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Alternative explanations for the relationship between maternal verbal interaction style and child language development*

PAUL J. YODER AND ANN P. KAISER
Vanderbilt University

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ABSTRACT

The present study analysed formerly unexamined indirect routes for relationships between time 1 maternal speech and later child language development. Ten normally developing children in Brown's early stage 1 and their mothers were the subjects. For each dyad, two free-play sessions occurring five months apart were videotaped in the subjects' homes. Mothers' pragmatic language use was coded from time 1 sessions. Child language level was coded at both sessions. Even though time 1 scores of the outcome were controlled, seven of the ten relationships involving mother speech and child language development were indirectly related through one of two time 1 child language measures. The results indicate that a mother-driven, direct influence model may be inappropriate for many mother speech–child language development relationships. We argue that child-driven and mother-driven explanatory models for the indirect relationships are equally feasible.

INTRODUCTION

For over a decade, researchers have used correlational, longitudinal designs to identify aspects of mother speech that may facilitate child language development (Snow 1984). These designs assume that the mother's speech observed early in the child's development (i.e. at time 1) affects the child's language development at a later point (i.e. at time 2). Although researchers have acknowledged the possibility that such time 1–time 2 relationships do not necessarily represent direct or unidirectional influence (Barnes, Gutfreund, Satterly & Wells 1983), evidence supporting indirect and/or bidirectional explanations for these relationships has not been forthcoming.

[*] Address for correspondence: Paul J. Yoder, Special Education, Vanderbilt University, Peabody Box 154, Nashville, TN 37203, USA.

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In one type of indirect route, mother speech may be related to later child language development through common relationships with a time 1 child language variable (i.e. a COVARYING VARIABLE).

The present study is the first to attempt to identify covarying time 1 child variables that may account for mother speech–child language development relationships. Olsen-Fulero's (1982) model of facilitative and impeding interactive styles was the basis for studying these relationships.

The direct maternal influence model

Most of the early research examining the relation between mothers' speech and later language development implicitly assumed a DIRECT maternal influence model. Such a model posits that children's language development is facilitated by specific maternal utterance types because these utterance types frequently present to-be-learned language structures to the child in a salient and, thus, analysable form. Direct influence models do not require the inclusion of a third, mediating variable.

For example, Newport, Gleitman & Gleitman (1977) suggested that auxiliaries were predicted by *yes/no* questions, but not by the general use of auxiliaries, because the auxiliary occurs in the initial position in many *yes/no* questions. Likewise, some form of the direct maternal influence model has been used to explain predictive relations involving maternal deictics (Newport *et al.*), self-repetitions (Hoff-Ginsberg 1986), expansions (Cross 1978) and recasts (Nelson 1981). More recent studies have examined pragmatic and discourse aspects of mothers' speech because these aspects may have direct and indirect influences on the child (Barnes *et al.* 1983, Hoff-Ginsberg 1986).

Olsen-Fulero's model

Olsen-Fulero (1982) provided a model of how specific pragmatic and discourse features of mother interaction styles may positively and negatively influence child language development. McDonald & Pien's (1982) findings demonstrated that requests for unknown information and requests for confirmations were positively intercorrelated. Olsen-Fulero posited that these behaviours were indicative of a conversation-eliciting style and would be positively associated with subsequent child language development (McDonald & Pien, Olsen-Fulero). In support of Olsen-Fulero's predictions, Hoff-Ginsberg (1986) found that maternal requests for unknown information and confirmation requests positively predicted language gains. In support of a direct influence explanation for why conversation-eliciting questions may facilitate language development, Hoff-Ginsberg (1987) found that requests for unknown information contained more auxiliaries, the predicted child language measure, than were contained in other maternal utterances.

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Conversation-eliciting styles, as well as other aspects of mothers' speech, may also have an indirect effect on development. In INDIRECT influence models, the mother affects some behaviour or process within the child that in turn causes changes in language ability. Figure 1 indicates this indirect influence by the inclusion of a third covarying variable that is correlated with both the mothers' speech and child language development. Two types of indirect influence are possible: IMMEDIATE and CUMULATIVE.

