Maternal Education and Measures of Early Speech and Language

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The present study was designed to determine whether 4 measures of children's spontaneous speech and language differed according to the educational level of the children's mothers. Spontaneous language samples from 240 three-year-old children were analyzed to determine mean length of utterance in morphemes (MLUm), number of different words (NDW), total number of words (TNW), and percentage of consonants correct (PCC). A norm-referenced, knowledge-dependent measure of language comprehension, the Peabody Picture Vocabulary Test–Revised (PPVT–R), was also included for purposes of comparison with the spontaneous measures. Three levels of maternal education were compared: less than high school graduate, high school graduate, and college graduate. Trend analyses showed statistically significant linear trends across educational levels for MLUm, NDW, TNW, and PPVT–R; the trend for PCC was not significant. The relationship of maternal education and other sociodemographic variables to measures of children's language should be examined before using such measures to identify children with language disorders.

KEY WORDS: child language disorders, child language development, child language assessment, test bias, maternal education

Language sample analysis is an important component of language assessment for preschool children, for both clinical and research purposes. Analyses based on the language forms produced freely by the child interacting with a familiar adult have face validity, and several investigators have provided evidence that measures derived from conversational language samples are both sensitive to developmental change and useful clinically in identifying children with language disorders (Dunn, Flax, Sliwinski, & Aram, 1996; Klee, 1992; Klee, Schaffer, May, Membrino, & Mougey, 1989; Miller, 1981, 1991; Miller & Chapman, 1981; Watkins, Kelly, Harbers, & Hollis, 1995). However, it is not known whether these spontaneous language measures are susceptible to sociodemographic biases similar to those reported for standardized language tests (e.g., Campbell, Dollaghan, Needleman, & Janosky, 1997; Fazio, Naremore, & Connell, 1996).

The fact that conversation-based measures of early language production have not been scrutinized for possible sociodemographic differences is surprising, given the extensive literature documenting sociodemographic differences in adult and adolescent language (e.g., Bernstein, 1973; Labov, 1966) and the truism that children acquire the language of their language community. With few exceptions (e.g., Klee et al., 1989; Loban, 1976; Rescorla, 1989; Roberts, Medley, Swartzfager, & Neebe, 1997; Wallace, Roberts, & Lodder, 1998), the preponderance of data concerning the expected sequence and rate of speech and language

development have been derived from children of families described as having middle- to upper-middle-class socioeconomic status (e.g., Bornstein & Haynes, 1998; Fenson et al., 1993; Miller & Chapman, 1981; Olswang, Stoel-Gammon, Coggins, & Carpenter, 1987; Scarborough, 1990; Shriberg, Austin, Lewis, McSweeny, & Wilson, 1997). The assumption that data from these relatively privileged children can be used validly in evaluating the language skills of less privileged children has rarely been tested (Feldman et al., in press), despite assertions of the need to do so (Craig & Washington, 1994; Klee et al., 1989; Miller & Chapman, 1981; Tomblin et al., 1997; Washington & Craig, 1994, 1998). Recent reports that both language exposure and the rate and extent of vocabulary growth differ significantly between children in professional, blue-collar, and welfare families (Hart & Risley, 1995) emphasize the need for studies of sociodemographic factors in relation to child language development. If the systematic sociodemographic biases that have been found in norm-referenced tests are also found regarding spontaneous language measures, the interpretation of these measures must take these biases into account.

A number of sociodemographic variables have been linked to children's development generally, including family income, parental education, and race or ethnicity. These characteristics co-vary significantly in the United States, making it extremely difficult to specify the extent to which they are independently associated with performance on developmental measures (Huston, McLoyd, & Garcia Coll, 1994). As part of a larger study designed to study the relationship of otitis media with effusion and child development, we had the opportunity to investigate the relationship of sociodemographic variables and spontaneous language production.

Three considerations led us to focus primarily on maternal educational level for this investigation. First, recent evidence suggests that family income and parental educational level are more significant influences on developmental performance than are race or ethnicity. For example, Brooks-Gunn, Klebanov, and Duncan (1996) examined the independent contributions of 14 variables to an average IQ difference of 17.8 points between Black and White 5-year-olds with histories of low birth weight and prematurity. A series of regression analyses showed that sociodemographic variables other than race accounted for most of this difference. Including a measure of family poverty in the model reduced the ethnic difference in IQ by 52%, and including measures of maternal verbal ability and education and the learning experiences provided in the home at age 3 reduced the IQ difference by an additional 28%, to 3.4 IQ points. Patterson, Kupersmidt, and Vaden (1990) similarly reported that family income was more closely linked to developmental outcome than was ethnicity (Black or White).

Second, there is considerable evidence that parental education and family income are associated with variations in the environment and experiences of children (e.g., Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Wallace, Roberts, & Lodder, 1998), including the quantity of language that they hear (e.g., Adams & Ramey, 1980; Hart & Risley, 1995; Laosa, 1980; Walker et al., 1994). In one analysis of these relationships, Entwisle and Astone (1994) suggested that family income affects the availability of material resources that can influence child development, whereas parental educational history is linked to nonmaterial resources, including the parent's academic competence, attitudes toward education (e.g., Brody & Flor, 1998; Fuligni, 1997), knowledge and beliefs about child development (e.g., Benasich & Brooks-Gunn, 1996; Tamis-LeMonda, Chen, & Bornstein, 1998), and overt behavior. It is reasonable to hypothesize that a parent's educational achievement might affect the characteristics of the child-directed language that he or she uses, independently or in conjunction with individual differences in parental communicative style (e.g., Haden, 1998; Morisset, Barnard, & Booth, 1995; Pine, Lieven, & Rowland, 1997; Wiley, Rose, Burger, & Miller, 1998).

Finally, of the two key variables, family income and parental educational level, educational level is often more stable (Huston, McLoyd, & Garcia Coll, 1994) and less controversial to measure than is family income (Hauser, 1994). Maternal and paternal educational levels are highly correlated (Entwisle & Astone, 1994), and a substantial number of low-income children live in mother-only families (Hernandez, 1997). Accordingly, maternal educational level was used as the measure of parental education in the present study.

We examined the relationship of maternal educational level to four measures of children's spontaneous speech and language: mean length of utterance in morphemes (MLUm), number of different words (NDW), total number of words (TNW), and percentage of consonants correct (PCC). MLUm is one of the best known measures of early language (Brown, 1973). It has been shown to correlate with age over the period from 18 to 60 months (Miller & Chapman, 1981) and to differentiate between children with and without language impairments over the age range from 24 to 50 months (Klee et al., 1989). Miller and Chapman (1981) reported MLUms for middle- to upper-middle-class children at specific monthly ages, but their caveat concerning the possibility that these MLUm values might be higher than values for the general population has not prevented the use of these MLUm data as if they were normative. Although Klee et al. (1989) found in a sample of primarily lower-middle-class children that MLUm increased at a rate similar to that observed by Miller and Chapman (1981), Walker, Greenwood, Hart, and Carta

(1994) reported a significant correlation between MLUm at age 3 and maternal education. Accordingly, we also predicted significant differences in MLUm by maternal educational level in the present study.

The number of different words produced (NDW) has been described as a measure of semantic or lexical diversity (Miller, 1991; Watkins et al., 1995), and the total number of words (TNW) as an index of general language facility, volubility, or talkativeness (Klee, 1992; Miller, 1991). Miller (1991) found that both NDW and TNW were significantly correlated with age in a sample of children from Madison, Wisconsin, similar to those for whom MLUm data had been reported by Miller and Chapman (1981). Klee (1992) provided evidence that NDW, but not TNW, differentiated between mainly lower-middle-class children with and without language disorders, and Watkins et al. (1995) reported that NDW was diagnostically useful in a sample of middle- to upper-middle-class children. No studies of NDW or TNW in relation to parental educational level have been reported to our knowledge, but Hart and Risley (1995) found that family SES, itself highly correlated with maternal education, accounted for 40% of the variance in their measure of vocabulary diversity at age 3, and that both parent and child volubility varied by SES. Accordingly, we hypothesized that both NDW and TNW would vary by maternal educational level.

The fourth conversational measure, percentage of consonants correct (PCC), is an index of consonant mastery (Shriberg & Kwiatkowski, 1982). PCC values for yearly age intervals have been reported by Shriberg et al. (1997), based on speakers at several sites around the country and consisting, with few exceptions, of middle-class speakers speaking General American dialect. No evidence is available concerning sociodemographic effects on PCC, but this measure would seem less likely than the language measures to vary according to maternal education because of the fact that substantial information on consonant sounds is available to children even in input that is not particularly frequent or diverse. Accordingly, we hypothesized that PCC would not differ significantly across the maternal education levels.

Finally, and by contrast with these four measures of spontaneous language, we also examined the relationship between maternal educational level and performance on a well-known, norm-referenced, knowledge-dependent test of vocabulary comprehension, the Peabody Picture Vocabulary Test–Revised (PPVT–R; Dunn & Dunn, 1981). Children from minority groups, whether defined by ethnicity or by measures of socioeconomic status, score below age-matched children from the majority comparison group on traditional norm-referenced tests generally, and on vocabulary tests in particular (e.g., Brooks-Gunn et al., 1996; Burchinal et al., 1997; Campbell et al., 1997; Fazio et al., 1996; Irvine & Berry, 1988). Accordingly, we hypothesized significant differences in PPVT–R by maternal educational level, and we predicted that the largest impact of differences in maternal educational level would be found on this measure.

Method

Participants

Participants were 241 three-year-old children drawn from a larger sample of children participating in a prospective, longitudinal study in which they were monitored closely for the presence or absence of middle-ear effusion (MEE; Paradise et al., 1993). The study was approved annually by the Children's Hospital of Pittsburgh Human Rights Committee. All children presented for primary care at one of eight participating pediatric practice sites, two of which were located in urban areas, two in small town/rural areas, and four in suburban areas. The children were enrolled in the study by age 2 months, and they had diverse sociodemographic characteristics as described below. Children were excluded from enrollment if they met any of the following criteria that could adversely affect global or communication developmental outcome: birth weight <5 pounds (2268 grams); small for gestational age; history of neonatal asphyxia or other serious illness; major congenital malformation or chronic illness; multiple birth; in foster care or adopted; mother dead, seriously ill, a known drug or alcohol abuser, or overwhelmingly limited socially or intellectually; mother aged <18 years; and English not the only language spoken at home. Children also were excluded if a sibling was participating in the study or if their parents planned to move from the region within 5 years of enrollment.

At the time of enrollment a standardized medical and social history was obtained from the child's parent or guardian. The questionnaire solicited information on the health insurance status of the family (private health insurance, medical assistance, or none) as an estimate of family income. The respondent also classified the highest level of education completed by the mother as "less than high school graduate," "high school graduate," "post-high-school technical training or college short of degree," "college graduate," or "post-baccalaureate education." For the present study, these five levels were collapsed into three categories of maternal education: "less than high school graduate," "high school graduate, with or without some college or technical school," and "college graduate with or without some post-baccalaureate education."

Although the reliability and scientific value of measures of race and ethnicity have been seriously questioned (e.g., Bhopal & Donaldson, 1998; Huston, McLoyd, & Garcia Coll, 1994), others have argued for the inclusion of such measures in describing research participants (Entwisle & Astone, 1994). In the present investigation, study personnel assigned the child's ethnicity (Black or White) based on observable physical characteristics of the child and the parent(s).

Children were scheduled for otoscopic evaluation at their primary care site at least monthly from 2 to 36 months of age. At each visit, a standardized interval history was obtained, and a study-team clinician performed pneumatic otoscopy, supplemented by tympanometry, to determine whether MEE was present in either or both ears. As detailed in Paradise et al. (1997), children who developed MEE that was sufficiently persistent to meet specified eligibility criteria were entered, contingent on parental consent, into a randomized clinical trial of tympanostomy-tube placement. The group of children whose MEE experience was not sufficient to qualify them for randomization by age 2 years represented a spectrum of cumulative MEE experience ranging from no MEE to MEE on 45% of days during the age period from 2 to 24 months. This spectrum was divided into four segments on the basis of individual subjects' cumulative number of days with MEE during that period: 0–60, 61–120, 121–180, or more than 180. To meet sample-size requirements for other analyses, a total of 241 subjects was randomly selected from within these quartiles to ensure approximately equal numerical representation from each quartile, as well as similar demographic characteristics within each of the four quartiles.

The single child whose parent refused to provide information on maternal education was excluded from the present analyses. As shown in Table 1, 24 (10%) of the remaining 240 mothers had not graduated from high school; 167 (70%) had graduated from high school but not college; and 49 (20%) were college graduates. These percentages may be compared with the corresponding percentages (17%, 63%, and 20%, respectively) reported for U.S. children living with their mothers in 1995 (Hernandez, 1997). The lower percentage of mothers in the present sample who had not graduated from high school in part reflects the exclusion of mothers younger than 18 years of age from the study as a whole.

Table 1 reflects the unequal distribution of other sociodemographic variables across these educational level groupings that was expected given the demographics of the United States (Hernandez, 1997; Huston, McLoyd, & Garcia Coll, 1994). Specifically, mothers who were college graduates were disproportionately likely to have private health insurance, to be White, and to be

Table 1. Mean percentage values and chi-square results for selected demographic and clinical characteristics of children at each maternal educational level.

Characteristic	Maternal educational level: < High school (*n* = 24)	High school (*n* = 167)	College (*n* = 49)	χ^2	*p*
Health insurance status				31.06	<.0001
Private	12%	67%	90%		
Medicaid	75%	32%	10%		
None	12%	<1%	0		
Ethnicity				16.72	<.001
White	50%	84%	96%		
Black	42%	16%	4%		
Other / uncertain	8%	0	0		
Sex				0.39	0.82
Female	54%	51%	47%		
Male	46%	49%	53%		
Practice site location				26.61	<.0001
Urban	67%	23%	8%		
Rural	33%	41%	31%		
Suburban	0	35%	61%		
% days (and range) with MEE[a], age 2–36 months	14% (0–33%)	16% (0–45%)	14% (0–39%)	1.70	0.43

[a]Middle ear effusion.

receiving pediatric care for their children from a suburban practice site; mothers who were not high school graduates were disproportionately likely to have Medicaid or no health insurance, to be Black, and to be receiving pediatric care from an urban practice site.

Procedures

Children participated individually in a testing session at the Children's Hospital of Pittsburgh at 36 to 38 months of age. Examiners were blinded to both MEE experience and maternal educational level. The testing session was approximately 2 hours long, and included the standardized and nonstandardized measures described below. Every effort was made to ensure that testing occurred only if the child's bilateral hearing thresholds earlier that day were 15 dB or less at 1, 2, and 4 kHz, and 20 dB or less at .5 kHz. Whenever possible, children who failed to meet these hearing criteria were rescheduled for testing at a later date no more than 2 months after their third birthday.

After the hearing test, a number of additional developmental measures were administered. Results of some of these will be reported separately. Among the measures of interest in the present study, the PPVT–R (Dunn & Dunn, 1981) was administered to most of the participants following the hearing test. However, for children from the study's two small-town/rural practice sites, who traveled a substantial distance to participate, we shortened the testing session by having PPVT–Rs administered not at Children's Hospital but by trained personnel at their primary-care sites, usually within 2 weeks of their developmental testing sessions. Two children (both of whose mothers had completed high school but not college) did not complete the PPVT–R.

In the final portion of the testing session a spontaneous language sample approximately 15 minutes long was audio-recorded during play with a set of toys (including kitchen utensils; food items; appliances; and a miniature playhouse with vehicles, furniture, and people) that was available to all participants. Except in two instances, caregivers familiar to the child were present during language sampling; the examiner also was present during some of the sessions. Caregivers were instructed to ". . .play and talk with your child as you would at home, so that we can get an idea of your child's speech and language skills."

Samples were recorded onto portable cassette recorders (Marantz PMD 201) using both a wireless FM microphone (Telex WT-25) and a table-top microphone (Radio Shack PZM); the transcriptionist used whichever tape had the better sound quality for each child. Samples were transcribed orthographically and timed with a stopwatch by trained research assistants blind to all participant information other than identification number. Analysis was performed using the Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 1986) computer program and a set of transcription conventions to ensure consistency. All transcripts were reviewed for consistency and accuracy of morpheme identification by the first author (Dollaghan), who also was blind to participants' MEE experience and sociodemographic characteristics. After any errors were corrected, SALT analyses were conducted to yield mean length of utterance in morphemes (MLUm), number of different words (NDW), and total number of words (TNW).

MLUm was calculated across all utterances that were both complete (i.e., neither interrupted nor abandoned) and intelligible (i.e., had no segments that the transcriber could not identify as words or word fragments). Mean length of utterance in words (MLUw) also was calculated in an effort to minimize the potential impact of dialect differences in this diverse sample. However, because the correlation between MLUm and MLUw in this sample was almost perfect ($r = .99$, $p < .01$) and because MLUm has been reported more frequently in the literature, MLUm was used in the analyses. NDW and TNW were calculated across all utterances produced by the child, including those that were interrupted or abandoned, or contained unintelligible segments, in an effort to avoid confounding lexical diversity and volubility with intelligibility. NDW represents a count of all first-occurrence word roots, ignoring inflectional morphemes. For example, because *jump*, *jumps*, *jumped*, and *jumping* have a common root (*jump*), only the first occurrence of this root contributed to the NDW count. By contrast, TNW represents an exhaustive tally of all words produced.

The first 100 first-occurrence words from the orthographic transcripts were then transcribed phonetically by trained research assistants who were blind to MEE history and sociodemographic information, using the transcription consensus procedures described by Shriberg, Kwiatkowski, and Hoffman (1984). These data were then analyzed using the PEPPER: Programs to Evaluate Phonetic and Phonologic Evaluation Records computer programs (Shriberg, 1986) to yield the percentage of consonants correct (PCC), an index of consonant production mastery. As described by Shriberg, Austin, Lewis, McSweeny, and Wilson (1997), PCC represents the percentage of intended consonants that are articulated correctly, that is, are not deleted, replaced by another phoneme, or distorted.

