between open and closed class is crucial to a variety of linguistic functions

and performances, e.g. speech planning (Garrett 1975), parsing (Wanner & Maratsos 1978), long-term language forgetting (Dorian 1978), and dissociation in certain pathologies (Kean 1979, Marin, Saffran & Schwartz 1976, Bradley, Garrett & Zurif 1979). Our investigations, including the correlational ones discussed in the present paper, repeatedly show a distinction in learning as well, based on this same categorial cut.

For example, we have studied the acquisition of gestural language by deaf children not exposed to a full gestural corpus (Feldman, Goldin-Meadow & Gleitman 1978). The relevant finding there was that, under conditions where the exposure to formal language input is radically reduced, many open-class functions (e.g. developing sentences with appropriate argument structure) emerge at appropriate ages, while the closed-class items and functions do not seem to appear. With somewhat less-reduced, but still impoverished input, closed-class items develop, but only when the exposure is during infancy; for example, in the acquisition of American Sign Language (Newport 1981, Newport & Supalla 1980), learners exposed to ASL only late in life do not reliably acquire the closed-class morphology. However, native learners whose parents learned ASL late in life, and whose input with regard to the closed class is therefore strikingly impoverished, do uniformly succeed in acquiring a set of closed-class items and functions. They apparently do this by reanalyzing the open-class, and some irregular closed-class usage, of their parents. Similar phenomena have been widely documented in the reanalysis of pidgin languages into creole languages, which occurs primarily under conditions of native acquisition (Sankoff & Laberge 1973, Bickerton 1975).

In contrast, the open-class items and functions appear regardless of input or time of acquisition. For example, they appear without accompanying closed-class functions, or with greater variability in the appearance of the closed-class, in the acquisition of ASL later in life and in the devising of pidgin languages by adults (see the previous references, and Slobin (1977)), as well as in more ordinary second-language learning late in life. Goldin-Meadow (1978) has suggested that the same distinction captures what is learned (the open class) and what is not learned (the closed class) in the late acquisition of English by a girl deprived of all input until after puberty (cf. Curtiss 1977). In short, the closed class seems to appear only under special conditions of input and time of exposure, while the open class appears regardless of these factors (see Goldin-Meadow (1982) for a related discussion).

As for experimental manipulation of the input data, there have been some training studies with child learners (e.g. studies of EXPANSION – the case where the mother repeats, but structurally amplifies, what the child says). Though results seem to be negative when the experimenter expands whatever he hears the child say (e.g. Cazden 1965, Feldman 1971), some intriguing effects are found for specific structures (e.g. expansions of the auxiliary structures in questions and tag sentences, in studies by K. E. Nelson and his associates;

see fn. 1 above). These results are again consistent with specific and dramatic learning effects for the closed class, but few and unstable ones for the open class.

There is evidently, then, a consistent difference between closed- and open-class items, in childhood learning and in a variety of adult normal and pathological linguistic performances. We believe that the correlational findings we have obtained (almost solely for the closed-class items and structures) are thus bolstered by this series of related findings in the psycholinguistic literature. Such consistency with the literature, given a specific analysis, i.e. the partialling procedure, supports the reasonableness of the procedure itself. In contrast, the simple correlations of FNB, scattered over a wide and often perplexing spectrum of child and maternal language measures, do not appear to have equivalent external support; in our view, this inconsistency with other known facts diminishes the plausibility of their proposed new data-collection and analytic procedures.

Salience. We have argued above that it is primarily the closed-class items that are the environmentally influenced materials. But HOW are these items influenced by the environment? In the present study, we are focusing attention on how caretaker selection of structures available in a single language affects the learner. But before beginning, we should emphasize that internal properties of the various natural languages themselves impose differing limits and opportunities for the learning child. For example, Slobin (1973, in press) has presented evidence that children listen selectively to the ends of words, i.e. they learn postpositioned closed-class materials more readily than pre-positioned closed-class materials. But if the language being learned contains important preposed closed-class materials, of course the caretakers are not free to present these word-finally. The environment generated by the mother can respond to the child's learning requirements only within the limits imposed by the conventions of each language. As Slobin (1982) has recently described, these language-specific properties are predictive of interesting differences in learning rate, crosslinguistically. This said, we now return to those selections that may be under the control of caretakers speaking a particular language to their offspring.