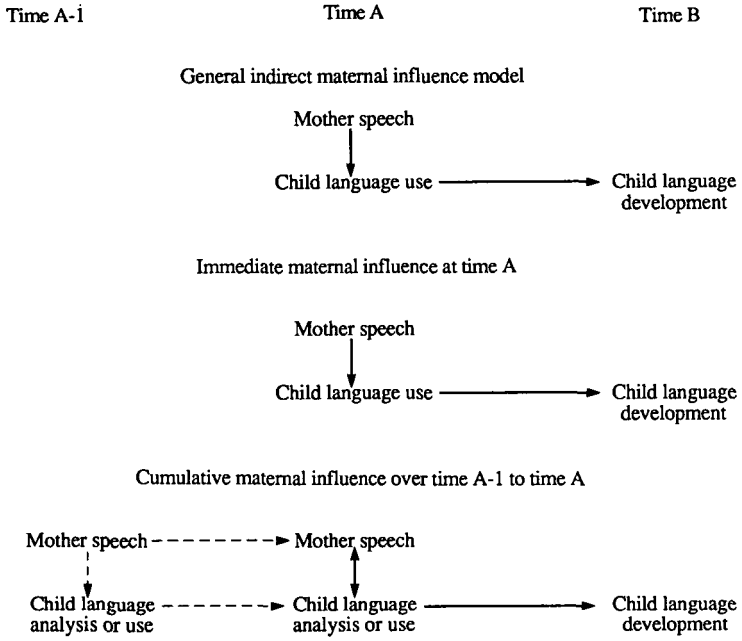

Fig. 1. Illustration of indirect maternal influence on child language development.

An immediate indirect influence on child language development is implied when Hoff-Ginsberg (1987) suggests that questions may be facilitative because they immediately elicit the child's conversation, which in turn elicits future language models to analyse. An immediate influence on conversation can be detected through sequential analysis during the time 1 session. A cumulative influence on child language development is implied when Hoff-Ginsberg (1986, 1987) suggests that questions may facilitate development because they 'prod the child to analyse language' so that he can eventually converse appropriately. A cumulative influence occurs repeatedly over time and may be reflected in summary level correlations. In the current study, cumulative influence may have begun before we recorded our first interaction session.

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Olsen-Fulero (1982) also posited that a DIRECTIVE INTERACTION STYLE, consisting of directives, requests for known information (i.e. test questions) and conversational dominance, may inhibit language development. These maternal behaviours were correlated negatively with the previously described behavioural components of the conversation-eliciting interaction style (McDonald & Pien 1982). Olsen-Fulero's findings and model are consistent with earlier research by Furrow, Nelson & Benedict (1979) and Newport *et al.* (1977) who found that directives negatively predicted measures of syntactic development in young children.

Direct and indirect causal models have also been posited to explain why directive interaction styles may impede language development. Using a direct model, Newport *et al.* (1977) suggested that directives do not facilitate language development because they 'rarely map clearly on to the non-linguistic context' making it difficult for the child to understand the referents for the utterance. However, some directives do refer to perceptually present nouns (e.g. 'Eat your supper'). Using an indirect influence model, one might suggest that when mother uses mostly directives to interact with her child, she teaches the child to interact in a predominantly non-verbal manner. Because the child converses infrequently, he/she is exposed to relatively few language models from potential conversational partners. A final explanation may be that directives are negatively related to conversation-eliciting behaviours that may facilitate development (McDonald & Pien 1982, Hoff-Ginsberg & Shatz 1982).

There is one published report that indicates that directives positively predicted language development (Barnes *et al.* 1983). This discrepancy concerning the direction of the relation between directives and language development may be due to differing data collection contexts. That is, a heavy reliance on directives in free-play contexts may more reliably reflect an intrusive style than does the use of many directives in other contexts. In the Barnes *et al.* study directives were collected from a random sample of input speech from many contexts. Directives used in the data of Barnes *et al.* may have been required to accomplish the task at hand and their content may have referred to the child's focus of attention. In contrast, the 'task' in the free-play sessions used to collect the data in Furrow *et al.* (1979) and Newport *et al.*(1977) was to engage the child in interaction. Alternatively, directives may have been negatively related to conversation-eliciting styles in the Furrow *et al.* and Newport *et al.* samples but unrelated in the Barnes *et al.* sample.

Child-driven common-cause models

A decade of mother–child interaction research has indicated that children affect mothers as well as mothers affecting children (Lamb & Easterbrooks

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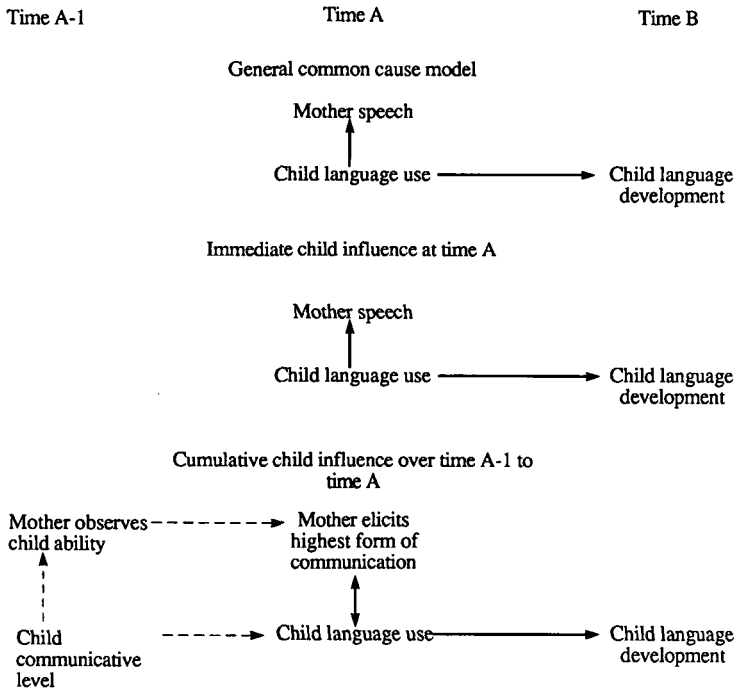

Fig. 2. Illustration of child variables as a common cause of individual differences in maternal speech and child language development.