Each child's standard score on the PPVT–R was calculated according to the procedures specified in the PPVT–R manual (Dunn & Dunn, 1981).

Reliability

Intertranscriber agreement for MLUm, NDW, and TNW was determined from independent transcription and analysis of 49 randomly selected transcripts (20%). The correlations between the original and the second transcriptions for each measure were as follows: MLUm $r = .98$; NDW $r = .96$; TNW $r = .99$; all correlations were statistically significant ($p < .01$). The mean size of the discrepancy between the two independent transcriptions was 0.14 morphemes for MLUm; 9 words for NDW; and 16 words for TNW.

To determine intertranscriber agreement for phonetic transcription, productions from 29 randomly selected subjects (12%) were transcribed independently by a second research assistant. The phoneme-by-phoneme percentage of agreement was 91%.

A second trained observer recalculated ages, raw scores, and standard scores on the PPVT–R for all subjects. Discrepant results were resolved by the developmental testing coordinator (Pitcairn).

Statistical Analyses

All statistical analyses were performed with alpha set at $p = .05$, after ensuring that all necessary statistical assumptions were met for each of the variables of interest. As a precursor to the primary analyses, analysis of variance was used to test for differences between the maternal educational groups with respect to three properties of the conversational samples that could influence the conversational speech and language measures: length of the language sample in seconds, total number of utterances produced by the child, and number of complete and intelligible utterances produced by the child. Extended median tests were used to test for group differences with respect to selected demographic and clinical variables, including the percentage of days with MEE from 2 to 36 months of age.

A trend analysis, or planned orthogonal contrast, was used to test for a linear trend in means among the three maternal educational groups, with respect to the primary speech and language measures (MLUm, NDW, TNW, PCC, and PPVT–R standard score). Following a significant trend, Fisher's least significant difference test was applied to test for differences between maternal educational groups in mean scores. These distinct statistical analyses address different questions. A significant trend simply indicates that changes (increases or decreases) in one variable are associated with similar changes in the other; it does not imply that individual group means are significantly different from one another, which is the purpose of the LSD test.

Results

Table 1 shows selected sociodemographic and clinical characteristics of children in the three maternal educational groups, and Table 2 shows certain properties of their conversational samples. As noted above, and as in the study sample as a whole (Paradise et al., 1997), the maternal educational groups differed significantly with respect to practice site location, ethnicity, and health insurance status. However, by design the groups did not differ significantly with respect to cumulative MEE experience in the first 3 years of life. Similarly, no significant differences between the groups were found in sex ratio or in the age at which children were tested, nor were there significant differences in their conversational samples with respect to three factors that could have influenced the frequency-dependent measures NDW and TNW: duration in seconds, total number of utterances, or number of complete and intelligible utterances.

Table 3 shows the mean scores and standard deviations on the four spontaneous language measures and on the norm-referenced test (PPVT–R) for the children at each maternal educational level. As shown in Table 3, trend analyses showed statistically significant linear trends across maternal educational levels for MLUm, NDW, TNW, and PPVT–R**.** The linear trend for PCC was not statistically significant.

As noted above, maternal educational level was confounded with other variables, including ethnicity (Black or White) in this sample. It is well known that African

Table 2. Means (and standard deviations) for properties of children's conversational samples and age at testing by maternal educational level.

	Maternal educational level							
Property	<High school ($n = 24$)		High school ($n = 167$)		College ($n = 49$)		*F*	*p*
Sample length in seconds	925	(74)	911	(91)	914	(61)	.32	.73
Total utterances	169	(47)	176	(42)	172	(36)	.40	.67
Complete and intelligible utterances	125	(38)	135	(37)	129	(33)	1.08	.34
Age in months at testing session	36.7	(0.7)	36.8	(0.7)	36.9	(0.8)	1.13	.33

Table 3. Mean scores (and standard deviations) on speech and language measures by maternal educational group, and for the entire sample, and linear trend analysis results.

	Maternal educational level								Linear trend analysis		
Measure	<High school		High school		College		Entire sample		*df*	*F*	*p*
MLUm	2.73	(0.8)	2.97	(0.8)	3.29	(0.7)	3.01	(0.76)	1, 237	22.80	<.0001
NDW	118	(36)	131	(32)	143	(28)	132	(32)	1, 237	24.45	<.0001
TNW	454	(194)	501	(172)	533	(159)	502	(172)	1, 237	8.41	<.01
PCC	78	(8)	80	(8)	81	(8)	80	(8)	1, 237	3.43	.065
PPVT–R	90	(18)	101	(14)	110	(14)	102	(15)	1, 235	74.64	<.0001

Note. MLUm = mean length of utterance in morphemes; NDW = number of different words; TNW = total number of words; PCC = percentage of consonants correct; PPVT–R = Peabody Picture Vocabulary Test–Revised standard score.

American English is not used by all or only African American individuals, and we are aware of no evidence linking these particular dependent measures to ethnic background or exposure to African American English. However, in an effort to ensure that these effects could be attributed unambiguously to group differences in maternal educational level rather than to potential dialectal variations, trend analyses were repeated after adjusting for group differences in ethnicity. Statistical conclusions were unchanged for MLUm, NDW, PPVT–R, and PCC, but the linear trend for TNW was no longer significant after adjustment.

In a separate analysis, we asked whether, beyond the significant linear trends that were found, group mean scores differed significantly by maternal educational level. Fisher's least significant difference (LSD) test showed that children whose mothers had graduated from college had significantly greater MLUms than children whose mothers had (LSD $t = 2.68$, $p < .01$) or had not (LSD $t = 3.04$, $p < .01$) graduated from high school. Similarly, children whose mothers had graduated from college had significantly greater NDWs than children whose mothers either had (LSD $t = 2.31$, $p < .05$) or had not (LSD $t = 3.14$, $p < .01$) graduated from high school. Neither MLUm nor NDW differed significantly between children whose mothers had not completed high school and children whose mothers had graduated from high school, but not from college. However, on the PPVT–R, scores for children of college graduates were significantly higher than scores for children whose mothers either had (LSD $t = 3.92$, $p < .01$) or had not (LSD $t = 5.48$, $p < .01$) graduated from high school, and PPVT–R scores for children whose mothers had graduated from high school also were significantly higher than for children whose mothers had not graduated from high school (LSD $t = 3.33$, $p < .01$). The effect size for the difference between the lowest and highest maternal educational levels on this norm-referenced, knowledge-dependent test was approximately twice as large ($\eta^2 = .36$) as that for either MLUm ($\eta^2 = .17$) or NDW ($\eta^2 = .19$).

Thirteen children were tested on a day when they failed to meet the hearing criteria described previously, either because they had failed the hearing screening at an earlier appointment and were at or near the 38-month cut-off ($n = 6$), or because their parents were unwilling to reschedule them ($n = 7$). To ensure that the results were not affected by inclusion of data from these subjects, all analyses were repeated separately on only the 227 children who had passed the hearing screening. Statistical conclusions were identical to those for the entire sample.

Discussion

The present investigation showed significant linear trends in mean scores with increasing maternal educational level on four measures of spontaneous language production, MLUm, NDW, and TNW, as well as on a norm-referenced vocabulary test (PPVT–R). The linear trend for PCC was not significant. After adjusting for ethnicity, which was confounded with maternal educational level in this sample as in the U.S. population generally, linear trends remained significant for all variables but TNW. Pairwise group mean comparisons conducted following significant linear trends showed significant differences favoring children whose mothers were college graduates over children from both other groups for MLUm, NDW, and PPVT–R. For PPVT–R only, there was also a significant difference favoring children whose mothers were high school graduates over children whose mothers had not graduated from high school.

The magnitude of these differences according to maternal educational level can be gauged by comparing the performance of this sociodemographically diverse sample of 3-year-old children with existing developmental data on these conversational measures.

Direct comparisons are not possible for NDW because a substantial number (15%) of participants in the present study produced fewer than the 100 complete and intelligible utterances to which previous reports on this measure have been indexed (Leadholm & Miller, 1992; Watkins et al., 1995). However, comparisons can be drawn for MLUm and PCC.

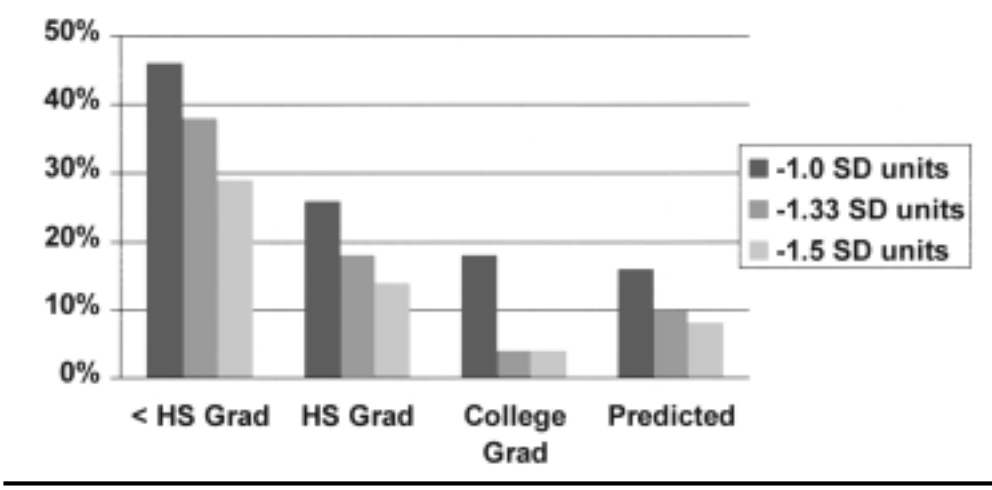
With respect to MLUm, Miller and Chapman (1981) reported a mean of 3.16 (*SD* = .69) for their sample of 36-month-olds from middle- to upper-middle-class families. The corresponding values in the present study were 2.73 (*SD* = .75) for children whose mothers had not graduated from high school, 2.97 (*SD* = .75) for children whose mothers had graduated from high school, and 3.29 (*SD* = .72) for children whose mothers had graduated from college. These data appear to validate Miller and Chapman's caveat concerning the possibility that MLUms in the general population might be lower than those observed in their sample.

The potential impact of these maternal educational group differences in MLUm can be assessed by considering the percentage of children in each group whose MLUm would be identified as significantly below age expectations in comparison with the MLUm data presented by Miller and Chapman (1981) for their sample. Assuming a normal distribution, approximately 16% of MLUms will fall 1 or more standard deviations below the mean, approximately 10% will fall 1.33 or more standard deviations below the mean, and approximately 8% will fall 1.5 or more standard deviations below the mean. As shown in Figure 1, only in children of college graduates were these predicted percentages approximated; in both groups whose mothers were not college graduates, the percentage of children with MLUms defined as significantly below average by any of these three criteria was much higher than would be expected based on the Miller and Chapman data. For example, nearly one third (29%) of children whose mothers were not high school graduates had MLUms 1.5 or more standard deviations below the mean, as did 16% of children of mothers who had graduated from high school but not college.

Based on their reference data base derived from children at several sites around the United States and, with few exceptions, consisting of middle-class children speaking General American dialect, Shriberg et al. (1997) reported a mean PCC of 80, with a standard deviation of 7, for 3-year-old children with normal speech acquisition. The mean PCC for the present study sample as a whole is well within this standard, with the mean PCC of 80 (*SD* = 8) for children of high school graduates identical to the mean reported by Shriberg et al., the mean of 81 (*SD* = 8) for children of college graduates slightly higher, and the mean of 78 (*SD* = 8) for children of mothers who had not graduated from high school slightly lower.

These findings indicate that measures of spontaneous speech and language derived from conversation during play should not be assumed to be free of the sociodemographic biases found on traditional norm-referenced tests of intelligence and language. Using either MLUm or NDW values derived from children of well-educated parents as normative will systematically identify a disproportionate number of children of less educated parents as "below average," in much the same way that use of norm-referenced tests results in higher rates of specific language impairment (Tomblin et al., 1997) and learning disabilities (e.g., McLeskey, Waldron, & Wornhoff, 1990) in minority children.

Figure 1. Percentage of children at each maternal educational level with mean length of utterance in morphemes (MLUm) placing them 1.0, 1.33, and 1.5 *SD* below the mean, respectively, in relation to predictions from data for middle- to upper-middle-class 36-month-olds reported by Miller and Chapman (1981).



The fact that both norm-referenced and conversational language measures vary across sociodemographic groups complicates efforts to specify the prevalence of language impairment (e.g., Tomblin et al., 1997), to define the pathognomonic features of the disorder (e.g., Leonard, 1998; Rice, Wexler, & Cleave, 1995), and to evaluate its heritability (e.g., Tomblin & Buckwalter, 1998). For example, Tomblin et al. (1997) reported that specific language impairment occurred at higher than expected rates in minority children, a finding that these investigators attributed to the cultural biases of the standardized measures employed. However, such an interpretation may be premature in the absence of a better understanding of the various pathways by which particular sociodemographic variables might influence children's performance on particular language measures. Some sociodemographic variables, such as socioeconomic status and ethnicity, have been associated with quantitative, qualitative, or stylistic differences in child-directed language. In these cases, it is reasonable to hypothesize that the lower performance of minority children on norm-referenced language measures might reflect at least partially these children's differing experiences with language, rather than fundamental deficits in the psycholinguistic operations required for language processing and acquisition (Campbell et al., 1997; Fazio et al., 1996). Sociodemographic variables such as poverty, on the other hand, might be linked to lower test performance because of physiological or neurological deficits resulting from conditions linked to poverty, such as inadequate nutrition and increased exposure to environmental lead (Campbell, Needleman, Riess, & Tobin, 1999; Duncan, Brooks-Gunn, & Klebanov, 1994; Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). Finally, some language variables may be less affected by sociodemographic variables; Rice, Wexler, and Hershberger (1998) recently reported that maternal educational level does not predict rate of growth in acquisition of the grammatical forms by which tense is marked in English.

We have emphasized that it is impossible to pinpoint the reasons for the effects of maternal educational level that were observed in the present study, and understanding the relationships among particular sociodemographic variables and particular measures of early language performance is an important area for future research. However, this endeavor will require large samples of subjects described in great detail, with careful attention to the issue of individual variability within groups defined according to sociodemographic factors.

Finally, the present results raise the question whether language intervention is warranted when less privileged children score lower than more privileged children on measures known to vary by sociodemographic group. According to one argument, language intervention for such children is necessary because their access to educational opportunities will be limited if they are unable to perform as well as more privileged children on language-dependent measures and tasks. The importance of vocabulary knowledge to a host of norm-referenced tests, as well as to reading skill, makes it particularly reasonable to propose efforts aimed at increasing the number of words that less privileged children know and use.

However, little evidence exists concerning the amount or kind of intervention needed to enable children from less privileged groups to perform on language-dependent measures at levels comparable to those of more privileged children. Based on their analysis of the enormous quantitative differences in words heard by young children from high- and low-income families, Hart and Risley (1995) calculated that 41 hours of high-quality intervention per week would be required merely to expose low-income preschoolers to the same number of words as their high-income peers, apart from attempting to compensate for past disparities in exposure. They argued that interventions to equalize the language experience of low-income and high-income children are of critical importance, but they emphasized that the likely cost and intensity of meaningful interventions should not be underestimated (cf. Campbell & Ramey, 1994).

An alternative perspective on the question of responding to the overidentification of children from minority groups is summarized by Garcia Coll et al. (1996). According to their view, the maternal educational level differences found in the present study directly illustrate the problems with defining "normal" development based on a narrow sociodemographic profile, including the insidious, more or less tacit assumption that children from less privileged sociodemographic groups are at risk for developmental deficits. As these investigators note, research on the development of minority children has been dominated by deprivation models that define the performance of White middle-class children as the desired standard and interpret minority children's differences from this standard as evidence of genetic or environmental deficiencies. They argue for alternative models of cultural diversity or difference, and for new measures of developmental competence not tied to a single sociodemographic context, so as to reduce the disproportionate identification of minority children as developmentally deficient or deviant.

Can these two perspectives on intervention for minority children be reconciled? We concur with Garcia Coll et al. (1996) that measures of language unaffected by sociodemographic variation are needed to ensure that children from minority groups are not labeled inaccurately as "language disordered," "language impaired," or even "language delayed." At the same time, we acknowledge the urgent need to reduce the disparities of language

experience among children of different backgrounds, in order, among other reasons, to forestall inequities in their access to opportunities and resources. Reducing these disparities in ways that emphasize not the so-called "deficits" of minority children, but rather the competencies of these children and their families, would seem to require of both clinicians and researchers the dramatic shift in orientation urged by Garcia Coll et al.

In summary, the results of the present study point to a critical need to examine the influence of maternal education and other sociodemographic variables on all measures of child language, including both traditional norm-referenced tests and measures of spontaneous language production and comprehension, as a prerequisite to using such measures to compare children or to identify children with language disorders. Further, these results provide support for efforts to identify measures of language impairment for preschool children that are free of sociodemographic bias.

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Language input and child syntax☆

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Abstract

Existing work on the acquisition of syntax has been concerned mainly with the early stages of syntactic development. In the present study we examine later syntactic development in children. Also, existing work has focused on commonalities in the emergence of syntax. Here we explore individual differences among children and their relation to variations in language input. In Study 1 we find substantial individual differences in children's mastery of multiclause sentences and a significant relation between those differences and the proportion of multiclause sentences in parent speech. We also find individual differences in the number of noun phrases in children's utterances and a significant relation between those differences and the number of noun phrases in parent speech. In Study 2 we find greater syntactic growth over a year of preschool in classes where teachers' speech is more syntactically complex. The implications of our findings for the understanding of the sources of syntactic development are discussed.

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1. Introduction

In the present article we report two studies concerning the role of language input in the acquisition of certain aspects of syntax. In recent decades there has been extensive work on syntactic development. While it is widely recognized that the acquisition of syntax depends on innately available structures in the child, it is also acknowledged that the child must receive input in the language he or she is acquiring. Here we investigate the role of input by examining the extent of individual differences in children's syntactic skills (both production and comprehension) and the relation of those skills to variations in input. Further, we explore how that relation is to be explained.