NGG interpreted certain of their significant correlational effects in terms of how the maternal input matched processing biases in the learner. This was because the commonsense views about the 'simplest inputs' did not predict the growth effects. We therefore looked to something about simplicity for learning, rather than simplicity of grammar, to explain the obtained findings. Again, the major example is the ineffectiveness of maternal use of canonical (simple, active, declarative) sentences in all three correlational studies (excepting the one relation with the child's use of verbs in group II), and the effectiveness of maternal *yes/no*-questions, with inverted subject and auxiliary. NGG conjectured that initial position of the auxiliary favours its

learning (as it might in any theory in which memory is a factor) but, moreover, that the initial position had the extra advantages of usually being stressed and noncontracted.

Since that time, we have laid out in detail the learning suppositions that would yield the special effects of stress and of noncontraction (more generally, noncliticization) on language learning (see Gleitman & Wanner 1982, and Newport, Gleitman & Wanner, forthcoming). In brief, a variety of properties of language learning, many of them cross-linguistic, suggest that the learner is biased in the initial stage to analyse stressed syllables, and ignore the rest of the waveform; the stressed syllables leap out at the child just as, in visual perception, the figures leap out from the ground.

An apparently related effect, which appeared in NGG and is here replicated in Group II, is that of maternal expansions on the child's learning of auxiliary verbs. Expansions are those maternal utterances which provide the learner with an imitation of his preceding utterances, but with the inclusion of the closed-class items which his own productions omit (Brown & Bellugi 1964, Cazden 1965). As NGG argued, following Brown & Bellugi, expansions thus provide the child with the relevant closed-class information at just the point when the child's attention is likely to be focused on the appropriate construction and the appropriate meaning. Moreover, expansions are also likely to present this information in a stressed form.

Summarizing, we believe that the effects of maternal input are ONLY THOSE THAT MATCH THE PROCESSING BIASES OF THE LEARNER. There is an effect of the characteristic maternal style, to be sure, but only to the extent that is congruent with the initial biases of the learner: how he is preprogrammed to represent the sound wave to himself. In the cases we have been discussing, it is the stressed and initial material that he is inclined to represent selectively. No objective machine, performing a straightforward manipulation and analysis of the maternal input data, could be expected to make the same selections.

Reconstruction of canonical form. WHAT is it that the child learns? Many language development studies suggest that centrality of canonical forms is a property of the child's interim grammars (see Gleitman & Wanner 1982, and particularly Slobin & Bever 1982). The first to observe this property, in the context of early child speech, was Bellugi (1967). She observed that children not only produce declaratives in canonical orders, but also come to say questions (incorrectly) in canonical order. That is, they produce questions that mark interrogation by intonation, but place the auxiliary in its MEDIAL position in the verb-phrase (e.g. *When we can go?*).

At the same time, our own correlational findings suggest that the canonical forms are not the sole or primary data on the basis of which these forms are learned. For the example we have been discussing, it is the *yes/no*-questions that provide the useful input data for noticing auxiliaries and beginning to

construct, in combination with declaratives, the canonical position of auxiliaries.

While the *yes/no*-questions themselves do not reproduce the language design features the child seems to be seeking ('canonical form, in English'), they do seem the correct ones in terms of what might be quite general – not necessarily language-specific – biases for collecting and storing information from the environment (that is, attending to initial position and to stressed items). In contrast, while the declaratives do reproduce the canonical forms for auxiliaries, they do not seem to fit in with such information-handling biases (that is, they contain auxiliaries which are medial and unstressed). The child appears to be predisposed not only to attend to initial position and stress, but also to use these to help himself begin to track and store the relevant items across their unstressed and non-initial positions as well. He thereby begins to reconstruct the canonical positions from which movement and stress features are derived. This, we conjecture, is an interim characterization of the facts (puzzling, taken together) that the child learns primarily FROM certain forms (the *yes/no*-questions more than the declaratives) but learns ABOUT other forms (the canonical declaratives earlier than the *yes/no*-questions).[11]