1981). Mother speech–child language relations may also be explained by CHILD-DRIVEN models. Child-driven models posit that specific aspects of the child's language elicit specific maternal interaction styles. These eliciting aspects of time 1 child language predict later language development. Figure 2 illustrates the immediate and cumulative child-influence models. As an example of immediate child influence at time 1, child multi-word utterances could immediately elicit maternal requests for unknown information because the children's informative, long utterances may stimulate the mothers' curiosity which in turn stimulates follow-up questions. In terms of cumulative influence, children who use many multi-word utterances may signal their ability to communicate complex information, thereby encouraging their mothers to ask more questions that request such information. In both cases, children who have more mature language at time 1 may also learn more language over time because they already have the linguistic or cognitive prerequisites for the structures they are about to acquire.

Although the explanatory models discussed here imply that one person has a primary influence on the other, many instances of social influence are BIDIRECTIONAL. In this paper, one direction of influence is indicated for the

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sake of clear presentation of the models. In actuality, bidirectional influences are possible and in some cases likely.

Contributions of the present study

Based on Olsen-Fulero's (1982) model, we selected several pragmatic aspects of mothers' speech to investigate the direct and indirect routes by which mothers' speech might be related to their children's language development. Additionally, the pragmatic aspects of mothers' speech were assumed to be sensitive to influences of the child on the mother. Other measures, such as frequency of mother talk, various types of mother comments and other questions were included to explore whether these aspects of mother speech covary with language development, initial child language skill, or other mother predictors of child outcomes.

Although we do not examine all possible alternative explanations, evidence of indirect routes would suggest that, in some cases, models that assume that the mother directly influences child language development may be overly simplistic. Reducing the number of models through systematic examination of possible direct and indirect routes in unmanipulated interactions is useful for hypothesis generation and model building.

METHOD

Subjects

Ten mother–child pairs served as subjects. The present data are a subset from an 18-month longitudinal study of mother–child interaction (Kaiser & Blair 1987). The subjects were originally recruited from records of a university infant research group that routinely screened all babies born in a local hospital. Families initially contacted had babies with Brazelton and Apgar scores in the normal range and met the following SES and family composition criteria. Families meeting these criteria were selected on the basis of their willingness to participate in a longitudinal study.

The children were all Caucasian, first- (8) or second-born (2) with average Bailey MDIs of 123 (S.D. = 14). During the initial speech sample used in this study, the children averaged 22 months old (S.D. = 4 months) and their mean length of utterance (MLU) averaged 1·13 (S.D. = 0·11). The mothers' average age was 26·05 (S.D. = 3·16). None of the mothers were employed outside the home and all were primary caretakers of their children. These were working class families as judged by family income and maternal and paternal education levels.

Procedure

Twenty-minute mother–child interaction sessions were the basis for the present study's data. Each session was videotaped in the subject's home.

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Age-appropriate toys preferred by the child were available during the play session. Mothers were instructed to interact with their children as they might during any other time they played with their children.

Two sessions for each dyad were selected from the larger project's archive for the present study. For the initial session, we selected the first session in which the children exhibited at least 50 intelligible utterances. This criterion was used because we wanted an adequate sample of the children's language during Brown's (1973) FIRST STAGE of language development. The second session occurred five months later. The time span between first and second sessions was chosen to approximate the span Hoff-Ginsberg (1986) used in a study which explored the predictive value of variables similar to those used in the present study.

Coding

Transcription. Research assistants prepared verbatim transcriptions of mother and child utterances for all sessions. English glosses of utterances were used because detailed phonetic and prosodic analyses were not necessary for the present study. Transcripts were organized to allow identification of speaker, utterance number, and sequence of spoken turn. Additionally, pauses greater than five seconds were indicated. Inter-transcriber agreement was calculated on eight independently transcribed sessions. Percentage agreement on a morpheme-by-morpheme basis was 98% for mother utterances and 89% for child utterances.

Maternal interaction variables. Ten aspects of the mothers' verbal interaction were coded from the transcripts and videotapes of session 1 (Table 1). Proportional, instead of absolute, frequency measures were used because we wanted measures of maternal style that were independent of the amount of maternal talking. Additionally, we recorded the total number of maternal turns as an index of the amount of maternal talking and the average number of utterances per maternal turn as an index of conversational dominance (Olsen-Fulero 1982).