Existing work on the acquisition of syntax has focused primarily on the striking commonalities found across children (cf. Brown, 1973; De Villiers & De Villiers, 1978). Normal children progress through a predictable sequence of stages and master the basic syntactic relations of simple sentences at a relatively early age. Despite the commonalities, however, there is evidence of individual differences in syntactic growth among children. Most of this work concerns the early stages of syntactic development where variations have been found in the rate and course of acquisition (e.g., Fenson et al., 1994; Miller & Chapman, 1981). There are some data to suggest that, at later ages, children show individual differences for more complex aspects of syntax. The first goal of the present study is to examine systematically the extent of individual differences at later points of development.

There also is accumulating evidence that there are substantial variations in the language environments children encounter and that these variations may be correlated with differences in development. The data show a relation between language input and children's skills for some aspects of syntax, but not for other aspects (e.g., Barnes, Gutfreund, Satterly, & Wells, 1983; Furrow, Nelson, & Benedict, 1979; Gleitman, Newport, & Gleitman, 1984; Newport, Gleitman, & Gleitman, 1977). Since existing studies have involved children at early stages of language acquisition, it is not yet clear what syntactic skills are affected by input over the full course of development. It is possible that different aspects of syntax may show sensitivity to particular forms of input at different stages of language development. That is, skills that are found to be unrelated to language input early in development may be found to be related to input later in development. The second goal of the present study is to examine the relation between input and child language at later points in development.

Examining the relation between input and child language is just a first step toward understanding how input is involved in the acquisition process. After all, such a relation can be explained in more than one way. One explanation would be that incoming speech has a direct effect on child syntactic skill (e.g., Nelson, 1977). Alternatively, it is possible that the input the child

receives is itself affected by the child's ability level (e.g., Snow, 1989; Sokolov, 1993). With respect to the input from parents in relation to children's skill levels, genetic similarity within a family may be critical (e.g., Plomin, Fulker, Corley, & DeFries, 1997). It may be difficult to determine which factors are critical in particular cases because of the covariations that occur in natural environments. For example, better input in a family may be provided by higher ability parents.

In order to distinguish among alternative explanations, it is important to design studies in which potentially relevant factors can be assessed separately. Different research designs have been used by investigators who have focused on the role of input (e.g., Morrison, Smith, & Dow-Ehrensberger, 1995) or on the role of genetic factors (e.g., Dale, Dionne, Eley, & Plomin, 2000). The aim of these investigators is to examine the relation between input and child syntax under conditions where only one explanation of this relation seems plausible. The final goal of the present article is to assess whether input has an effect on children's syntactic skills using a design where the potential effect of other factors is minimized.

1.1. Individual differences among children

There have been extensive studies of children's early syntactic development (e.g., Bloom, 1970; Braine, 1976; Brown & Fraser, 1964; Brown & Hanlon, 1970). While this work has focused on commonalities among children, the data show substantial individual differences. In Brown's (1973) description of the early syntactic development of four children, he reported wide variability both in the age of emergence of the basic grammatical relations and in the mean length of children's utterances (MLU) at particular ages. MLU is a measure of children's syntactic development that is independent of the amount they talk. It is generally agreed to provide a valuable assessment method, although not after MLU 4. What is captured in MLU in the early stages of grammatical development is the acquisition of the basic grammatical relations and morphological markings found in simple sentences.

There are studies with large samples of children that provide convincing evidence that MLU varies widely across children. A study of 123 middle-class children ages 17–59 months reveals large standard deviations in the MLU's of children at particular ages (Miller & Chapman, 1981). Using a parent report procedure to assess language skill, Fenson et al. (1994) found extensive variability in the syntactic development of a sample of over 1800 children ages 8–30 months.

Work with older children shows that individual differences in syntactic skills persist. As we have noted, MLU does not provide as valuable a measure of skill level in later stages of syntactic development as at earlier stages (Scarborough, 1990; Scarborough, Rescorla, Tager-Flusberg, Fowler, &

Sudhalter, 1991). There have been reports of later differences based on other indices of syntactic skill. Variability among school-aged children has been reported in the use of expanded noun phrases and prepositional phrases (Scott, 1984) and in the extent to which individuals use complex structures such as dependent clauses in their sentences (Loban, 1976). Individual differences also have been found in the ability of 5- to 10-year-olds to understand coreference relations (Chomsky, 1969; Goodluck, 1981). In fact, individual differences in syntactic skills are found even in adults, as seen in variations in the ability to interpret noun phrases (Gleitman & Gleitman, 1970), to judge grammaticality (e.g., Ross, 1979), and so on.

1.2. The relation of children's syntactic skills to their language environments

As we have seen, there is reason to believe that there are substantial individual differences across the stages of syntactic development. In this section we examine what is known about the relation between such individual differences and variations in the input children receive. Consider the early stages of linguistic development when children acquire basic features of the syntax of their language. Empirical examination indicates that utterances addressed to young children generally include the basic grammatical relations and morphological markers and, indeed, that they are "unswervingly well formed" (Newport et al., 1977, p. 121). Even though the features of simple syntax appear in most utterances addressed to children, there are substantial variations in the numbers of utterances that different caregivers produce in fixed amounts of time (e.g., Bee, Van Egeren, Streissguth, Nyman, & Leckie, 1969; Farian & Haskins, 1980; Hart & Risley, 1992; Hess & Shipman, 1965). Such differences in frequency might be related to development. Indeed, in a study with children beginning in an early stage of syntactic skill (MLU 1.5), it was found that the amount of parent speech directed to children was strongly related to growth in their MLU (Barnes et al., 1983). In discussing findings on the relation of birth order to syntactic development, Hoff-Ginsberg (1997, 1998) attributes more rapid syntactic development of first borns in the early stages of word combination to the greater frequency of parent speech addressed to them.

In contrast to aspects of syntax that appear regularly in most utterances parents produce, there are other aspects of syntax that appear in only some subset of utterances. For the latter, variations in the makeup of parent speech have been shown to be related to children's syntactic development. For example, in a study of the acquisition of auxiliary verb forms, Newport et al. (1977) found that the proportion of auxiliary-fronted yes/no questions in parent speech was strongly and positively related to the development of these forms. This result was replicated in later studies (e.g., Furrow et al., 1979). Also, Hoff-Ginsberg (1985) found a positive relation between

mother's use of "wh-" questions (which contain auxiliaries) and children's auxiliary development. The positive relation of auxiliary-fronted questions to auxiliary growth has been corroborated in experimental studies (e.g., Nelson, Carskaddon, & Bonvillian, 1973; Shatz, Hoff-Ginsberg, & MacIver, 1989). The observed relation may indicate that placing auxiliary verbs in a salient position in a sentence aids in their mastery. On the other hand, the growth in children's use of auxiliaries was negatively related to the proportion of imperatives in parent speech. This negative relation may reflect the fact that auxiliaries are not used at all in positive imperatives.

It has been pointed out that, in many cases, reports of significant relations between parent speech and children's syntactic development have not been replicated in all studies. In fact, Scarborough and Wycoff (1986) and Valian (1999) have questioned whether existing data actually provide evidence of reliable relations between input and syntactic growth. However, there is more than one interpretation of the observed lack of consistency in input studies. Published reports generally involved small numbers of participants, so only very strong relations would be detectable. Further, different input studies may have involved children whose syntactic skills differ, and input effects may be specific to children's language levels.

Several researchers (e.g., Barnes et al., 1983; Furrow et al., 1979; Hoff-Ginsberg, 1985) have noted that the aspects of parent input that are related to syntactic growth may vary with the children's developmental level. For example, while the use of imperatives in parent speech generally is found to be negatively related to syntactic growth, and the use of questions to be positively related to growth, Barnes found the opposite. He attributes this difference to the stage of development of the children in his study. The children he studied were "at the stage at which the child still is just beginning to produce structured utterances" (Barnes et al., p. 76). If the child is just beginning to acquire lexical verbs, the occurrence of verbs in sentence initial position, as in imperatives, might be helpful while the fronting of auxiliaries might not yet be helpful.

It would seem that the aspects of child speech that show a relation to input would necessarily depend on the child's language level. In this context, consider an additional finding of Newport et al. (1977), namely that certain aspects of child speech are unrelated to any of the parent measures they used. They reported "noneffects" for number of noun phrases per utterance and number of verb phrases per utterance in children's speech. One possible explanation for the observed noneffects of input is that number of noun and verb phrases are "indices of the child's exploitation of universal aspects of language structure..." (Newport et al., p. 133) and are truly unrelated to variation in input. Alternatively, however, the reported noneffects may reflect the child's syntactic skill level during the age period studied. At the start of the Newport et al. study, children ranged in age from 12 to 27 months,

with about two-thirds of the group being under 24 months. The children were followed for 6 months. Across this age range, variation in the number of noun phrases and verb phrases in an utterance may be so small that a relation to parent speech would be hard to show. In a study with slightly older children who were between 24 and 30 months at the start of the study, Hoff-Ginsberg (1986) found a significant relation of input to children's use of noun phrases, but not verb phrases.

It is possible that a stronger relation of input to multiple noun phrases or verb phrases in child speech could be found when children are older and begin to use a higher proportion of prepositional phrases, multiple-clause sentences, and so on. The question of whether later syntactic development is related to input has not been systematically studied. Possibly this is because research on syntactic development has focused on the acquisition of the basic grammatical forms that appear early. Yet, the more complex syntax which appears later is a central aspect of language development. Consider, for example, multiclause sentences constructed from simple sentences via recursive devices in which one clause is embedded in or conjoined with another. Such structures provide linguistic tools that allow expression, within a single sentence, of complex thoughts concerning mental states, causal relations, and so on. Recursive devices have been described as a defining characteristic of human language (e.g. Chomsky, 1965). In principle, there is no limit to the complexity of the sentences that can be constructed via recursive devices, although there are constraints in practice and there may be individual differences in the use of these devices.

In addition to multiclause sentences, other aspects of syntax also can be examined to explore later syntactic development and its relation to input. For example, one can examine the number of noun phrases per utterance. While multiclause sentences emerge relatively late (e.g., Hoff-Ginsberg, 1997; Sheldon, 1974; Tavakolian, 1978), noun phrases are seen in children's syntax from the earliest stages of syntactic development. However, the average number of noun phrases per utterance continues to grow past these earliest stages; it increases with the number of clauses in a sentence, and also, in a single clause, with the number of arguments of a verb, as well as with the use of adverbial and prepositional phrases. As the number of noun phrases children use increases, the variability across children may also increase, making it easier to detect a relation to input if one exists.

In examining the relation of input to children's use of multiclause utterances and of utterances with increasing numbers of noun phrases, it should be noted that their use is generally viewed as reflecting advances in syntactic development. However, it is at least possible that variations in production could reflect stylistic differences rather than differences in syntactic knowledge. Hence, in addition to analyzing the relation between syntactic production and input, it is also important to examine comprehension of complex syntactic structures and its relation to input.

1.3. Evaluating the role of input in syntactic development

Above we discussed studies of the relation of language input by parents to child language skill; these were interpreted by the investigators as showing effects (or noneffects) of input. However, as we have noted, the source of correlations between parents and their children is typically ambiguous. To explore whether input is a critical factor, it is important to use designs that make it possible to establish whether variations in input can explain some of the variance in growth (these designs do not, generally, preclude the possibility that other factors also explain some of the variance in growth).

One way of exploring input effects is to examine individual differences among children associated with birth order. Since the genetics of parents does not vary with birth order, a genetic explanation of such individual differences is not plausible. Zajonc and his colleagues described the effects of birth order on intellectual development (e.g., Zajonc & Markus, 1975; Zajonc & Mullally, 1997). They found that, within a family of a particular size, the average level of children's intellectual performance varies with birth order such that older children show better performance than younger children. They suggest that, since older children receive most input from parents (as opposed to younger children who also receive input from their siblings), the input to these children may be more intellectually mature. Hoff-Ginsberg (1998) has explored birth order effects on syntactic development. She found that parents used longer utterances to first borns than to later borns and that the language development of the first born children was accelerated. However, since family size for first and later borns was not equated in her study, input is not definitively implicated.

Another way of exploring the role of input in children's skill levels is to examine input from outside the biological family, notably input at school. However, simply looking at growth in different school environments does not ensure that observed variations in input are causally related to differences in growth. Higher ability parents may send their children to better schools. Also, teachers might provide better input when the children in their classes are more highly skilled at the start. Hence a correlation between school input and child growth could indirectly reflect genetic factors.

Huttenlocher, Levine, and Vevea (1998) introduced a design that clearly implicates school input as a critical factor in growth in a set of domains, including syntax. The design involved a time period comparison in which growth in the same population of children was examined over equal length time periods that varied in input. Growth in kindergarten and first grade children was compared over the period of October–April, which includes most of the school year, to that over the period of April–October, which includes summer vacation. Huttenlocher et al. found substantially greater growth over the school year for a variety of skills, including both vocabulary and syntax. Since the same population is assessed at different time points,

input must be playing a critical role in syntactic growth. However, since the activities in the classroom were not directly assessed, we do not know whether it was *language* input at school that was relevant.

2. The studies

We present two studies of children's syntax in the period after the basic grammatical forms and morphology have been acquired. In both studies, we use large samples of children and draw our samples from a broad range of socioeconomic groups in order to accurately estimate the nature and extent of individual differences in children's syntactic skills and the relation of those differences to their language environments.

In Study 1 we investigate whether aspects of syntax found to be unrelated to variation in parent input at an early age may actually be related to input variation at a later time point. This is an important issue because it pertains to possible limits on the role of induction in the acquisition of syntax. The first part of the study (Study 1A) is a preliminary examination of existing production data from a group of 4-year-old children (Hall, Nagy, & Linn, 1984). To anticipate, the data show sizable individual differences in children's skill levels and a substantial relation of those differences to the complexity of parent speech, motivating us to do Study 1B with a new sample of 4-year-old children. In Study 1B we assess children's comprehension as well as their production of complex sentences and examine the relation of complexity for both measures to parent input. We also determine the relation of the number of noun phrases in parent utterances to the number in child utterances. The data again show a relation between children's skill levels and the complexity of parent speech.

In Study 2 we further explore the relation of children's mastery of complex syntax to input by examining teacher speech at preschools. Our purpose is to distinguish among alternative interpretations of the relation between children's language environments and the levels of skill they achieve. One possibility is that input is a critical factor in the growth of syntax. The other possibilities are that observed relations between input and child language are due to genetic factors or that input providers adjust the complexity of their speech to children's ability levels. To anticipate our results, the observed pattern of correlations in our school study is most consistent with the first interpretation, namely that input is critical to syntactic growth.

3. Study 1A: Preliminary study of parent input and childrens syntax

Our initial step in investigating the relation between children's use of complex sentences and parent input was to examine an existing language corpus obtained by Hall et al. (1984), available in the CHILDES database

(MacWhinney, 1991). Hall et al. gathered a large sample of speech from 4-year-olds and their parents. The authors used the data to examine vocabulary; we have used the data for an initial study of grammatical complexity in children and its relation to parent speech. Although the sample was obtained in the 1970s, it meets important requirements for our study. The children were 4 years of age, by which time complex sentences are used to some extent by all children. The sample included families from different ethnic and socioeconomic groups so that there may be considerable variability in the input. Finally, the child's speech was sampled both at home and at school, making it possible to determine if the use of complex sentences by a child is relatively constant across situations.

For children, our measure is the proportion of multiclause sentences in their speech. This is a measure of their syntactic competence; it indicates the extent to which children express relations captured by complex syntax, independent of the amount of speech they produce. For parents, we use two measures—the overall number of multiclause sentences (frequency) and the proportion of such sentences. Both kinds of measures have been used in previous research on parent input. It would seem that the importance of frequency vs proportional measures may vary with the aspect of input under study. As noted above, for aspects of language that occur regularly in parent utterances, the overall number of utterances in a fixed time period (i.e., frequency) may be strongly related to mastery. However, for aspects of language that occur only in some subset of utterances, such as multiclause sentences, proportional measures may be most important since they indicate how typically certain forms are used in describing particular kinds of situations.

3.1. Method

3.1.1. Participants

Descriptions of the sample (as well as of materials and procedure) appear in Hall et al. (1984). Participants included 34 children ages 54–60 months and one of their parents. Hall et al. divided families into four groups. For the families whose data are examined here, 15 were Caucasian and 19 were African American, approximately equally divided between lower and middle SES. SES was determined by income level and educational indices scales (Warner, Meeker, & Eells, 1949). Lower SES children attended federally funded preschools and middle-SES children attended private preschools. The procedures used in obtaining the sample of families are not described. In all groups, males outnumbered females (overall, 23–11).

3.1.2. Data collection procedure

Children wore vests with microphones that recorded everything they said and heard in 10 different situations: prior to school in the morning, arriving

at school, snack time at school, free play at school, directed activity at school, arriving home from school, before dinner, at dinner time, before bed, and in transition (on the way to school). Each situation was recorded for approximately 15 min on 2 consecutive days for a total of about 5 h of audiotape per child. An observer was present in the home and at school for almost all of the data collection. For the Black families, the observer was Black and for the White families the observer was White. The audio tapes were transcribed and made available in printed form.[1]

3.1.3. Data analysis

We examined complete sentences marked as intelligible in the printed transcripts. We defined sentences as utterances that contained both a subject and a verb. In the case of the imperative, utterances with an understood second person subject were included. Sentences exhibiting copula deletion (e.g., "He tired") were included as complete sentences. This is an important point because the copula is optional in some cases in the African American English dialect.

For parents, all sentences in the transcripts directed to the target child were included, as indicated in the contextual notes of the original transcriptions from Hall et al. (1984). With one exception, the parent was the child's mother. In this one case, we included speech from the child's father because the child's mother appeared in no part of the transcript. Our analyses of child speech included all sentences produced in four situations at school (arriving at school, snack time, free play, and directed activity) and in five situations at home (before school, arriving home from school, before dinner, dinner time, and before bed). We excluded sentences that were exact repetitions of self or other, and sentences that were read directly from written material.