Summary description. The facts of child language suggest that the learner, exposed to the varying orders of input sentences, finds one that is (as Fodor, Bever & Garrett (1974) have named it) 'canonical', or configurationally central, from which the others can be derived. This canonical form provides a fixed order in terms of which the language is organized at early stages, and is the format for stating predicate-argument structure in the language and, at least according to some grammars, stating the domain of movement transformations. At the surface, this canonical ordering is in English and many other languages closest to the declarative sentence. This bias towards

[11] Rather reassuringly from this perspective, there is one correlational effect that suggests the learner does attend at some stage (that represented by Group II) to canonical declaratives: more complex verb forms are produced earlier by children of mothers who use the declarative more frequently (see Table 8). However, in accord with the methodological canons we have adopted, and stated in earlier sections of this paper, we must be wary in interpreting this effect, plausible though it seems. For one thing, why should the mother's use of declaratives affect only verb-sophistication in the learner rather than, for example, his tendency to express all the arguments of predicates? What we have, in the effect under discussion, is one that is at best loosely interpretable on a plausibility hypothesis: the child is learning about declaratives, so it must be that he is at some point attending to declaratives. But the correlational effect is not precisely the one we would have predicted. Moreover, this effect does not appear in the other two correlational studies, and so is not bolstered in terms of its reliability. But on the other hand, this finding does meet some of our canons for the interpretability of correlational effects: it is at least potentially coherent according to many linguistic theories, there is supportive acquisitional evidence (e.g. from Slobin & Bever 1982), and the effect survives the split-half procedure. Summarizing, the state of the evidence on this subtopic is problematic. We cannot evaluate securely whether the effect is real, but its plausibility suggests that it deserves further experimental pursuit.

a canonical ordering, and hence towards declaratives, begins to explain why the child preserves this ordering even for the sentence types (e.g. interrogative, negative) that are reordered at the surface in the input speech.

However, the child's quest for the canonical sentence is made difficult by the fact that certain of the relevant materials (e.g. auxiliary verbs) appear in most input strings in a form that imposes a burden on language perception: namely, in unstressed syllables and in medial positions. In early stages of learning, such unstressed and medial items are therefore absent altogether. In subsequent stages, the learner makes an apparent detour in his learning strategies: he focuses his attention on certain noncanonical forms (e.g. *yes/no*-questions) that present these burdensome materials in ways he can readily perceive, that is, initially and with stress. Eventually, then, by integrating information from the canonical and noncanonical forms, he is able to include these materials as well in his own canonically ordered speech.

GENERAL CONCLUSIONS

The Motherese Hypothesis, as usually stated, is that the way the caretaker talks plays a causal role in acquisition. In a general sense this must be so, for it is the only explanation for the fact that language learning is variable – that French children learn French and Turkish children learn Turkish. What is not clear are any details of such a position, for example, what the Hypothesis asserts about HOW the environment exerts its effects, and the extent to which properties of the learner himself modulate or reorganize the information provided in the environment. For the hypothesis to be anything but question-begging (i.e. to be anything but the claim that whatever input turns out to support learning is the 'best' or 'simplest'), one must state in an explicit fashion what kinds of linguistic environments aid what kinds of learning procedures (for such discussions, see the many interesting articles in Baker and McCarthy 1981). In the absence of such explicit proposals, the claim that certain properties of maternal speech explain the learning seems suspiciously like affirming the consequent.

With these provisos in mind, we can nevertheless make some preliminary conjectures from the correlational studies reported in this paper, and supportive literature from developmental psycholinguistics. These suggest, as we have discussed at some length above, that while language is learned through experience with the environment, its ultimate character is materially an effect of the learner's own dispositions as to how to organize and exploit linguistic stimulation. The major correlational findings supporting this view have to do with the facts that the child is selective in WHAT he uses from the environment provided; he is selective about WHEN in the course of acquisition he chooses to use it; and he is selective in what he uses it FOR (i.e. what grammatical hypotheses he constructs from the data presented). We conclude that restrictive and non-obvious predispositions of the learner – both about information-handling and about language itself – rather than transparent inductions from the input corpus, bear most of the burden for language learning.

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