The maternal variables predicted from Olsen-Fulero's model to positively covary with language development were (*a*) *wh*-requests for unknown information and (*b*) requests for confirmation. The maternal variables predicted to negatively covary with language development were (*a*) *wh*-test questions, (*b*) directives for nonverbal child responses and (*c*) conversational dominance. The remaining categories were not specifically predicted by Olsen-Fulero (1982) to covary with language development but may covary with conversational or directive interaction styles and were thus of interest. These were requests for clarification, comments that encode the child's activity, comments that encode child's activity in question form and comments that add new information to the conversation. Generalizability

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TABLE 1. *Maternal verbal interaction style variables at time 1*

Variable name	Definition/description	Example
	Proposed positive predictors	
Requests for unknown information	*Wh*-requests for information the mother presumably does not know	What happened?
Requests for confirmation	Request for the child to confirm the mother's interpretation of the child's utterance	Did you say ball?
	Proposed negative predictors	
Test questions	*Wh*-requests for information the mother presumably knows	What is this? (pointing to a ball)
Directives	Instructions to do a non-verbal behaviour	Sit down
Conversational dominance	Average number of utterances/ maternal turn	
	Others that may covary with interactive style	
Requests for clarification	Request for the child to repeat part or all of his previous utterance	What did you say?
Comments that encode child's activity	Statements that describe child's act	You're making the car go
Comments that encode in question form	Utterances that describe child's acts in form that requests a child response, e.g. tag question	You're making the car go, aren't you?
Comments that add new information	Statements that add new information to conversation	You're making the *red* car go *fast*
Amount of maternal talking	Number of maternal turns	

coefficients (Cronbach, Gleser, Nanda & Rajaratnam 1972) estimated the average inter-observer reliability of maternal variables at 0·88 (range = 0·50–0·99).

Child language measures. Eighteen measures of the children's language skills were computed from the transcripts and videotapes of both sessions (see Table 2). The variables measured were selected from Miller's (1981) review of the language skills that develop during Brown's (1973) first two stages. The variables represented the following areas of language acquisition: frequency of talking, lexicon, morphology, syntax and pragmatics. The number and percent specific semantic relations were not useful in differentiating among children due to insufficient occurrences of each two- and three-term relation during either time 1 or time 2 sessions. Instead, total number and percentage of two- and three-term utterances were used as measures of syntactic development.

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TABLE 2. *Child language variables at time A*

Variables	Definition/description	Example
	Amount of child talk	
Number and percentage of child turns	A TURN is defined by sequence and pauses over 2 seconds	C: I want M: A ball, you want a ball
Total number of tokens	Two instances of one word counts as 2 tokens	Ball, ball = 2 tokens
	Lexical diversity	
Number of different words	DIFFERENT defined by exact spelling of word root and meaning	C: I can C: *Can* fall (as aluminium can falls)
Number of different verbs	Irregular tense markers are counted as different from base form	*Do* and *did* are different words
	Morphology	
Number of copulas	Number of utterances with copulas	*I'm* tired
Number of auxiliaries	Number of utterances with auxiliaries	*I'm* sleeping
Number of different inflected words	Inflections include plural *s*, '*s*, past tense, *ing* and negative contractions	I *goed* I *sleeping*
	Syntax	
Mean length of utterance	Brown's (1973) conventions followed	—
Number and percentage of utterances with at least two words	—	Car go
Number and percentage of utterances with at least three words	—	Car go house
	Pragmatics	
Number of child questions asked	Questions determined by intonation and inferred intent	What's that?
Percentage of mother's test questions addressed	Responses are semantically related child talk following questions	M: What colour is that? C: Red
Percentage of mother's requests for unknown information addressed	—	M: What happened to the car? C: In house
Percentage of mother's requests for confirmation addressed	—	M: Did you say ball? C: Yeah
Percentage of mother's requests for clarification addressed	—	M: What? C: Ball

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The child language development variables were selected from the above variables on the basis of two criteria. First, the measure must have sufficient occurrence at time 2 to differentiate among children. Second, statistical or design control of time 1 child differences on the measure must be possible. The second criterion was achieved in two ways. We computed residualized gain scores (i.e. the time 2 measure with time 1 measure partialled out) for variables that had time 1 measures that were linearly related to their time 2 counterparts. The remaining language development measures were time 2 variables that had little or no occurrence of the language skill at time 1. As a result, the ten child language outcome variables shown in Table 3 were selected for the following analyses. Generalizability coefficients estimated the average inter-observer reliability on child variables to be 0·95 (range = 0·89–0·97).

TABLE 3. *Child language development measures*

Amount of child talk
Percentage of child turns[a]
Morphology
Number of different inflected words
Number of utterances with copulas
Number of utterances with auxiliaries
Syntax
Mean length of utterance[a]
Number utterances with at least two words[a]
Number utterances with at least three words
Percentage of utterances with at least three words
Pragmatics
Percentage of test questions that child addressed[a]
Number of child questions

[a] Residualized gain score (time 2 score with time 1 score partialled out).