Each sentence was classified as either simple or complex. Simple sentences contained one clause (e.g., "John made a mistake" and "He gave the book to the girl"). Complex sentences contained more than one clause (e.g., "He thought John made a mistake" and "He gave the book to the girl who lived down the street"). For certain forms, categorization of sentences as simple or complex was not obvious. We included as simple sentences utterances with a single lexical verb even when modified by a modal auxiliary, marginal modal, or quasi modal (see Table 1). The tag in a tag question (e.g., "You went to the store, *didn't you*?") was not counted as an additional predication.

We included as complex sentences utterances with infinitival forms of an additional verb (e.g., "I like to play" and "Want to go home?"). Sentences

[1] The corpus of data collected by Hall et al. (1984) is currently available in a digitized audio format, although it was not available in this format when our project began.

Table 1
Auxiliary verbs

Modals	Marginal modals	Quasi modals
can	used to + V[a]	going to + V
could	ought to + V	gonna + V
will	has/have to + V	go + V
would	had better + V	wanna + V
may	would rather + V	got to + V
might	might/could + V	let's + V
shall	may/can + V	supposed to + V
should	need to + V	to come + V
must		to be able to + V

[a] V = Verb.

with verbs like "let" followed by a pronoun with another predication (e.g., "Let them do it") and gerund verb forms (e.g., "Stop hitting me" and "Start picking up your toys") were also included in the complex sentence category. Coordinated clauses with a single subject were treated as complex if they contained more than one verb phrase as in "He read the book and watched TV." Sentences with a conjoined subject or object were not treated as complex (e.g., "Sam and Harry watched TV" and "He ate mashed potatoes and chicken").

After coding each sentence as either simple or complex, we applied our measures to parent and child utterances. For children, we calculated the proportion of complex sentences by dividing the number of complex sentences they produced by the total number of complete sentences. One computation of children's syntactic complexity was made across the five home settings and another computation was made across the four school settings. For parents, we performed the same computation to determine the proportion of complex sentences. In addition, we calculated the total number of multiclause sentences produced by parents in the entire period of observation (which was a constant time period across parents).

3.2. Results

3.2.1. Child speech: Demographic factors

The use of multiclause sentences varied in the four different demographic groups both at home and at school. Table 2 shows the average percentages and standard deviations in these groups. The examination of individual data revealed that all children used at least some complex sentences. However, there was considerable variability across children in the percentage of multiclause sentences produced (range at home was from 7 to 29% and range at school was from 4 to 35%).

An arcsin transformation was carried out on the proportional data for the purpose of statistical analyses. For the child at home, a two-way ANO-

Table 2
Percent of complex sentences by children (Study 1A)

	Lower SES		Middle SES	
	Mean	*SD*	Mean	*SD*
(A) Children at home				
Race				
African American	14.56	4.20	19.76	3.91
White	16.35	4.32	22.34	5.59
(B) Children at school				
Race				
African American	12.96	3.53	16.96	2.22
White	14.05	5.04	23.46	8.30

VA with proportion of multiclause sentences as a dependent variable and SES and race as independent variables revealed a significant main effect for SES, $F(1,32) = 12.13$, $p < .01$, but neither the main effect of race, $F(1,32) = 1.72$, $p = .1998$, nor the interaction of SES by race, $F(1,31) = .02$, $p = .9020$, was significant. For the child at school, we also performed a two-way ANOVA with SES and race as independent variables. Again the ANOVA was significant for SES, $F(1,32) = 15.38$, $p < .001$, but neither race, $F(1,32) = 2.78$, $p = .1057$, nor the SES by race interaction, $F(1,30) = 1.28$, $p = .2661$, was significant.

3.2.2. Parent speech: Demographic factors

Parent speech also varied with demographic factors (see Table 3). We conducted a two-way ANOVA with the proportion of multiclause sentences in parent speech as the dependent variable and with SES and race as independent variables. This ANOVA revealed significant main effects for SES, $F(1,32) = 14.28$, $p < .001$, and race, $F(1,32) = 6.36$, $p < .05$. The SES by race interaction was not significant, $F(1,31) = .35$, $p = .5576$. We also conducted a two-way ANOVA with the frequency of multiclause sentences in parent speech as the dependent variable and with SES and race as independent variables. The ANOVA revealed significant main effects of SES, $F(1,32) = 6.09$, $p < .05$, and race, $F(1,32) = 7.63$, $p < .01$. The SES by race interaction was not significant, $F(1,31) = 2.06$, $p = .162$. Our findings are

Table 3
Percent of complex sentences by parents (Study 1A)

	Lower SES		Middle SES	
	Mean	*SD*	Mean	*SD*
Race				
African American	20.07	5.69	27.34	2.97
White	25.20	4.43	30.90	5.70

consistent with those of earlier studies showing frequency differences in different demographic groups.

3.2.3. Predictors of complexity in children's sentences

We carried out a multiple-regression analysis to determine the independent contributions of the proportion of complex sentences and the frequency of complex sentences in parent speech as well as of SES. First consider the relation of these predictors to child speech at home. The analysis showed that the proportion of multiclause sentences in parent speech was by far the best predictor of such sentences in child speech, accounting for 38.88% of the variance, $F(1, 32) = 20.36$, $p < .0001$. After the proportion of multiclause sentences by parents was accounted for, SES accounted for an additional 5.23% of the variance in children's speech, which is only marginally significant, $F(1, 32) = 2.90$, $p < .10$. The contribution of frequency of complex sentences by parents was negligible ($p > .50$).

We examined the relation between the best predictor identified in the analysis above, the proportion of multiclause sentences in parent speech, and the proportion of multiclause sentences in child speech at home. As shown in Fig. 1, a high correlation was obtained ($r = .6252$, $p < .0001$).

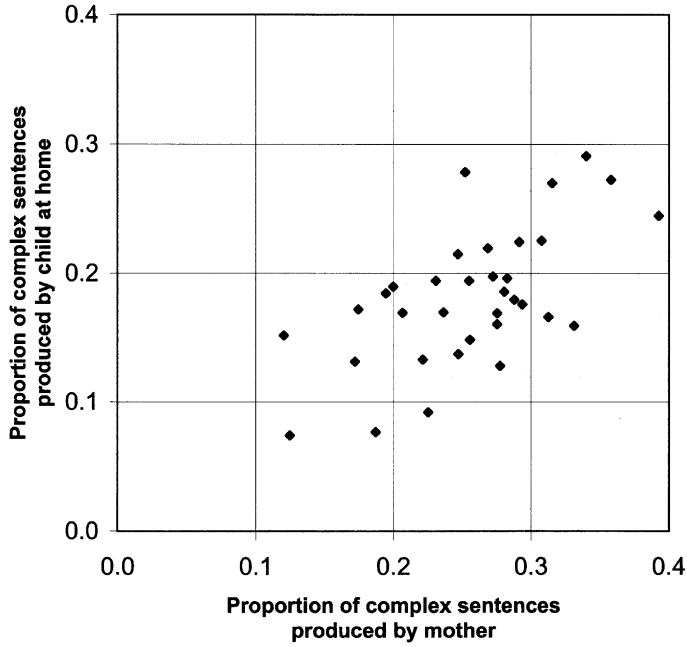

Fig. 1. The relation of the proportion of complex sentences in parent speech to the proportion of complex sentences in child speech at home, Study 1A.

Next consider the relation of the predictors to child speech at school. Multiple-regression analysis showed that the proportion of multiclause sentences by parents again was the best predictor of the proportion of such sentences by the child, accounting for 35.42% of the variance, $F(1, 32) = 17.55$, $p < .001$. After parent speech was accounted for, SES accounted for an additional 7.47% of the variance in child speech at school, which again is only marginally significant, $F(1, 32) = 4.05$, $p < .10$. Frequency of complex sentences in parent speech was not a significant factor, $F(1, 32) = 1.84$, $p = .1852$. As in the analysis of child speech at home, we examined the relation between the proportion of complex sentences in parent speech and the proportion of complex sentences in child speech at school. Again, the correlation was high ($r = .5933$, $p < .001$), as shown in Fig. 2.

The analysis of child speech at home and at school revealed a parallel pattern with respect to the three predictors we considered. Note that the correlations between the proportion of complex sentence in parent speech and the proportion of complex sentences in child speech are highly similar at home and at school. Hence the correlation of parent and child speech observed at home does not reflect the fact that the parents and their children were engaged in shared activities and conversational topics.

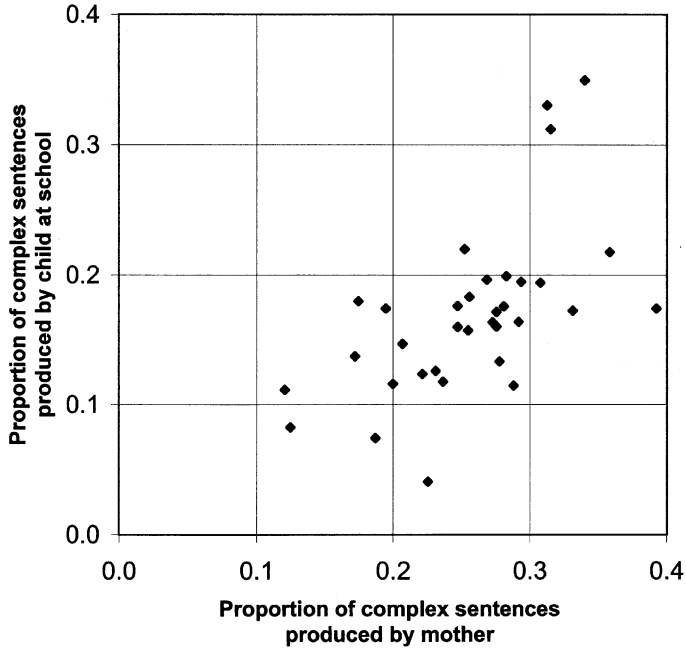

Fig. 2. The relation of the proportion of complex sentences in parent speech to the proportion of complex sentences in child speech at school, Study 1A.

3.3. Discussion

We used an existing data base for a preliminary examination of individual differences in the proportion of multiclause sentences in the spontaneous speech of a group of 4-year-old children. We found sizable differences among children. A multiple-regression analysis revealed that the proportion of multiclause sentences in parent input was the major predictor of complexity in children's speech. Further, this analysis showed that frequency of parent speech was not a significant predictor of child complexity, and SES was only marginally significant. The marginally significant relation to SES could reflect aspects of parents' use of language not captured directly in their speech, such as how language is used in relation to nonlanguage context and use of gesture. The same predictors of complexity in child speech were found at school and at home, indicating that the observed relation to parent input at home was not due to the shared settings or common conversational topics.

4. Study 1B: Parent input and childrens syntax

Given the striking relation between the proportion of multiclause sentences in child speech and in the speech of their parents, we carried out a new study. One goal of the study was to establish the robustness of the findings of Study 1A that were based on data gathered more than 20 years ago. We wanted to determine whether significant findings would be found in a current sample. In doing so, we collected our own tapes of parent–child interaction and created transcripts from sound track rather than using existing transcripts. The transcripts of Hall et al. (1984) used in Study 1A were originally made with the purpose of examining children's vocabulary. Hence it was not critical for the investigators to specifically attend to syntax in transcribing speech. Since our focus is on complex syntax, decisions such as whether an utterance is a multiclause sentence or two separate sentences are critical. In making these decisions, information from the speech signal, including pauses, intonation, and so on can provide important cues. Thus, it seemed important to make sure that a significant relation would appear in a sample where analyses were based on listening to taped speech.

Another goal of the study was to establish with greater certainty than in Study 1A whether it is mastery of multiclause sentences that is related to input. Even though we obtained similar results for production at home and at school in Study lA, it still seemed possible that observed differences in the production of multiclause sentences could reflect variations in the speaking styles of different families. In this interpretation, children who vary in production of such sentences would not differ in their comprehension. If there is a substantial correlation between children's comprehension and their pro-

duction, it would provide strong evidence that production indexes children's underlying language skills, not their styles of speaking. This interpretation would be further supported if comprehension varies with parent speech in a way that parallels the relation found in production. Thus, in the present study we assess comprehension as well as production of multiclause sentences.

A final goal of the study was to further examine the relation between parent syntax and child speech using a different measure of syntactic complexity—the number of noun phrases per utterance. Recall that Newport et al. found no relation of parent speech to number of noun or verb phrases in children's utterances. We noted above that a potential explanation for these negative findings is that the sentences the children used were still very simple and that a relation between children and parents for these measures might be found at later stages of language development. Indeed, Study 1A showed a strong relation between parent and child use of multiclause sentences (a measure parallel to the number of verb phrases per utterance) in older children. Hence we decided to examine the number of noun phrases children used per utterance to investigate whether, at a later stage of syntactic development, this measure may be related to parent speech.

A few additional points should be made in comparing Studies 1A and 1B. We divided our sample into two SES groups as did Hall et al. However, our sample was drawn in Chicago more than 20 years later. It is possible that corresponding SES groups in the two studies are somewhat different. It also should be noted that in the present study child speech data was obtained only at home. The reason is that in Study 1A the proportion of complex sentences in child speech was very similar at home and in school, and the relation to parent speech also was similar in the two situations. Finally, we did additional syntactic analyses in Study 1B. We examined different types of multiclause sentences separately.

4.1. Method

4.1.1. Participants

We studied 48 mother–child pairs. Children varied in age between 47 and 59 months, with the mean age of 54 months. Half the children were from middle SES families and half were from lower SES families. The families were drawn from the different ethnic groups in the greater Chicago area. In obtaining our sample of families we first gathered information about the socioeconomic makeup of different neighborhoods and used this information to prepare a list of preschools from neighborhoods where families from particular SES groups heavily predominated. We obtained permission from a set of schools to approach parents as they picked up their children at the end of the day. We talked to the parents and gave them written information about the study. In addition to the neighborhood criterion, we also set

an educational criterion for SES assignment. We divided educational backgrounds into five levels: 1 = some high school, 2 = high school graduate, 3 = some post high school training, 4 = college graduate, and 5 = some graduate school. For lower SES families, all mothers were from levels 1–3 and for middle SES families all mothers were from levels 4 and 5. Families were paid $50 for participating in the study.

4.1.2. Gathering and analysis of language data

Children were visited in their homes. The child was videotaped during his or her ordinary activities for 2 h. In our lab, a transcriber made a complete record of the speech of the child and the caregiver. Transcription involved breaking the stream of speech into distinct utterances, which was done relying in part on intonation and pauses. Reliability of transcripts was checked by a second transcriber who independently transcribed 100 child utterances and 100 parent utterances from each transcript. Cases of disagreement that would affect grammatical analysis were rare; they were resolved by having the two transcribers reexamine the tape. Each distinct utterance was then placed on a separate line in preparation for grammatical analysis. A third person did the grammatical analysis as described below.

Analysis of production data was similar to that in Study 1A. However, a few differences must be noted. First, while Study 1A included only utterances addressed to the child, Study 1B included all caregiver utterances regardless of who was being addressed. We did this because it was clear from the videotapes that children sometimes reacted to comments and questions that were directed to others, showing that such speech constituted input to them. In fact, it was sometimes difficult to determine who the caregivers were addressing. Although children at the earliest stages of language acquisition may process only speech that is directed to them, at some age they clearly process incoming speech that is not specifically addressed to them. This seems to be the case by 4–5 years.

Second, rather than coding only complete sentences, as in Study 1A, we coded all intelligible utterances. This allowed us to determine the proportion of multiclause sentences relative to the total number of utterances as well as to the total number of sentences. We wanted to determine how these two measures are related. In analyzing types of sentences, four utterance codes were used: 0 for nonpredicative utterances (e.g., "yes" or "no" or an object name, usually in response to another speaker), F for formulaic speech (e.g., "What's up?"), S for simple sentences, and C for multiclause sentences. Multiclause sentences were divided into three types: those involving coordinate clauses, complement clauses, and relative clauses. False starts where, midway through an utterance, the speaker changes to another sentence entirely or stumbles and repeats the sentence from the beginning, were not counted.

Third, we revised the criteria for multiclause sentences. In Study 1A, sentences with "want to" and "let us" were treated as complex, whereas "wan-

na'' and ''let's'' were treated as simple. However, in Study 1B these were all treated as simple. The reason was that it was not clear from the tapes in all cases whether the full two words were being said. Since these forms are fairly frequent in speech of parents and children, the estimates of the proportion of complex sentences may be lower in Study 1B than in Study 1A. This might result in a lower correlation between input and child syntax if it leads to compression of the proportional variation across individuals. We do not regard this as a problem, since our purpose in Study 1B is to establish the robustness of the correlation for multiclause sentences observed in Study 1A.

Fourth, we used an additional measure of syntactic complexity, the mean number of noun phrases per utterance. All simple and complex sentences produced by parents and children were used in determining the number of noun phrases in each utterance. Our coding procedure involved identifying noun phrases as described below (in the examples each noun phrase is bracketed). We counted phrases that included regular nouns (''[Dogs] can scare [little kids]'') as well as pronouns (''[I] like [him]''). Other parts of speech (e.g., adjectives) were counted as forming a noun phrase when they did not modify a noun and served in place of a noun (''[The red] in [that painting] hurt [my eyes],'' ''[I] got [two],'' and ''[Some] are missing''). Possessive nouns were treated as distinct noun phrases (''[[The girl]'s mother] is tired''). Compound nouns were counted as a single noun phrase (''Let go of [the computer cord]''). Once all noun phrases were identified, we divided the total number of noun phrases by the total number of utterances in the transcript to arrive at our noun phrase measure.

4.1.3. Comprehension task

Our comprehension task involved picture selection. A sentence was read to the child and he or she chose from among a set of three pictures which one ''goes with'' that sentence. Fig. 3 shows some sample items. This comprehension task is quite different from the measure of spontaneous production of complex sentences. Hence one would not expect a perfect correlation between comprehension and production even if the same underlying syntactic skill is involved. Our purpose in constructing the task was to measure the extent to which children could successfully process multiclause sentences. That is, we sought a sensitive and reliable assessment of children's skill in processing multiclause sentences. In constructing the task, we examined the multiclause sentences used by parents in Study 1A and drew a sample of these sentences to develop a set of comprehension items.

4.2. Results

In determining the proportion of multiclause sentences in Study 1A, we used the number of such sentences as the numerator and the total number

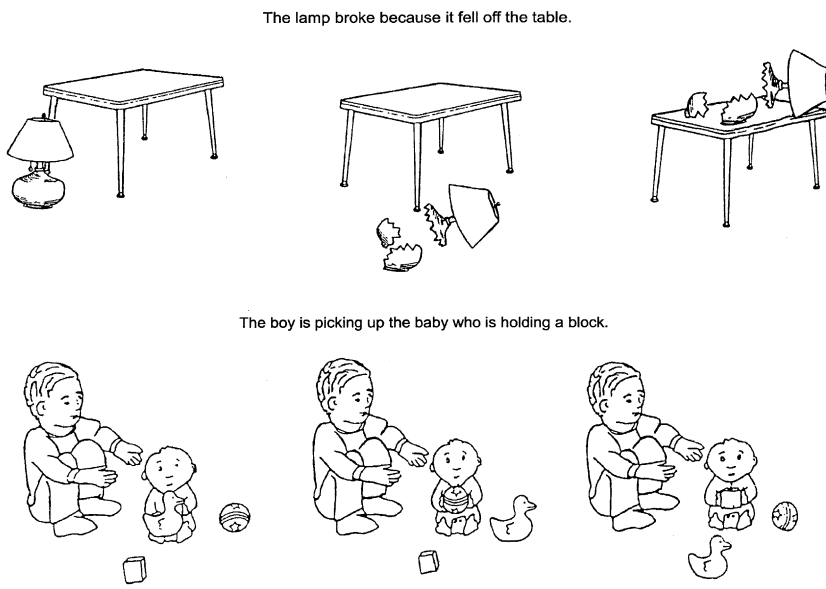

Fig. 3. Two sample items from the comprehension test, Study 1B.

of complete sentences as the denominator. It is possible instead to calculate the proportion relative to all utterances, including formulaic and nonpredicative utterances. For the present study, we wanted to make sure these two measures were comparable. The correlation between the proportion relative to complete sentences and relative to all utterances was .92. Hence, we continue to use the same measure as in Study 1A, proportion of multiclause sentences relative to complete sentences.

Consider the relation between the proportion of multiclause sentences children produce and their comprehension scores. The correlation was .64 ($p < .001$). Given that comprehension and production measures are so different, the high correlation suggests mediation by a common underlying syntactic skill. This interpretation is bolstered by the fact that, as is shown below, comprehension and production measures were related in a similar way to parent speech and demographic factors.

4.2.1. Production of complex sentences: Relation to SES

The average percentages and standard deviations for production of multiclause sentences in children and parents are presented in Table 4 (rows 1 and 2 respectively) separately for each SES group. The analysis of individual data revealed that all children produced at least some multiclause sentences. The mean proportion of such sentences across SES groups was 13% and the range was from 5 to 29% To examine the relation of SES, we performed a two-tailed t test; the relation was not significant, $t(46) = .41$, $p = .68$.

Table 4
Production and comprehension of complex sentences (Study 1B)

	Lower SES		Middle SES	
	Mean	*SD*	Mean	*SD*
Percent produced by children	12.74	5.78	13.25	4.56
Percent produced by parents	19.20	5.38	21.00	5.09
Percent comprehended by children	50.00	14.20	60.31	15.38

For parent speech the mean proportion of multiclause sentences was 20% and the range was from 10 to 30%. To examine if SES was related to the complexity of parent speech, we first conducted a t test with SES as the independent variable and the proportion of complex sentences in parent speech as the dependent variable. There was no significant effect for SES, $t(46) = 1.18$, $p = .24$. Next, we conducted a t test with SES as the independent variable and the frequency of complex sentences in parent speech as the dependent variable. Again, there was no significant effect for SES, $t(46) = 1.45$, $p = .16$.

4.2.2. Predictors of complexity in children's sentences

As in Study 1A, we carried out a multiple-regression analysis to determine how much of the variation in the proportion of children's complex sentences was accounted for by the independent variables investigated in this study. The analysis showed that the proportion of complex sentences by parents was the best predictor of the syntactic complexity of child speech, accounting for 14.08% of the variance, $F(1, 46) = 7.54$, $p < .01$. After the proportion of multiclause sentences by parents was accounted for, additional contributions of the frequency of complex sentences by parents and SES were negligible ($p > .50$).

The correlation between the proportion of multiclause sentences produced by parents and the proportion produced by children is significant, $r = .4111$, $p < .01$. Although this value is lower than the correlation at home in Study 1A, the difference between the correlations for the two studies is not statistically significant ($p > .10$). The relation of syntactic complexity in parent speech to that in children's speech is shown in Fig. 4.

4.2.3. Subcategorizing multiclause sentences

Having found a highly significant relation between input and children's skill levels for multiclause sentences treated together, we next considered whether breaking these sentences into subtypes might further clarify the relation to input. That is, we examined if parents vary in the relative frequencies of different types of multiclause sentences they produced and if those differences are reflected in production differences in their children. We divided the sentences according to whether they involved coordinate clauses,

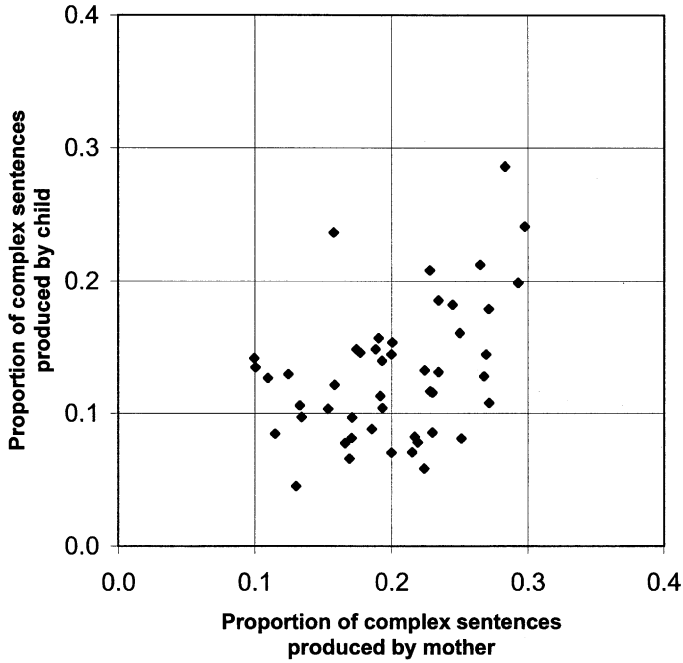

Fig. 4. The relation of the proportion of complex sentences in parent speech to the proportion of complex sentences in child speech, Study 1B.

relative clauses, or complement clauses (complement clauses were mostly object complements; subject complements were very rare). We found that relative frequencies for these different types of sentences were highly similar across all parents. For 44 of 48 parents, the relative frequency of complements was greater than the relative frequency of coordinate clauses, and that of coordinates was greater than that of relative clauses. Complement clauses accounted for 68% of all complex utterances ($SD = 11\%$), coordinate clauses accounted for 30% ($SD = 11\%$), and relative clauses for 2% ($SD = 2\%$). Table 5 shows that the pattern did not vary across SES groups.

The same relative frequencies of different sentence types as found for parents were also found for children. That is, for children, complements accounted for 68% ($SD = 12\%$) of the complex utterances, coordinate clauses accounted for 30% ($SD = 11\%$), and relative clauses accounted for 2% ($SD = 2\%$). Again, Table 5 shows that the pattern is the same across SES groups. Since there were virtually no individual differences in the pattern of relative frequencies for the three types of multiclause sentences, there is no possibility of determining if differences among parents would be related to the level of children's mastery of these different types of the sentences.

Table 5
Percent of different kinds of complex sentences by parents and children in different demographic groups (Study 1B)

	Coordinate	Complement	Relative
Parent speech			
Low SES	33	65	2
Middle SES	28	70	2
Child speech			
Low SES	31	67	2
Middle SES	29	68	3

4.2.4. Comprehension of complex sentences: Relation to SES

Parallel to the finding that children show large variation in the production of multiclause sentences, there also was large variation across children in the comprehension of these sentences (see Table 4, row 3). The range of comprehension scores was from 16 to 90%. Note that if children selected pictures at chance, they would get 33% right. Considering the distribution of scores, one can establish a confidence interval around the chance level. It is possible to say with 95% certainty that a child who got 44% of the items right was not simply choosing randomly. Of the 48 participants, 37 received scores of 44% or above. For the 11 children whose scores were below 44% it is not clear that they could reliably understand multiclause sentences, at least in the context of picture selection tasks. The majority of children (73%) who performed around chance level were from the lower SES group. A two-tailed t test showed that there was a significant difference in comprehension scores between the low SES and middle SES groups, $t(46) = 2.42$, $p < .05$.

4.2.5. Predictors of children's comprehension of complex sentences

A multiple-regression analysis shows that the proportion of complex sentences in parent speech, the frequency of such sentences and SES together account for 21.43% of child comprehension. Multiple-regression analysis using the selection forward procedure reveals that the proportion of complexity in parent speech is the best predictor of children's comprehension of syntactically complex utterances accounting for 13.82% of the variance, $F(1, 46) = 7.37$, $p < .01$. The relation of parent speech to child comprehension is shown in Fig. 5 ($r = .3906$, $p < .01$).

SES accounts for 7.61% of the variance in the comprehension score, $F(1, 46) = 4.36$, $p = .0425$. After the contribution of these two factors is accounted for, the contribution of frequency of complex sentences by parents is negligible ($p > .50$). Note that, for the two factors that are related to children's comprehension, the role of SES as a predictor is less important than the role of the proportion of complex sentences in parent speech.

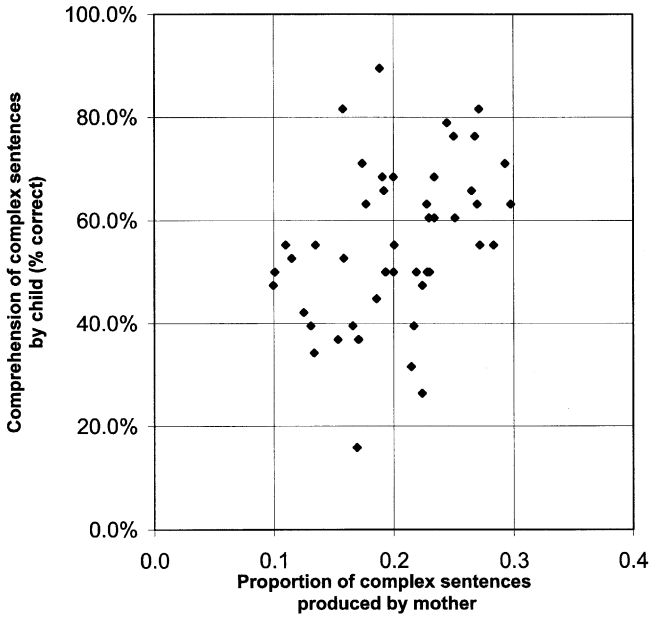

Fig. 5. The relation of the proportion of complex sentences in parent speech to comprehension scores, Study 1B.

4.2.6. Noun phrases in children's production and the relation to input

The mean number of noun phrases per utterance was highly related to our other measure of syntactic complexity, the proportion of multiclause sentences ($r = .68$, $p < .001$ in children; $r = .75$, $p < .001$ in parents). In children, the mean number of noun phrases per utterance varied from 1.14 to 2.11 ($M = 1.65$). To examine the relation of SES to the mean number of noun phrases in children's speech, we performed a two-tailed t test. There was no significant effect of SES, $t(46) = .46$, $p > .1$. In parents, the mean number of noun phrases per utterance varied from 1.20 to 2.22 ($M = 1.76$). To examine the relation of SES to the mean number of noun phrases in parents' speech, we again performed a two-tailed t test. There was no significant effect of SES, $t(46) = 1.53$, $p > .1$.

Finally, and most importantly, we examined the relation between the mean number of noun phrases per utterance in parents' speech to the mean number of noun phrases per utterance in children's speech. The relation is shown in Fig. 6; it is highly significant ($r = .55$, $p < .01$).

4.3. Discussion

Study 1B verified and extended the findings of the preliminary study with the Hall et al. data (Study 1A). We again found that there was substantial

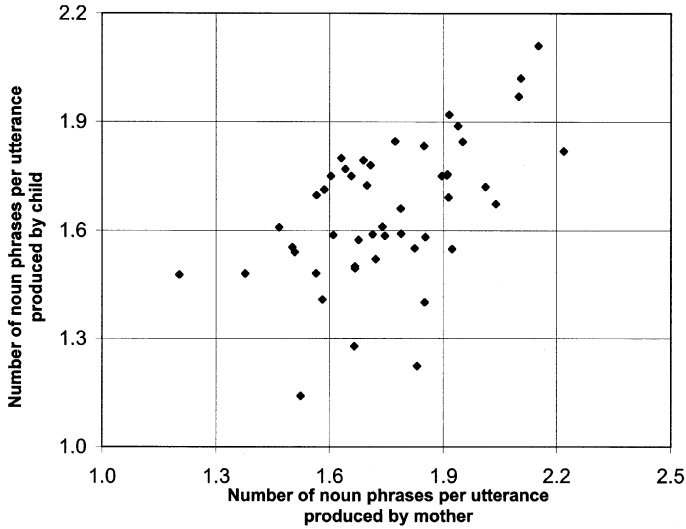

Fig. 6. The relation of the mean number of noun phrases per utterance in parent speech to the mean number of noun phrases per utterance in child speech, Study 1B.

variation in children's syntactic complexity. The proportion of complex sentences in parent input was the major predictor of the proportion of such sentences in children while frequency of complex sentences and SES were not significant predictors. The correlation between parent and child in Study 1B was lower than in Study 1A, but it was highly significant and not statistically different from the correlations in Study 1A.

A major extension in Study 1B was to obtain comprehension data. We found large variations in the comprehension of complex sentences by 4-year-olds. Children's comprehension of complex sentences was highly correlated to the proportion of such sentences in their speech. This finding indicates that production differences among children observed in Studies 1A and 1B are not simply differences in style of speaking. Children's comprehension of complex sentences, like their production of these sentences, was related to the proportion of complex sentences their parents produced. The similarity of the relation between parent input and all our child measures (production at home, production at school, and comprehension) further supports the view that parents' use of complex sentences is related to children's underlying mastery of these forms.

Finally, we examined children's production of noun phrases in relation to the same measure of parent speech. Using this measure we found a high correlation between parents and children. The number of noun phrases per utterance provides a valuable measure of syntactic complexity; it captures the "embellishment" of utterances beyond skeletal simple sentences arising not

only from multiple clauses, but also from prepositional and adverbial phrases.

Our results provide important information about syntactic development. They show a relation of child language to parent input for aspects of syntax that were unrelated to input at earlier stages, notably for multiclause sentences and the number of noun phrases per sentence. However, the finding of a relation between parent speech and children's acquisition does not definitively implicate differences in input as a source of differences in development. The possibility that observed correlations could reflect either genetic similarity or child ability effects on parents remains open.

5. Study 2: Is input a source of syntactic growth?

The purpose of Study 2 is to examine if differences in language input actually are a source of variation in children's syntactic skill levels. To explore this issue we investigate a case where input may play a critical role in an observed relation between speech to children and the children's skill levels, namely the case of teacher speech. There is neither a biological relation of the teacher to the children in her class, nor, at the start of a school year, is there a history of prior input from the teacher. This state of affairs potentially provides a basis for examining the effect of input by analyzing its relation to growth over the school year. However, a simple correlation is not sufficient to implicate input as a source of skill levels in children. To conclude that a relation between teacher language and child growth is an input effect, certain additional conditions must be met.

If teacher input during the school year is correlated with children's skill levels at the start of the year, the interpretation of the role of that input would be ambiguous. It might indicate that teacher input varies with children's ability levels. That is, higher ability families may send their children to schools with higher ability teachers, or teachers may provide better input to children with higher ability levels. On the other hand, if teacher input is not correlated with children's skill levels at the start of the school year but is correlated with the growth of skill, then it would strongly support the view that the input is a critical factor in growth.

At the start of the school year, children's skill levels may be related to their SES. Indeed, a correlation of child comprehension to SES was found in Study 1B. Such a relation might reflect variables having to do with children's families—genetic factors and/or prior input differences. Potentially, SES-related factors might also be responsible for differential growth over the school year. If SES has a stronger relation to child growth over the school year than teacher input, it would be unclear whether input itself plays any role in growth of language skills. However, if child growth is more

highly related to teacher input than to SES, it would indicate that this input is a critical factor.

Finally, note that a correlation between teacher speech and syntactic growth does not necessarily implicate teacher speech per se because teacher speech may be associated with other, more global, teacher characteristics. Further, such a correlation is not necessarily specific to syntactic growth but rather may be associated with more general aspects of cognitive growth. To aid in interpreting correlations if they occur, we use additional measures for teachers and for children. We use additional teacher measures to determine if syntactic growth is more highly associated with teacher syntax than with other teacher measures. We also use other child measures (namely mathematics growth) to determine if it is syntactic growth rather than general cognitive growth that is associated with teacher syntax.

In this study, syntactic input is assessed by recording and analyzing teacher speech on a typical day during the school year. Children's skills are evaluated by assessing children's syntactic comprehension at the beginning and end of the school year. The relation of the teacher's input to language growth in his or her class is evaluated by examining the average growth of that class over the school year (the period in which the teacher provides input to that class). That is, while the unit of analysis in studying parent input is the individual child, the unit of analysis for evaluating the effectiveness of teacher input is the class rather than an individual child.

5.1. Method

5.1.1. Participants

Our sample included 40 classrooms drawn from 17 different preschools in the Greater Chicago area. The schedules for preschools and day care centers are quite variable both in the Chicago area and nationally. About half of our schools were half-day programs and the other half were full-day programs. However, the full-day programs typically involved half-day preschool while the other half-day involved primarily noneducational activities (naps, meals, etc.). About a third of the participating preschools served high-income families, another third (HeadStart schools) served low-income families, and yet another third served families with a mixed socioeconomic background (from middle-class to low-income families). The children were on average 43 months old at the first testing point and 50 months at the final testing point. About half of all participants were boys and half were girls.