RESULTS

Analysis procedure

All relationships were tested using simple correlational analyses. Pearson product-moment correlations (i.e. *r*) were used when both variables were approximately normally distributed. Spearman's *rho* (i.e. *rs*) was used when the distribution of one or both variables was greatly skewed. All relationships were tested with two-tailed tests and an alpha level of 0·05. Direct routes were examined by simply correlating the maternal style variables from the first session (MI) with the child language outcomes (CLD). Mother–child variable pairs that were significantly related were further analysed to test for the possible existence of an indirect route.

A two-step procedure was used to identify indirect routes. First, we tested

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correlations between child language measures at time 1 and the child language outcome measures that were predicted by specific aspects of maternal style. Secondly, if any significant correlations were identified in this first step, we then tested the relationships between the predictive maternal time 1 measures and the time 1 child measures.

To reduce the amount of redundant information conveyed by the results, the intercorrelations within the three sets of variables were examined, and redundant results were omitted from the discussion. That is, three correlation matrices were constructed to test the degree of intercorrelation within covarying time 1 child variables, maternal time 1 predictors, and child language outcomes.

Relationships between initial maternal style and later child language development. Both of the maternal time 1 variables that were studied as potential positive predictors of child language development were positively related to child language development (see Table 4).

Maternal requests for unknown information at time 1 were positively related to gains in the mean length of child utterances ($rs = 0{\cdot}74$, $p < 0{\cdot}01$), the percentage of child utterances with at least three words ($rs = 0{\cdot}62$, $p < 0{\cdot}05$) and the number of child utterances containing copulas ($rs = 0{\cdot}74$, $p < 0{\cdot}01$). Maternal requests for confirmation at time 1 were positively related to gains in the number of child utterances with copulas ($rs = 0{\cdot}76$, $p < 0{\cdot}01$).

Additionally, two of the three maternal time 1 variables that were studied as potential negative predictors of child language development were negatively related to child language development. Maternal directives at time 1 were negatively related to gains in mean length of child utterances ($r = -0{\cdot}80$, $p < 0{\cdot}01$), the percentage of child utterances with at least three words ($rs = -0{\cdot}68$, $p < 0{\cdot}05$) and the number of child utterances containing copulas ($rs = -0{\cdot}75$, $p < 0{\cdot}01$). Maternal test questions at time 1 were negatively related to gains in the percentage of maternal test questions the child addressed ($rs = -0{\cdot}75$, $p < 0{\cdot}01$) and the number of child utterances with auxiliaries ($rs = -0{\cdot}68$, $p < 0{\cdot}05$). Conversational dominance was not related to any measured aspect of child language development.

One maternal variable at time 1 for which we did not make a directional prediction was negatively related to child language development. Maternal requests for clarification were negatively related to gains in the number of child utterances with at least two words ($rs = -0{\cdot}65$, $p < 0{\cdot}05$).

Intercorrelation of predicted child outcomes. As shown in Table 5, three of the six measures of language development predicted by maternal style variables were related to at least one other outcome. Percentage of utterances with at least three words was positively correlated with gains in both child MLU and the number of child utterances containing copulas ($r = 0{\cdot}73$, $p < 0{\cdot}05$;

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TABLE. 4. *Correlations of maternal style and child language outcomes*

Child language outcomes	Maternal style									
	Requests for unknown information	Requests for confirmation	Test questions	Directions	Requests for clarification	Encoding comments	Encoding questions	Comments that add information	Amount of maternal talk	Converstional dominance
Percentage child turns[a]	0·21	−0·06	−0·14	0·15	−0·48	−0·19	−0·13	−0·07	−0·32	−0·04
No. of inflected words	0·59	0·04	−0·23	−0·37	−0·46	0·29	−0·08	0·12	−0·33	0·23
No. of utterances with copulas	0·74‡[b]	0·76‡[b]	−0·56	−0·75‡[b]	−0·12	0·14	−0·18	0·33	−0·39	−0·19
No. of utterances with auxiliaries	0·39	0·39	−0·68†	−0·21	0·11	0·05	−0·25	0·38	0·06	−0·23
MLU[a]	0·74**[b]	0·14	−0·04	−0·80**[b]	−0·27	0·25	−0·29	−0·11	−0·26	−0·30
No. of utterances with two words[a]	0·24	−0·36	−0·02	−0·05	−0·65†	0·38	−0·39	0·06	−0·21	0·01
No. of utterances with three words	0·59	0·48	−0·18	−0·61	−0·22	−0·15	−0·52	−0·11	−0·03	−0·21
Percentage of utterances with three words	0·62†[b]	0·52	−0·21	−0·68†	−0·14	0·12	−0·23	0·23	−0·32	0·12
Percentage of test questions addressed[a]	0·39	0·44	−0·75‡[b]	−0·03	−0·01	0·12	−0·03	0·28	−0·00	0·12
No. of child questions	0·23	0·29	−0·09	−0·10	0·23	−0·60	−0·15	−0·20	−0·21	0·07

[a] Residualized gain scores.
[b] Covarying time 1 variable found.
*, ** = Pearson coefficient significant at 0·05 and 0·01 levels, respectively.
†, ‡ = Spearman coefficient significant at 0·05 and 0·01 levels, respectively.