All participating children were recruited at the start of the school year. These children, who were in the class over the school year, made up the group used in calculating class scores. Across the 40 classes, 305 children participated in the study. Each class had one primary teacher from whom input data was collected.

5.1.2. Comprehension task

Each child was given a syntax comprehension task. In this task, children were read a sentence and were asked to point to the picture that goes with the sentence. The testing format was similar to that in Study 1B. One difference should be noted: While the comprehension task in Study 1B consisted of multiclause sentences, in the present study we included simple sentences with varying numbers of noun phrases as well as multiclause sentences (see Fig. 7 for two sample items). This was done for two reasons. First, some of the children in Study 1B performed at a chance level and we wanted to have a task that would allow us to differentiate children's syntactic level. Second, when we analyzed number of noun phrases in children's utterances in Study 1B we found an even higher correlation with parent input than for multiclause sentences. Therefore we constructed a syntax comprehension task, including sentences that differed in the number of noun phrases not only because of variations in the number of clauses, but also because of variations in the number of noun phrases within a clause.

5.1.3. Math task

Each child also was given a math task. Children were shown a target picture and had to choose one of a set of pictures that matched the target picture. This measure of mathematical skill was obtained primarily to address other research questions, but in the context of this study, the task provides a

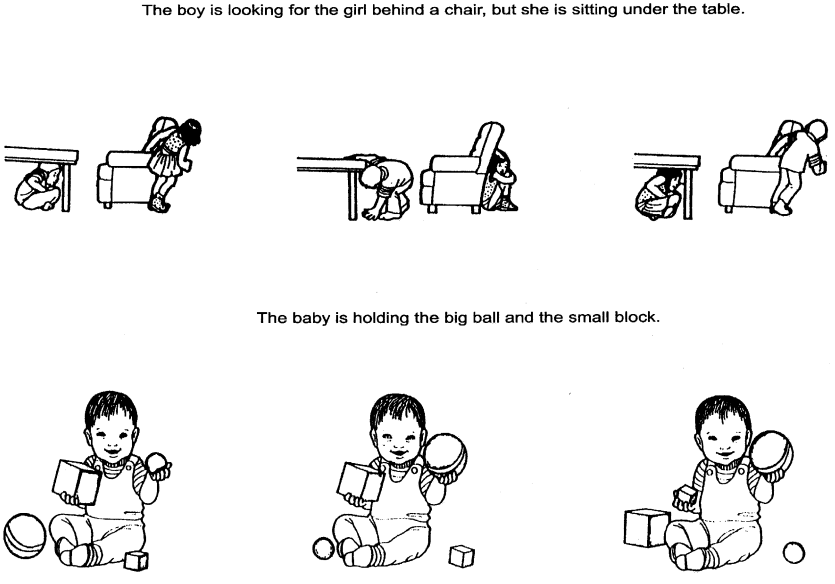

Fig. 7. Two sample items from the comprehension test, Study 2.

way of examining if teacher speech has a stronger effect on children's syntactic growth than on other aspects of children's intellectual development.

5.1.4. Schedule of testing

Children were tested twice, at the beginning and at the end of the school year. To reduce practice effects, each child was given different test forms at the two testing points. Preliminary studies showed that the alternative forms were equivalent in difficulty. Children were tested individually in their preschool. Each testing session lasted 10–15 min. Our concern was to obtain reliable data on the average class score at the beginning and at the end of the year. Most children were tested at both test point 1 and at test point 2. However, some children are absent from school on particular days, and 45 of the children were tested at just one time point. To obtain the most reliable estimate of the average class score at each time point, scores for all children present at a test point are included in the analysis.

5.1.5. Teacher observation

In addition to the testing of the children, classroom observations were conducted. All participating classrooms were visited in the middle of the school year when the teacher speech was recorded and the classroom observation data were collected. Each classroom was observed once for 2.5–3 h. During that period the teacher wore a lapel microphone and the teacher's speech was audiotaped. One hour of the tape was later transcribed and the speech was analyzed. The procedure used in syntactic analysis of teachers' speech was identical to that used in the analysis of parents' speech in Study 1B.

During the classroom observation, the observer filled out a questionnaire describing the teacher's interaction with students. The questionnaire was based on NAEYC checklist for preschools. We included 10 questions which concerned the general quality of teaching, for example, the extent to which teachers use positive reinforcement and redirection, the extent to which they stimulate children's curiosity and interest, and so on. For each question, the observer assigned a score that varied from 1 (*not at all like this classroom*) to 5 (*very much like this classroom*). The average score was calculated over the 10 measures and used as a general quality of teaching measure. In a subset of classrooms the second observer made independent observations. The reliability across observers was .85.

5.2. Results

5.2.1. Comprehension

We calculated the average comprehension score for each class using the scores of individual children. At the first testing point, the comprehension scores for the classes varied from roughly chance level (33% correct) to

65% correct. SES was related to children's initial level of syntactic skill ($r = .48$, $p < .01$). That is, children coming from higher SES families have better syntax comprehension scores at the initial testing than children coming from lower SES families. For each classroom, a growth score was calculated (the average class score at the first testing point was subtracted from the average class score at the second testing point). These growth scores varied dramatically from −.15 to .31; there was a rise in average comprehension scores in 30 of the 40 classrooms. Syntactic growth over the school year was not significantly correlated with SES ($r = .21$, $p > .10$).

5.2.2. Teachers' speech

We examined two measures of teachers' speech, the proportion of multiclause sentences and the mean number of noun phrases per sentence. As in Study 1B, the two measures were highly correlated ($r = .75$, $p < .01$), and the patterns of relation with child measures were the same for both teacher measures. We did not examine the overall frequency of complex sentences since it did not prove to be a significant predictor of children's syntactic complexity in either Study 1A or Study 1B. Below we present the results using the proportion of complex sentences as we did in examining input throughout Study 1. The proportion of multiclause sentences in teachers' speech varied from 11 to 32% with a mean of 21%. For schools with more than one classroom in our target age group, we found considerable variation among teachers within the school. In fact, teachers in different schools, on average, are no more different from each other than teachers within a school. The analysis of teachers' speech indicated that the average variance within schools (.0021) is very similar to variance between schools (.0014).

The correlation between complexity of teachers' speech and SES was not significant ($r = .2873$, $p > .05$) although, as noted above, the correlation between complexity of children's speech at the start of the school year and SES *was* significant. Note that our SES measure indicates the composition of the families in a school, not the background of the teachers in that school. Although there may be some relation between teachers' own SES and the SES of the families served by the school, there is no reason to believe that this would be a very strong relation. The possible dissociation between teacher and family backgrounds should prove useful in separating teacher effects from family effects on children's syntactic growth.

5.2.3. Relation of syntactic growth to teacher input

The level of children's syntactic skill at the start of the school year was *not* significantly related to teachers' syntax ($r = .19$, $p > .25$). Because the initial levels for classes were not related to teacher input, that input can be examined as a possible source of growth without concerns that prior similarities of teachers and children might account for the relation. This result also indicates that teachers' input (that was measured in the middle of the school

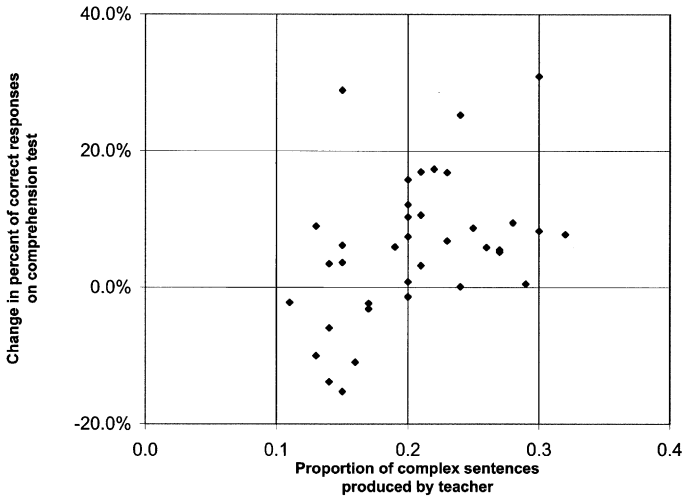

Fig. 8. The relation of the proportion of complex sentences in teacher speech to comprehension scores, Study 2.

year) was not being driven by children's ability level. The examination of syntactic growth in children showed that it was significantly related to the proportion of complex sentences in teachers' speech ($r = .42$, $p < .01$). The relation is shown in Fig. 8. Furthermore, when initial skill levels in different classes were partialed out, the relation between growth and input became stronger ($r = .51$, $p < .01$).

Note the difference in the pattern of relation of children's syntactic skill to SES and to teacher input. As reported above, while SES *was* related to children's skill levels at the start of the school year, it was *not* related to the growth of their skill levels during the school year. On the other hand, teacher speech was *not* related to children's start level but *was* related to their growth. This means that children from low-SES families, whose syntactic level is quite low at the beginning of the year, may grow as much or more than children from higher SES families, if their teachers provide input comparable to or greater than the input in the higher SES preschools.

5.2.4. Other aspects of child growth; other teacher measures

We examined the relation of teacher syntax to our other measure of cognitive growth, nonverbal math. The correlation between the two measures was not significant ($r = -.085$, $p > .10$). Thus, while the correlation between the proportion of complex sentences in teacher's speech and children's growth on syntax comprehension is substantial, there is no relation of teacher syntax to the growth of nonverbal math skill.

Next we examined the relation between the growth in children's syntactic scores and the measure of general quality of teaching. We found that the correlation between these two measures was significant ($r = .32$, $p < .05$). To separate the effects of this teaching measure from specific effects of teacher's syntax, we conducted a regression analysis using a selection forward procedure. The growth score was the dependent variable and the two teacher measures were the independent factors. Teacher syntax was a much stronger predictor of children's growth scores than the other teacher measure. In fact, when the contribution of teachers' complexity is accounted for, 17.8%, $F(1, 38) = 7.99$, $p < .01$, the contribution of the other measure is negligible, 4%, $F(1, 38) = 1.84$, $p > .10$. This pattern of results points to a specific effect of syntactic input on children's syntactic growth.

5.3. Discussion

The results of this study indicate a substantial relation between teachers' syntactic input and syntactic growth in the classes they teach. We conclude from our findings that teacher speech is a critical factor in the extent of growth in comprehension over the school year. Possible alternative explanations for the observed relation are not supported by the data. It would have been possible that more skilled children had teachers with higher skills or that more skilled children elicited better input from teachers. However, the fact that class start levels were not correlated with the complexity of teachers' speech fails to support such interpretations. It seems clear from the results of this study that variations in input are a source of the variation in growth.

6. Overall discussion

Recent interest in the acquisition of syntax has been a natural outcome of emerging concerns in psychology with children's early intellectual development and in linguistics with the characterization of human language. For psychologists, the understanding of development involves specifying intellectual start points as well as the processes by which mature forms of skill are achieved. For linguists, understanding of syntax involves specifying the nature of the grammars that underlie the ability to produce an infinite number of sentences of varying degrees of complexity. In this context, the acquisition of syntax represents a fascinating aspect of cognitive development. During the first few years of life, and across a wide range of environments, children master the intricate patterning of linguistic units that make up the grammar of their language and become able to use the language to express their thoughts and feelings. The complexity of syntax together with

its early mastery pose a challenge in understanding how this intellectual accomplishment is achieved.

One kind of data relevant to determining the sources of syntactic development comes from studies that show commonalities in early syntax across children. These commonalities have been taken as evidence for powerful innate constraints in acquisition. Note, however, that commonalities in language development may depend on either structure in the child, structure in the input, or both. It has been argued that structure in the input is not sufficient to permit induction of a grammar and further that speech in natural context is in any case filled with false starts, incomplete sentences, and so on (Chomsky, 1965). However, empirical investigation of parent utterances to young children has revealed that those utterances actually tend to be highly regular, involving mainly complete sentences (Newport et al., 1977). Hence regularities in the input could be a source of commonalities in early syntactic development, although at present it is not clear to what extent this is the case.

The other kind of data relevant to understanding the sources of syntactic development comes from studies that show individual differences in children's skills and a relation to variations in input. Individual differences among children are found from the start of syntax acquisition. As we have seen, earlier studies had found that some aspects of syntax were related to variations in input, whereas others were not. The finding that there were aspects of syntax that were unaffected by input could have important implications, since it might indicate that there are features of syntax that are not acquired from the input, but rather are innately available. However, existing studies involved very young children and did not explore the possibility that a relation to those aspects of input might be found at later stages of development.

Our first study systematically addressed the possibility of a relation between children's skill levels and input in 4-year-olds. We looked at the proportion of multiclause sentences, a measure parallel to the Newport et al. measure of number of verb phrases per utterance. We also looked at the number of noun phrases per utterance, a measure used by Newport et al. We found sizable individual differences among children in the proportion of multiclause sentences produced as well as comprehended and in the average number of noun phrases in an utterance. The measures of child syntax that we have used were significantly related to variations in input. Thus our data show that a relation of child language to parent input can be observed for syntactic skills that are unrelated to input at earlier stages.

The findings of Study 1 suggest that different aspects of syntax may show sensitivity to input at differing points in children's language development. Indeed, a relation between the growth of particular forms and the variation in parent speech should be expected only over the period when those forms are growing. Once a child has fully mastered a form, such a relation will not

be found, nor will a relation be found before the form emerges. Earlier research has shown a relation of input to certain aspects of syntactic skill in very young children. Our work has demonstrated a relation between input and other aspects of skill at later stages of syntactic development. The results, taken together, provide evidence that the aspects of syntax that have been examined so far show input sensitivity at some point during the course of language development.

Our results in Study 1 are consistent with the idea that processes sensitive to patterning in the input are central to the acquisition of syntax. If children learn language from the input, higher skill levels should be found in individuals who receive better input. However, since the input findings in Study 1, like most input findings, are based on parent–child relations, it is possible that biological factors might account for the observed results. That is, since individuals from the same biological family are more similar in genetic makeup than unrelated individuals, one might expect parent–child correlations even if input were not relevant to children's syntactic skill levels.

Some investigators might even argue that, for the aspects of syntax examined in this article, a genetic hypothesis is especially plausible. It has been argued that innate ability differences are most strongly seen for complex skills; simple skills are acquired relatively early even by low ability level individuals (e.g., Jensen & Inouye, 1980). Pursuing this line of argument for syntax, one would expect that basic grammatical relations and morphology of simple sentences would be mastered by humans across a very wide range of ability levels, although there might be some differences in timing. For more complex aspects of syntax, however, genetic differences should be especially clear. According to this argument, the findings in Study 1 might not be due to differential input at all but, rather, only to the genetic similarity of parent–child pairs.

In our second study we examined whether the nature of the input actually affects the level of child skill. As we have noted, studies of families are generally ambiguous with respect to causation since parents and children are biological relatives. In a design to evaluate whether certain features of input have an effect on particular aspects of syntactic skill, the input provider should not be a biological relative of the child and the ability level of the provider should not be related to that of the child. An additional issue in interpreting the role of particular aspects of parent input is that parents are input providers across the entire period of language acquisition. Hence there will be ambiguity as to whether the growth of particular syntactic skills over delimited time periods is due to the characteristics of input during that period. For a design to implicate input over a particular period of time in the growth of a target skill, the interaction of the provider with the child should be limited to that time period.

Potentially the teacher–child relation can provide an appropriate context for exploring input effects. In Study 2 we investigated teacher input and

child growth over the school year. We found that teacher speech was *not* significantly related to children's skill levels at the start of the school year, but *was* significantly related to growth in children's skill levels over the school year. This pattern suggests that the correlation of input to growth was not due to similarities in underlying ability levels of teachers and children nor to adjustment of input to child ability levels. Further, the observed correlation could not be explained in terms of other characteristics of teachers or growth in general cognitive skills of the children. Our finding was specific to syntax—complexity of teacher speech and growth of syntactic comprehension in the children. These results implicate the syntax of input providers as a factor that affects the extent of syntactic growth.

While our findings show the importance of input in the acquisition of syntax, it is clear that prior mental structure also is critical. In fact, existing work on syntactic development has focused more on delineating the prior structure in the child necessary for acquisition of syntax than on the needed input. That focus is understandable given the salient facts about language development—that only humans develop a grammar and that it develops rapidly in early childhood. However, it is important to remember that both input and prior structure are critical to development in all domains, even though the role of prior structure may be especially great for the development of syntax. In this context, we should note the evidence presented by Goldin-Meadow (1982) that the spontaneous gestures of deaf children may exhibit complex structure even though the children have received no linguistic or gestural input to support it. The existence of such structure in spontaneous communication would seem to reflect preexisting mechanisms in the child.

Note, however, that while the very capacity to use complex structure may not be actually *produced* by input, input *is* required for acquiring a conventional system that captures such structure. The processes that underlie acquisition of a conventional system differ from those that underlie spontaneous gesturing behavior. Proficiency in using complex syntax to express complex ideas in a particular language requires exposure to the ways sentences can be embellished through combining clauses and through the use of prepositional and adverbial phrases in that language. For example, the English-learning child must learn that two clauses can be conjoined by "but" or "because" to express particular relations between clauses.

In fact, we find that it takes considerable exposure to complex linguistic forms to achieve proficiency in producing those forms and reliability in comprehending them. For all our measures in both studies, we have found a linear relation between children's syntactic skill levels and language input over the entire range of variation in input complexity. The existence of such a relation is relevant to the interpretation of the role of input in acquisition. Some investigators have argued that input functions as a trigger to allow children to "set parameters" within a highly constrained set of syntactic pos-

sibilities (Chomsky, 1981). This notion suggests that a relatively small amount of input should be sufficient to trigger the setting of the parameters. Yet our findings indicate that the greater the proportion of complex syntactic forms in the input, the higher the level of skill with these forms.