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$r = 0{\cdot}96$, $p < 0{\cdot}01$, respectively). All maternal style variables that predicted gains in the percentage of child utterances with at least three words also predicted the MLU outcome. Therefore, we eliminated percentage of child utterances with at least three words at time 2 from further analyses without loss of information about the relationships under study.

Additionally, gains in the percentage of maternal test questions that the child addressed were positively related to the number of child utterances with auxiliaries ($rs = 0{\cdot}72$, $p < 0{\cdot}05$). Both measures were negatively predicted by maternal test questions. However, because these measures index conceptually different domains, relationships including either measure will be discussed.

TABLE 5. *Intercorrelation of child outcomes that were predicted by maternal style variables at time 1*

Predicted child language development measures	2	3	4	5	6
(1) MLU[a]	0·31	0·73†	0·54	0·05	0·33
(2) No. of utterances with at least two words[a]	—	0·32	0·16	0·32	0·06
(3) Percentage of utterances with at least three words	—	—	0·96‡	0·16	0·51
(4) No. of utterances with copulas	—	—	—	0·43	0·58
(5) Percentage of test questions addressed[a]	—	—	—	—	0·72†
(6) No. of utterances with auxiliaries	—	—	—	—	—

[a] Residualized gain scores. All other variables are time 2 variables with virtually no variance or occurrence at time 1.

†, ‡ = Pearson coefficient significant at 0·05 and 0·01, respectively.

Intercorrelation of predictive maternal style measures. There were no positive relationships among the five maternal style predictors. The only statistically significant relationship between any two of the five predictors was a negative one between requests for unknown information and directives ($rs = -0{\cdot}88$, $p < 0{\cdot}01$).

Intercorrelation of time 1 covarying child variables

Two of the three time 1 covarying child variables were unrelated. Percentage of maternal confirmation requests that the child addressed was unrelated to percentage ($rs = 0{\cdot}09$) and number of child utterances that were multi-word utterances at time 1 ($r = 0{\cdot}35$). However, number and percentage of multi-word utterances were strongly related ($rs = 0{\cdot}91$, $p < 0{\cdot}001$). Percentage of multi-word utterances was the covarying variable in more time 1–time 2

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relationships, including all of those in which the number of multi-word utterances was also a covarying variable. Therefore, the latter variable was excluded from subsequent discussion without loss of information.

Indirect routes for relationships between initial maternal style and later child language development

Of the ten significant MI–CLD relationships, seven could be explained through a common relationship with a time 1 child variable (see Fig. 3). To reduce redundancy, only indirect relationships involving uncorrelated covarying variables and conceptually different outcomes are discussed below.

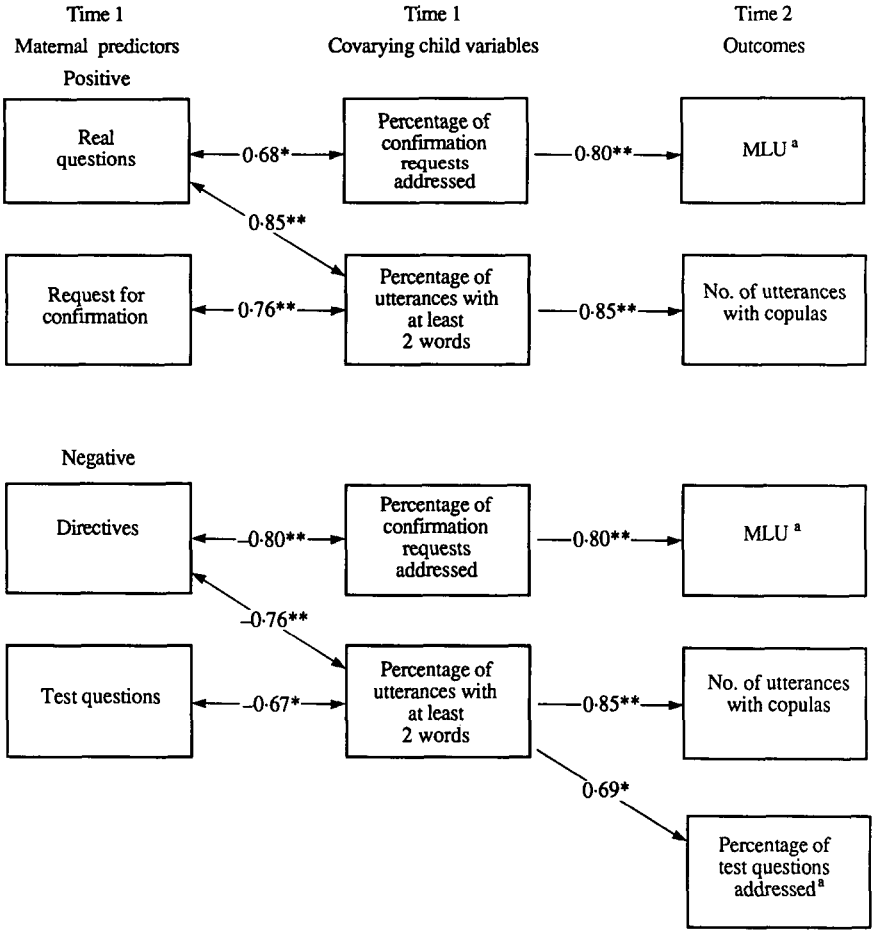

Fig. 3. Illustration of the indirect routes by which maternal time 1 style predicts subsequent child language development. * $p < 0{\cdot}05$; ** $p < 0{\cdot}01$. [a] Residualized gain scores. (*Note*. There was no occurrence of child utterances with copulas at time 1.)