At present, we can only speculate about why greater proportions of complex syntactic forms in caregiver speech allow children to achieve higher levels of proficiency in both comprehension and production. It seems clear that children must experience these forms in a variety of linguistic contexts across various situations to become familiar with the patterning of units in their language and to establish the mappings of those patterns onto conceptualizations of events. Hearing speech with a high proportion of particular syntactic forms may facilitate the encoding of events in ways that map onto those forms. A possible way of thinking about such a facilitation is that language experience affects children's skills in representing events in a form appropriate for verbalization, i.e., "thinking for speaking" (Slobin, 1996; Vygotsky, 1962). Slobin has, in fact, proposed that "acquiring a first language involves learning particular ways of thinking for speaking" (p. 76).

In addition to the importance of multiple exposures to complex speech in forming generalizations about linguistic forms and their pairings with meanings, further exposure may be needed to achieve sufficient ease of access to support on-line use in production or comprehension situations. Difficulty of access may account for low levels of production of complex sentences by some children in our studies. These children may require favorable circumstances to produce such sentences—for example, recent exposure to particular syntactic forms or lexical items, situations that are familiar and hence are easily conceptualized, and so on. Difficulty of access may also account for unreliable comprehension. Some children performed at chance on our comprehension task even though they produced some complex sentences, showing that they did not completely lack skill with such sentences. Clearly, further investigation will be needed to arrive at the proper formulation of the ways in which children achieve proficiency as language users.

It should be noted that the fact that individual differences in language skills are reflected by variations in input does not imply that genetic factors are not also relevant. Pinker and Bloom (1990) argue that if language is a biologically regulated skill shaped by evolutionary forces, genetically based variations in skill levels are to be expected. Studies which suggest that genetic factors may contribute to individual differences in syntactic skill across children have been reviewed by Stromswold (2001). Genetic differences might affect the ease of learning the code itself, of conceptualizing situations in ways that map onto complex syntax, and so on. Our data showing input effects on syntactic growth do not account for all the variability in skill among children, and it is possible that differences in genetic endowment explain some of the remaining variance.

In conclusion, while language development has received considerable attention in recent decades, our understanding of the acquisition process is at present very incomplete. Despite the fact that syntactic acquisition has been the focus of many theoretical discussions, systematic empirical work on the role of input has been limited. The present article provides evidence concerning the relation of input to aspects of syntax that are regarded as epitomizing the human language capacity—the ability to embellish simple sentences using multiple noun phrases and to combine clauses to form multiclause sentences. It is already clear that level of syntactic skill varies substantially across children. It also is clear that input affects the skill levels that individuals achieve. Our findings suggest that it is critical to specify the nature of the interplay between the roles of structure in the child and structure in the language environment in order to develop adequate theories of language acquisition.

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The Home Environments of Children in the United States Part I: Variations by Age, Ethnicity, and Poverty Status

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Although measures of the home environment have gained wide acceptance in the child development literature, what constitutes the "average" or "typical" home environment in the United States, and how this differs across ethnic groups and poverty status is not known. Item-level data from the National Longitudinal Survey of Youth on four age-related versions of the Home Observation for Measurement of the Environment–Short Form (HOME-SF) from five biennial assessments (1986–1994) were analyzed for the total sample and for four major ethnic groups: European Americans, Asian Americans, African Americans, and Hispanic Americans. The percentages of homes receiving credit on each item of all four versions of the HOME-SF are described. For the majority of items at all four age levels differences between poor and nonpoor families were noted. Differences were also obtained among African American, European American, and Hispanic American families, but the magnitude of the effect for poverty status was greater than for ethnicity, and usually absorbed most of the ethnic group effects on HOME-SF items. For every item at every age, the effects of poverty were proportional across European American, African American, and Hispanic American groups.

INTRODUCTION

Over the past 4 decades, the home environment has become a central focus of inquiry in human development. Debates have arisen concerning the extent to which children affect their environments (Bell & Chapman, 1986; Scarr & McCartney, 1983), whether experiences during any particular period of development (mostly earlier experiences) have a lasting effect on developmental course (Clarke & Clarke, 1976; Lewis, 1997), and whether the observed correlation between measures of the environment and measures of children's development solely represent environmental effects or are partially mediated by genetic factors (Plomin & Bergeman, 1991). Despite these debates, there is near-universal agreement on the value of understanding the dynamic interplay between child and environment (Ford & Lerner, 1992; Magnusson, 1995; Wachs, 1992, 2000). Accordingly, there continues to be interest in constructing and using measures of the home environment for both research and applied purposes in human development. It has, indeed, become commonplace to include measures of the home environment as part of large-scale surveys (e.g., the Panel Study of Income Dynamics, the National Longitudinal Survey of Youth [NLSY], the National Household Education Survey, the Early Childhood Longitudinal Study), multisite naturalistic investigations (e.g., the National Institute of Child Health and Human Development Study of Early Child Care), and multisite intervention studies (e.g., evaluations of Early Head Start, the Job Opportunities and Basic Skills program, and the Infant Health and Development Program).

Despite the widespread use of both broad- and narrow-gauge home environment measures, relatively little is known about how often children actually encounter the kinds of experiences reflected in such measures, be they particular caregiver behaviors, objects, or events. The information available (especially for members of minority groups) has typically been obtained from relatively small convenience samples at single geographic locations. As a result, researchers, policy makers, parents, and professionals who are interested in children's well-being lack the kind of detailed framework needed to maximally interpret information about children and their environments. Knowing what is common—or not so common—in children's experience can provide useful contextual information for research on the relation between environment and development. It can also aid in understanding the impact of interventions. For example, suppose a person is interested in whether early literacy experiences are related to reading comprehension in the third grade. If there is evidence that the vast majority of 4- and 5-year-old children have at least 50 books in the home and also have parents who read to them at least three times a week, then an interpretation of a modest correlation between these kinds of experiences and third-grade reading performance may be different than if the average number of books in the home is less than 15 and fewer than 30% of parents read to their children even once a week. Indeed, researchers' approach to further study of the issue of early literacy experiences may be quite different under

the two scenarios. If the prevalence of a large number of books in the home is high (and likewise, the prevalence of parents reading to their children is multiple times a week), then the strategy may be to focus on finer-grained nuances of literacy experiences, such as whether parents actually spend time teaching their children sound–symbol associations and letter recognition. If the prevalence is low, then the strategy may be to look at other relatively gross indicators of home literacy experience (e.g., the amount of TV watched) or even literacy experiences that occur outside the home (e. g., whether the child has attended preschool). Likewise, under the two scenarios, approaches to early intervention with children who are at increased risk for reading failure may be different. Under the first scenario, the approach may be on activities aimed at improving specific reading skills. Under the second scenario, the approach may be more on simple exposure to printed materials. The purpose here is not to discuss the merits of particular approaches to developing reading competence or doing research on literacy, but to illustrate why detailed knowledge of children's experiences is valuable for framing the issues. Moreover, if, as Magnusson (1995) argues, the total process of environment–development relations cannot be understood by studying one aspect after another in isolation from other simultaneously operating elements, it will be useful to know the general frequency with which the full array of elements tends to occur. For example, when it comes to fourth-grade achievement in language arts, parents' reading to 3- and 4-year-olds may be less potent—or, alternatively, more salient—in the absence of enriching out-of-home experiences than in the presence of such experiences.

Knowing more about how frequently children encounter certain experiences is particularly important in making comparisons. García Coll and colleagues (García Coll et al., 1996; García Coll & Magnusson, 1999) have offered a compelling argument about the dangers of making group comparisons in the absence of a framework that links those differences to macro-level social, political, and economic factors. Observed group differences in patterns of correlations between measures of the environment and measures of development may reflect the fact that in one group certain experiences occur much more frequently than is the case for the second group. In effect, group differences in patterns of correlations may not reflect different underlying environmental processes at work, but rather the fact that in one group, particular processes rarely have a chance to operate (i.e., too few children actually have the experience and/or children are simultaneously experiencing inhibitory processes within the home or in the broader social environment). Group differences could also reflect the fact that nearly everyone in a particular group has the experience (i.e., there is little variance, and the process transpires for almost everyone).

Having information on how frequently children in different groups (ethnic, social class) encounter particular actions, objects, and events can be especially helpful in mapping the relations between various dimensions of the environment and developmental processes across groups. Granting the complexity of environment–development relations (Bronfenbrenner, 1995; Wachs, 1992, 2000), most ecological–developmental theories stipulate the same basic relation between particular dimensions of the environment and the course of development for all groups (good examples include parental responsiveness and exposure to a variety of learning materials; see, e.g., Bornstein, 1989; Ford & Lerner, 1992; Kagan, 1984). Nonetheless, clarifying the relations often requires examining the details with which certain processes are enacted, including their frequency of occurrence, within each group (Bornstein et al., 1992).

The majority of studies that have examined particular dimensions of the home environment have not focused on individual indicators of those dimensions as part of the analysis. Rather the analyses have been performed on summary-type scores. Accordingly, very little is known about the prevalence of each indicator within most groups, and even less is known about group differences with respect to particular indicators of environmental dimensions. If such indicators represent the actual processes presumed to affect development, then more needs to be known about the frequency of occurrence of particular indicators in order to advance understanding about environmental "effects." According to Hui and Triandis (1985, p. 136), "the continuum of universality-cultural difference of a construct closely parallels the construct's level of abstraction." In other words, item-level analysis tends to be more precise in detecting group differences. For example, a review of uses of the Home Observation for Measurement of the Environment (HOME) Inventories (Caldwell & Bradley, 1984) outside the United States produced evidence of several items that did not seem appropriate in certain cultures (Bradley, Corwyn, & Whiteside-Mansell, 1997): "parent introduces interviewer to child," and "child has free access to musical instrument" were considered inappropriate for Caribbean households (Durbrow, Jones, Bozoky, & Adam, 1996), and African and Asian researchers questioned the validity of items used to assess socioemotional support because these cultures have characteristically different parenting styles (Aina, Agiobu-Kemmer, Etta, Zeitlin, & Setiloane, 1993; Nihira, Tomiyasu, & Oshio, 1987).

The value of having detailed information about particular indicators in specific groups becomes even

clearer when considering both the type and number of indicators that compose most measures of the home environment. To be more specific, home environment measures generally contain cause—not effect—indicators; that is, the indicators of particular environmental dimensions are selected not because they are assumed to reflect some specific underlying cause, but because they are presumed to produce a particular effect (for a discussion of this distinction, see Bollen & Lennox, 1991). Accordingly, since all the indicators of a particular environmental dimension—unlike trait characteristics in humans—are not presumed to derive from a single, underlying common cause, it is not appropriate to assume that they are essentially fungible. Whereas a relatively small number of indicators of a human trait may well be sufficient to represent the trait because all the indicators are presumed to derive from that trait, it is critical that environmental measures include a broad enough census of indicators of each dimension to assure adequate representation of the dimension (i.e., the actions, objects, or events that compose a dimension may emanate from a variety of different sources or for a variety of different reasons).

The purpose of the present study was twofold: (1) to provide detailed information on the frequency with which children in the United States experience the kinds of actions, objects, and events that are found in commonly used measures of the home environment (Part 1); and (2) to examine the relation between frequently studied dimensions of the environment and several aspects of children's well-being for different ethnic and income groups from infancy through adolescence (Part 2; Bradley, Corwyn, Burchinal, McAdoo, & García Coll, 2001). In both parts, Ethnic Group × Poverty Status analyses were conducted, because in each ecological niche there are characteristic ways of adapting to the demands of the environment, a unique set of affordances, and traditional approaches to accomplishing the goals of childrearing (Harkness & Super, 1995; Masten, 1999). Thus, there is strong reason to believe that what children experience in their homes will vary across ecological niches. The research on economic status indicates that economic hardship (poverty) means less access to certain material goods and services, less access to potentially enhancing experiences, and greater exposure to potentially debilitating substances and experiences (Bradley & Whiteside-Mansell, 1997; Duncan & Brooks-Gunn, 1997; Huston, McLoyd, & García Coll, 1994). The difference in what poor children versus nonpoor children experience in their home environments is both a direct function of not having enough money to access goods and services and an indirect function of where children live and how their parents cope with the stress connected with economic hardship (Luster & McAdoo, 1996; McLoyd, 1990). Ethnicity also provides a frame for what children experience at home. Childrearing goals and socialization practices also vary from culture to culture (García Coll, 1995; Greenfield, 1994; Hui & Triandis, 1985; Parke & Buriel, 1997). Ethnicity shapes what parents do, what children have, how children and adults spend their time, and the types of exchanges between family members. For even basic caregiving activities, such as soothing a baby, there are characteristic differences in the strategies used in different ethnic groups (Bornstein et al., 1992; McAdoo, 1997). For minority cultures living within a dominant majority culture, the childrearing goals and socialization practices can become even more complicated, particularly if the minority culture is subjected to discrimination (McLoyd, 1999). As Greenfield (1994, p. 25) argues, "Culture not only is context; it has context as well." For every culture, there is a cultural frame of reference that "refers to the correct or ideal way to behave within the culture" (Ogbu, 1994, p. 375). These ideals guide parenting practices. For example, Boykin and Toms (1985) specified that for African Americans, families must teach their children to deal with three different realms of experience: mainstream American, African American cultural heritage, and the oppressed experience of people of color. García Coll and colleagues (García Coll, Meyer, & Britten, 1995) identified issues of acculturation and racial socialization as major influences on parenting practices. These processes may contribute to individual differences among members of any particular ethnic group, as well as to differences across ethnic groups.

Our primary purpose in Part 1 of this study was to describe what occurs in the home environments of children in the United States with regard to the types of indicators found in widely used home environment measures. The relative effects of ethnicity and poverty status on children's home environments were also investigated. To accomplish this, we used data from the NLSY. Although families in the NLSY were not fully representative of the current U.S. population (U.S. Department of Commerce, 2001), the families more closely approximated the U.S. population than was the case for most other studies. The original NLSY sample included 6,283 women who were between the ages of 14 and 21 in 1979. The sample was selected to be nationally representative; however, there was deliberate oversampling of African Americans, Hispanic Americans, and poor European Americans to allow separate analyses of these three major cultural subgroups. Data from this sample has been collected every year. Beginning in 1986, the NLSY also included

a child supplement, which contained information both about the children and their environments.

One advantage of the NLSY is that it includes a short form of the HOME Inventory (HOME-SF) as part of the child supplement. The HOME is one of the most widely used of the broad-scale measures of the home environment (Caldwell & Bradley, 1984). There are four versions of HOME: the Infant–Toddler HOME (IT-HOME) for children under age 3, the Early Childhood HOME (EC-HOME) for children ages 3 to 5, the Middle-Childhood HOME (MC-HOME) for children 6 to 9, and the Early Adolescent HOME (EA-HOME) for children 10 to 14. Each version of the HOME has undergone a rather extensive norming and standardization process and has acquired considerable validation as applied in a wide array of studies throughout the world (for reviews, see Bradley, 1994; Bradley, Corwyn, & Whiteside-Mansell, 1996). In general, the HOME inventories have shown patterns of relations with developmental, parental, and other environmental measures that are in line with theoretical expectations. For example, the inventories have consistently shown moderate associations with family demographic characteristics and with social and cognitive development in children. Research also indicates that the HOME is related to theoretically relevant parental characteristics like IQ, depression, and drug use, as well as children's health status (Bradley, 1994). Importantly, for our purposes, items on the HOME-SF are typical of the kinds of home environment indicators used in developmental research and program evaluation.

In sum, we hoped to reveal the "lay of the land" with regard to the kinds of indicators found in commonly used measures of the home environment, to create a kind of topography of children's experiences connected to their home life. Although our basic purpose was to describe children's experience within each group, we examined the size of the difference in performance on each HOME-SF among ethnic groups to provide an additional perspective on within-group findings. These comparative analyses were limited to three of the four major ethnic groups because there was insufficient information on Asian Americans to allow for meaningful comparisons. Likewise, we examined the size of the difference in performance on each item for families living in poverty and families living above the poverty line. It is well documented that persistent poverty and its co-factors induce stress, and that stress decreases the likelihood that parents will provide responsive and stimulating care (Bradley & Whiteside-Mansell, 1997; Conger, Conger, & Elder, 1997; Luster & McAdoo, 1996; McLoyd, 1990; Slaughter, 1988). It is also well documented that poverty is confounded with minority status (Huston, McLoyd, & García Coll, 1994), that not all the relation between economic status and children's development is mediated through what parents do (Duncan & Brooks-Gunn, 1997; García Coll et al., 1996), and that relations between measures of the home environment and children's development vary as a function of socioeconomic status (Bradley et al., 1989). For example, family economic conditions determine the disciplinary practices of parents (Kelley, Power, & Wimbush, 1992; McLoyd, 1990): Spanking is one approach to discipline that has been cited as being more prevalent in poor and ethnic minority families in the United States (Day, Peterson, & McCracken, 1998; Giles-Sims, Straus, & Sugarman, 1995). Economic factors however, explain only a small percentage of the variance in spanking behaviors (Erlanger, 1974; Giles-Sims et al., 1995; Portes, Dunham, & Williams, 1986). The collective influence of these variations in discipline techniques has not been studied extensively.

METHODS

Sample

Data for this study came from five biennial NLSY child data files from 1986–1994 (see Center for Human Resource Research [CHRR], 1995, 1997b). The sample consisted of those women from the 6,283 originally recruited as part of the NLSY who had at least one child born prior to the 1994 biennial assessment. Beginning with the 1990 survey, however, data were no longer collected from most of the women ($N = 456$) who were either in the military or part of the oversampling of "poor" European Americans ($N = 901$). This left 4,944 of the original sample eligible to be interviewed in 1994. Ninety-one percent of those eligible were interviewed, and about 77% (3,464) were mothers. These women had 7,089 children in 1994, of which 6,109 were younger than 15 years of age and, therefore, eligible to receive HOME-SF assessments. Over 93% of eligible children (5,715) received HOME-SF scores in 1994. The number of children assessed in prior years was 4,971 in 1986, 6,266 in 1988, 5,803 in 1990, and 6,509 in 1992. The 29,264 child assessments, less those with missing values and questionable ethnic group membership, were analyzed in the present study. Because ethnicity was a key variable in this study, cross-tabulated validations of agreement between respondent's self-reported ethnicity and the interviewer's assessment of ethnicity were conducted for all five assessment periods. Cases with a discrepancy between the interviewer's and respondent's classification of ethnicity were dropped from the study. Three dummy variables were created for ethnic group

comparisons: Hispanic Americans versus other, European Americans versus other, and African Americans versus other. It should be noted, however, that the Hispanic sample is somewhat diverse. Although the majority of NLSY Hispanic women were either Mexican Americans (40.1%) or Mexicans (20.9%), a significant percentage identified themselves as having Puerto Rican (17.9%), Cuban (6.4%), other Hispanic (6.5%), and other Spanish (5.2%) origins. Those who were classified as Native Americans were left in the sample for analytic purposes (e.g., European American versus other), but the total number of Native Americans was too small to permit treating them as a unique ethnic group.