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In three instances where MI and CLD variables were positively correlated, the mother and child variables were also positively correlated with a child time 1 language variable. Indirect routes for relationships involving maternal requests for unknown information were through (*a*) the percentage of maternal requests for confirmation that the child addressed at time 1 and (*b*) the percentage of multi-word child utterances at time 1. Maternal requests for confirmation were indirectly related to gains in copula use through the percentage of multi-word child utterances at time 1.

In three of the six instances in which MI and CLD variables were negatively correlated, the mother and child variables were both correlated with a child time 1 language variable. Indirect routes for the relationships involving maternal directives were through (*a*) the percentage of mother requests for confirmation that the child addressed at time 1 and (*b*) the percentage of multi-word child utterances at time 1. Finally, maternal test questions were indirectly related to gains in the percentage of test questions that the child addressed through the percentage of multi-word child utterances at time 1.

Relationships between initial maternal style and child language development without evidence of indirect routes. Three of the ten significant relationships between initial maternal style and child language development did not show evidence of an indirect route for this relationship. The first was the negative relationship between requests for clarification and gains in the number of child utterances with at least two words. The second was the negative relationship between directives and percentage of child utterances with at least three words at time 2. It should be noted, however, that percentage of utterances with at least three words at time 2 was highly intercorrelated with MLU. As indicated on Fig. 3, MLU and directives were correlated through a common relation with the percentage of requests for confirmation addressed at time 1. The third was the negative relationship between maternal test questions and gains in the number of child utterances with auxiliaries at time 2. Again, it should be noted that the correlation between maternal test questions and child MLU at time 1 approached significance ($rs = -0{\cdot}62$, $p < 0{\cdot}06$). MLU at time 1 did significantly predict auxiliaries at time 2 ($rs = 0{\cdot}63$, $p < 0{\cdot}05$).

DISCUSSION

The major contribution of the study is the finding that seven of the ten relationships between time 1 maternal interactive style and subsequent child language development were indirectly related through one of two aspects of child language at time 1. This suggests the need to examine aspects of time 1 child behaviour that may explain many relationships between maternal style and later child language development.

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The following discussion of the results begins with a general discussion of the covarying time 1 child variables. Subsequently, the obtained relationships between maternal style and later language development will be discussed using the models presented in the introduction as guides for generating hypotheses for future studies.

Covarying variables

Two uncorrelated, time 1 child language variables covaried with maternal style at time 1 and later child language development. These covarying variables were percentage of multi-word child utterances and percentage of maternal confirmation requests that the child addressed.

Percentage of multi-word child utterances is a summary variable that may have included unanalysed expressions (Peters 1983) in addition to ones generated by the child. To the extent that these utterances were unanalysed phrases, these scores reflect more than one construct (i.e. syntactic level and number of unanalysed phrases). The high correlation between percentage of multi-word child utterances and child mean length of utterance ($rs = 0{\cdot}66$, $p < 0{\cdot}05$) supports our interpretation that multi-word utterances is a measure of syntactic level.

The second covarying variable, the percentage of maternal confirmation requests that the child addressed may be a distal measure of the child's conversational responsiveness that is relatively independent of the child's lexical and syntactic skill. Three factors support this interpretation. First, this variable was not related to any other measure of child language performance at time 1. Secondly, requests for confirmation are relatively easy for the child to respond to. Because only semantic relevancy, not correctness, was the criterion for scoring child behaviours as responses, the child only had to indicate *yes* or *no* to respond to confirmation requests. Thirdly, requests for confirmation differ from other *yes/no* questions in that they always query the content of the child's previous utterance and thus topic of interest. Kaye and Charney (1980) have suggested that question types that continue the child's topic are particularly effective in eliciting the child's conversation. Therefore, children who do not respond to confirmation requests may fail to do so because of a lack of interest in continuing the topic, rather than a lack of lexical or syntactic skill.

Since the current study is one of the first to posit the existence of specific covarying aspects of child behaviour, the following section discusses in some detail the ways in which these variables might provide indirect routes by which mother style is related to later language development. Implicit in this discussion are hypotheses to be investigated in future research.

Alternative explanations for the indirect relationships

Immediate influence of mother and child at time 1. In the introduction, we presented the notion that mother or child may influence the other's

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behaviour immediately and/or accumulatively. However, a *post hoc* examination of the actual sequential occurrences of mother and child behaviours within the time 1 sessions indicated that an immediate influence was seen for only one pair of variables: maternal test questions and child single-word utterances. An average of 49% (S.D. = 21) of the mothers' test questions at time 1 were followed immediately by single-word child utterances. That is, test questions tended to elicit single-word responses. This finding could, in part, explain the negative relationship between test questions and child multi-word utterances at time 1. The conditional probability of the sequential occurrence at time 1 of all other relevant pairs of covarying child variables and maternal style predictors was less than 5%. Therefore, the following discussion of alternative explanations for the indirect relationships assumes that the relationships between the covarying time 1 child variables and maternal style variables are primarily due to cumulative influences.

Possible cumulative child influence at time 1. The children's syntactic level and interest in continuing the topic of conversation may have elicited variation in the way the mothers used their language during the time 1 session. This explanation assumes a specific version of the fine tuning hypothesis (see Snow, Perlman & Nathan (1987), for review) in which mothers generally attempt to elicit the most mature form of communication that they believe their children are capable of and interested in producing. That is, mothers of syntactically advanced and conversationally responsive children may use requests for unknown information and confirmation proportionately more often than mothers of less advanced chidren because they believe their children are capable of and interested in conversation. Conversely, mothers of children with relatively little syntactic structure or conversational responsiveness, may use test questions and directives to elicit single-word and nonverbal interaction.

Possible cumulative mother influence at time 1. Alternatively or additionally, mothers who used proportionately many requests for unknown information and confirmation may have had an influence on their children's syntactic ability and interest in conversation over time. Variation in this aspect of maternal style and child language skill may have been stable over time, thus accounting for a relationship between maternal style and child skills during the time 1 sessions. As mentioned earlier, requests for unknown information may act as prods for language analysis (Hoff-Ginsberg 1986). Similarly, requests for confirmation may have stimulated language analysis because such requests prompt and reward children for talking more clearly about their topic of interest (Hoff-Ginsberg 1987). The eventual result of this language analysis may be relatively advanced child syntactic levels. Children of mothers who request unknown information frequently may develop relatively high levels of interest in conversation because their mothers expect

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and support their conversation. Our findings support the notion that mothers' time 1 directives were negatively related to child syntactic level because mothers who elicit conversation frequently with requests for unknown information use relatively few directives.

The covarying variables and later child language development. Time 1 child syntactic level and conversational responsiveness may have been related to later gains in various areas of language development because all benefit from or stimulate analysis of adult language. For example, the children who are interested in conversing at time 1 may begin to analyse adult language so they can converse better. The same language analysis strategy that may have facilitated the children's syntactic development at time 1 may have facilitated their later copula development. Such language analysis strategies require much attention to mothers' speech which may result in later gains in comprehension of and responsiveness to frequently occurring test questions.

Relationsips in which no covarying variable was identified

The three M1–CLD relationships in which no covarying variable was found could be explained by direct and/or indirect explanatory models. There is always the possibility that an unmeasured aspect of child language at time 1 accounts for these relationships. Additionally, a larger sample size may have resulted in finding covarying variables within the set of variables we measured.

For example, the relationship between maternal time 1 test questions and gains in the number of child utterances with auxiliaries may have been indirect in a larger sample. As mentioned in the results, a time 1 child variable that predicted later auxiliary use (i.e. MLU) was almost significantly related to maternal test questions.

CONCLUSION

The present findings support the contention that a direct maternal influence model for explaining the relationship between maternal style and later child language development may be inadequate in many cases. Our results suggested that two covarying time 1 child variables provided an indirect route for many M1–CLD relationships in naturally occurring interactions. The present study does not exclude the possibility that covarying time 1 child variables mediate the indirect influence of maternal speech on later child language variables. However, we have argued that the existence of covarying time 1 child variables highlights the equally reasonable position that such variables may cause both variation in maternal speech and later child language development. Common-cause variables are in need of control or

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testing if mother speech–child language relationships are to be interpreted as evidence of maternal influence.

Some previous investigators have argued that controlling for initial differences in the time 1 measures of language outcomes sufficiently eliminates the possibility of child influence at time 1 (Hoff-Ginsberg 1986). This assumption is not valid. The present study found evidence supporting the common-cause role for covarying time 1 child variables even though time 1 scores of each language outcome were statistically or procedurally controlled.

The non-experimental design employed in this study was not sufficient to determine whether these indirect relationships were child-driven, mother-driven or both. The use of experimental designs in future studies would allow investigation of which actor (i.e. mother or child) is primarily responsible for the relationship between covarying time 1 child variables and maternal style.

At this early stage of investigating indirect relationships, a combination of naturalistic and experimental studies should be used. The sole reliance on naturalistic studies leaves unanswered questions about causality and direction of effect of the obtained relationships. The sole reliance on experimental studies may lead to testing overly simplistic models of what could occur, rather than determining what typically does occur.

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