Table 1 displays a demographic breakdown of the samples analyzed for each of the four age periods. Because of the structure of the sampling process, the information on older children was somewhat less representative than was the information on younger children. That is, the original NLSY cohort of women was between 29 and 36 years of age in 1994, most of their children had been born, but proportionally fewer had reached the maximum age of children being investigated in the NLSY. Because age of mother at the birth of her first child is known to be associated with other demographic characteristics of the mother, the sample for older children was likely to be less representative than the sample for younger children. Indeed, Table 1 indicates that children in the older age groups were more likely to have younger mothers with less education, and were less likely to be living with their fathers.

Approach to Data Analysis

For a study that follows a single cohort longitudinally, such as the NLSY, data can be analyzed in two basic ways: (1) the data collected during each wave of data collection can be analyzed separately (i.e., as a cross-section from a particular year, such as 1988); or (2) data can be combined across waves of data collection, and analysis done on the combined data set. We chose the latter strategy because it takes fuller advantage of the original sampling in that it more fully and faithfully represents the lives of children born to

Table 1 Percent of Participants within Various Demographic Categories by Ethnicity and HOME Inventory

	European American				African American			
	0–2 Years	3–5 Years	6–9 Years	10–14 Years	0–2 Years	3–5 Years	6–9 Years	10–14 Years
Mother's education								
1–11 years	14.5	19.1	24.4	29.2	24.5	26.0	31.5	33.9
12–15 years	62.8	65.8	67.0	66.3	67.1	66.7	63.7	62.4
16 or more years	22.7	15.0	8.6	4.4	8.4	7.3	4.7	3.6
Father present	89.0	79.7	65.8	57.6	48.1	39.9	28.4	21.7
Age of mother at birth								
15–24 years	44.0	95.7	99.1	86.7	56.1	95.8	96.2	91.3
25–34 years	53.1	4.3	.9	13.3	41.6	4.2	3.8	8.7
35–44 years	2.9	—	—	—	2.2	—	—	—
Income below poverty	14.0	17.1	18.0	18.1	48.0	47.2	49.5	50.7
	Hispanic American				Asian American			
	0–2 Years	3–5 Years	6–9 Years	10–14 Years	0–2 Years	3–5 Years	6–9 Years	10–14 Years
Mother's education								
1–11 years	38.2	40.9	48.7	54.0	15.2	16.3	35.9	53.3
12–15 years	55.4	54.2	47.7	43.1	65.2	74.4	59.8	46.7
16 or more years	6.4	4.9	3.6	2.8	19.6	9.3	4.3	—
Father present	79.3	70.4	56.1	48.1	92.3	83.7	70.7	63.3
Age of mother at birth								
15–24 years	52.6	96.6	99.2	91.3	38.9	100.0[a]	100.0[a]	85.7[a]
25–34 years	43.7	3.0	.8	8.7	55.6	—	—	14.3
35–44 years	3.8	.3	—	—	5.6	—	—	—
Income below poverty	35.2	33.4	35.4	33.8	11.9	17.1	8.4	11.5

Note: HOME = Home Observation for Measurement of the Environment.
[a] 10 or fewer cases with nonmissing values.

the original cohort than would a cross-sectional analysis done from any particular wave of the data. To be more specific, to the extent that the original cohort of female participants in the NLSY is representative, then their children will also be representative, but only if all the children born to these women are included. Such a sample should include firstborns, secondborns, thirdborns, and so on in proportion to their representation in the population. Likewise, it should include singletons, twins, and so on in proper proportions; families of various sizes and age distributions in proper proportions; and so forth. The original cohort of women becomes a cohort of families, a cohort of extended families, and so forth. All things that emanate from the cohort will be representative to the same degree as the original cohort, but only over time after all members of a certain class have reached whatever criterion age point is the subject of investigation. In effect, what the NLSY sample can reveal about the home environments of 6-year-old children can be most accurately determined only after all the children that will ever be born to the initial cohort of women have reached age 6. Otherwise, 6-year-olds of women who give birth later in life, 6-year-olds who have multiple older siblings, and so forth will be underrepresented and the information about the home environments of 6-year-olds will be distorted to that degree. The findings will also underrepresent any demographic group that tends to start having children later in life. In fact, until all the children born to mothers in a cohort reach some criterion age, the sample will underrepresent families who have larger numbers of children. A secondary advantage of using the combined dataset is that it increases the numbers of persons available for analysis from small populations that are not oversampled (e.g., Asian Americans) and, thus, increases the accuracy of estimates from these samples. For example, the first wave of data (1986) consisted of 73 Asian children, only 14 of whom had scores on the IT-HOME-SF, whereas the combined file contained 45 Asian children with scores on that version. The combined data also provide a more representative look at the typical American family. It includes, for example, a more complete representation of those women who had a first child late in life and those who had multiple births. On the other hand, the dataset has shortcomings. It has been estimated that the NLSY data collected through 1994 represent only about two thirds of the childbearing years for mothers from the original cohort (CHRR, 1997b, p. 3). Thus, the data on older children are likely to be somewhat less representative than are the data on younger children. Moreover, as is the case with any cohort, the findings are representative only of the period in history during which the data were collected.

Measures

HOME-SF. Experienced, specially trained interviewers assessed the quality of the home environments of children born to mothers participating in the NLSY. The home environment was measured using the HOME-SF. Like the original, full-length versions of the HOME (Caldwell & Bradley, 1984), the short form is a combination of observer ratings and mother's report on aspects of the environment. Unlike the HOME, however, which focuses on the child as a recipient of objects, events, and actions in the environment, two items in the HOME-SF ("How often does child read for enjoyment?", and "How many hours does child watch TV on a typical weekday?") were considered indicators of the child's behavior rather than the home environment, and were, therefore, not included in this study. In contrast, the question, "How many hours is the TV on during a typical weekday?" was considered an indicator of the environment and was, therefore, included in this study. Finally, even though most of the items were available for all five assessment points, a few were added after 1986. For example, "Does child see father (figure) daily?" was added to the 1990 survey, and both "taking away allowances" and "taking away privileges in response to child's tantrum" were added to the 1988 survey.

Although items on the original HOME Inventory were designed to be scored in a dichotomous fashion (yes or no), some of the items from the NLSY HOME-SF used three- or four-choice ordinal scoring (see Tables 2–5). The percentage of families who fell into each response category on each item is displayed in Tables 2 through 5. Before making comparisons between groups, however, the items were converted to the original scoring metric by collapsing the ordinal categories into the original dichotomous ones.

Caldwell and Bradley (1984) clustered items on the original HOME scales into subscales based on a review of research and theory. They used factor analysis as an aid to form empirically distinct, psychometrically sound, conceptual subscales. In an effort to organize the presentation of descriptive information on the HOME-SF and in preparation for examining key relations between components of the home environment and children's well-being (see Part 2), items from the HOME-SF were clustered with the aid of factor analysis. Item-level data from each of the four forms of the HOME-SF were subjected to factor analysis (maximum likelihood with varimax rotation). For the IT-HOME-SF,

Table 2 Percent Responses to HOME Items by Ethnic Group and Poverty Status: Homes of Children from Birth to 2 Years, 11 Months

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Observational items		N = 2,568	N = 431	N = 716	N = 663	N = 578	N = 309	N = 45
Parental responsiveness								
(Mother/Guardian) Spontaneously spoke to child twice or more (excluding scolding)	Yes	92.4	89.2	91.5	86.6	93.2	88.9	90.5
(Mother/Guardian) Responded verbally to child's speech	Yes	81.2[p]	70.7[p]	80.5[p]	69.3[p]	81.8	78.5	70.7
(Mother/Guardian) Caressed, kissed, or hugged child at least once	Yes	86.5[p]	73.4[p]	79.7[p]	64.3[p,e]	85.3[p]	75.8[p]	83.3
(Mother/Guardian) Provided toys or interesting activities for child	Yes	73.6[p,e]	55.2[p,e]	57.8[p]	34.2[p,e]	68.6[p]	46.3[p,e]	71.4
(Mother/Guardian) Kept child in view/could see child/looked at (him/her) often	Yes	89.6	81.0	85.3	78.2	84.7	82.9	80.5
Other								
(Mother/Guardian) Slapped or spanked child at least once	Yes	3.2	8.3	8.8[e]	13.6	4.8	8.1	4.8
(Mother/Guardian) Interfered with child's actions or restricted child from exploring more than 3 times	Yes	16.9	19.4	25.6	27.2	18.6	19.9	12.2
Child's play environment is safe (no potentially dangerous health or structural hazards within a toddler's or infant's range)	Yes	91.0[p]	80.7[p]	89.0[p]	79.8[p]	91.9[p]	79.0[p]	88.4
Interview items		N = 2,707	N = 438	N = 774	N = 713	N = 594	N = 331	N = 45
Learning stimulation								
About how many children's books does your child have of his/her own?	None	10.4[p,e]	24.7[p,e]	21.4[p,e]	35.7[p]	23.1[p],e	41.1[p,e]	24.4
	1 or 2 books	8.3	13.0	18.1	17.0	17.2	19.6	20.0
	3–9 books	18.2	20.5	27.5	27.7	23.2	23.3	15.6
	10 or > books	63.1	41.8	33.0	19.7	36.5	16.0	40.0
How often do you get a chance to read stories to your child?	Never–several/year	14.7[p,e]	28.0[p,e]	24.0[p,e]	32.0[p]	27.8[p,e]	39.9[p,e]	27.9
	Several/month–1/week	18.6	27.1	32.2	36.3	30.3	35.0	27.9
	3/week to daily	66.7	44.9	43.8	31.7	41.9	25.1	44.2
About how many, if any, cuddly, soft or role-playing toys (like a doll) does your child have (may be shared with sister or brother)?	0	.5[e]	1.4[e]	2.1[p,e]	4.5[p,e]	2.4[e]	3.4	—
	1–4	6.7	10.9	16.0	24.6	12.2	19.4	11.1
	5 or 6	10.9	11.1	14.8	18.4	15.1	15.4	13.3
	7 or >	81.9	76.6	67.1	52.5	70.3	61.7	75.6
About how many, if any, push or pull toys does your child have (may be shared with sister or brother)?	None	10.0[e]	12.0[e]	15.0[e]	18.6	13.2[p]	19.7[p]	18.2
	1 or 2	9.4	13.6	18.9	23.1	14.9	23.4	9.1
	3–6	41.3	35.6	38.8	35.9	39.5	33.2	40.9
	7–10	24.9	22.4	16.8	13.5	22.7	15.4	18.2
	11 or >	14.5	16.4	10.6	8.9	9.6	8.3	13.6
Spanking								
Sometimes kids mind pretty well and sometimes they don't. About how many times have you had to spank your child in the past week?	None	46.0[p]	25.1[p]	37.0	28.4	48.7	46.4[e]	42.9
	1 or 2 times	29.6	32.9	32.6	33.8	31.2	30.5	35.7
	3 to 7 times	21.3	31.9	24.8	31.3	17.5	21.8	21.4
	8 or > times	3.1	10.1	5.7	6.5	2.5	1.3	—

(*Continued*)

Table 2 *Continued*

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Interview items, continued								
Other								
Some parents spend time teaching their children new skills while other parents believe children learn best on their own. Which of the following best describes your attitude?	Parent always teaches	44.2	55.0	65.7	69.9	59.4	59.2	45.5
	Parent usually teaches	48.9	39.6	28.9	26.2	34.6	33.6	50.0
	Usually learn on own	6.7	4.9	5.0	3.0	4.8	6.5	4.5
	Always learn on own	.2	.5	.4	.9	1.2	.6	—
Does your child see his/her father or father figure on a daily basis?	Yes	94.3[P,e]	72.5[P]	81.4[P,e]	60.4[P,e]	92.5[P]	73.0[P]	93.2
How often does your child eat a meal with both mother and father or father figure?	1/day or >	74.1	65.3[e]	59.9[P,e]	36.7[P,E]	75.9	67.5[e]	81.8
	Several/week	14.1	10.2	14.6	19.6	9.1	9.8	11.4
	1/week–1/month	4.5	6.8	12.3	16.4	4.4	7.5	2.3
	Never/no dad	7.3	17.8	13.2	27.3	10.7	15.3	4.5
Children seem to demand attention when their parents are busy, doing housework, for example. How often do you talk to your child while you are working?	Always talking	45.7[e]	47.6[e]	45.3[P,e]	44.2[P,e]	44.5[P]	48.3[P]	40.9
	Often talking	45.9	40.0	37.5	28.7	38.7	24.9	40.9
	Sometimes	7.2	11.0	14.7	21.1	13.6	18.8	15.9
	Rarely talk	.6	.7	2.0	3.3	1.0	3.4	—
	Never talk	.6	.7	.5	2.7	2.2	4.6	2.3
About how often does your child have a chance to get out of the house (either by himself/herself, or with an older person)?	1/month or <	6.3	8.7	6.6[P]	10.0[P]	11.8[P,e]	20.9[P,e]	11.1
	Few/month–few/week	17.8	22.6	18.5	26.7	27.0	28.8	17.8
	4 or > /week	75.9	68.7	74.9	63.3	61.1	50.3	71.1
About how often do you take your child to the grocery store?	2/week or >	30.9	37.1	35.2[P]	37.8[P,e]	37.8	51.4[e]	37.8
	1/week	49.9	39.2	40.1	27.2	44.9	33.7	31.1
	1/month	10.7	14.7	13.8	21.5	7.8	7.3	17.8
	Hardly ever	8.5	9.0	10.8	13.6	9.5	7.6	13.3

Note: Asian Americans are combined nonpoor and poor because there were too few Asian Americans with incomes below poverty. HOME = Home Observation for Measurement of the Environment.
[e] Ethnicity effect size above .20; [E] ethnicity effect size above .50; [P] poverty effect size above .20; [P] poverty effect size above .50.

five factors were retained, three of which were used for this report: learning stimulation (four items), parental responsiveness (five items), and spanking (one item). For the EC-HOME-SF, seven factors were retained, five of which were used for this report: learning stimulation (six items), parental responsiveness (four items), spanking (one item), teaching (four items), and physical environment (four items). For the MC-HOME-SF, seven factors were retained, four of which were used for this report: learning stimulation (six items), parental responsiveness (four items), spanking (one item), and physical environment (four items). For the EA-HOME-SF, seven factors were retained, three of which were used for this report: learning stimulation (seven items), parental responsiveness (two items), and spanking (one item). With one exception, factors were retained if they were conceptually meaningful (including the fact that they closely paralleled subscales on the original HOME) and technically sound. The exception was spanking. Each version of the HOME-SF contained the item, "How often was child spanked in the past week." That item was considered meaningful on its own. Items not contained in these clusters are presented individually in the tables.

Poverty status. The determination of "family poverty status" (i.e., "in poverty" versus "not in poverty") was based on estimates made by the CHHR in 1986, and the official poverty income guidelines issued by the Department of Health and Human Services (DHHS) for the years 1988 through 1994 (CHRR, 1997a). Comparable to the DHHS guidelines, the CHHR estimates were determined by total family income, controlling for family size, farm/nonfarm residence, and state of residence. The designation of poverty status for a family for a given assessment period does not carry with it the assumption that the family is persistently poor. It only represents the family's economic well-being at the time of assessment.

Table 3 Percent Responses to HOME Items by Ethnic Group and Poverty Status: Homes of Children from 3 to 5 Years, 11 Months

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Observational items		N = 2,472	N = 498	N = 865	N = 766	N = 704	N = 348	N = 41
Parental responsiveness								
(Mother/Guardian) Spontaneously spoke to child twice or more (excluding scolding)	Yes	94.9[P]	86.3[P]	91.4[P]	80.0[P]	92.6[P]	83.1[P]	97.5
(Mother/Guardian) Conversed with child at least twice (excluding scolding or suspicious comments)	Yes	94.2[P]	87.0[P]	90.3[P]	80.6[P]	90.0	84.7	97.4
(Mother/Guardian) Answered child's questions or requests verbally	Yes	92.4[P]	82.5[P]	85.9[P]	77.0[P]	88.7	83.2	94.9
(Mother/Guardian) Caressed, kissed, or hugged child at least once	Yes	63.2[P,e]	48.7[P,e]	46.2[P,e]	31.7[P,e]	59.3[P]	41.8[P]	57.9
Physical environment								
Child's play environment is safe (no potentially dangerous structural or health hazards within a preschooler's range)	Yes	95.7[P]	84.0[P]	94.0[P]	87.3[P]	94.0[P]	87.6[P]	90.2
Interior of the home is dark or perceptually monotonous	Yes	4.5[P]	15.5[P]	10.0[P,e]	23.8[P]	5.8[P]	15.0[P]	7.3
All visible rooms of house/apartment are reasonably clean	Yes	95.3[P]	82.3[P]	94.9[P]	84.0[P]	96.5[P]	85.3[P]	90.2
All visible rooms of house/apartment are minimally cluttered	Yes	83.8	77.2	86.2[P]	78.3[P]	87.6	81.9	82.5
Other								
(Mother/Guardian) Introduced interviewer to child by name	Yes	48.8[P]	33.9[P]	41.0[P]	28.4[P]	38.6[P]	29.1[P]	47.4
(Mother/Guardian) Physically restricted or (shook/grabbed) child	Yes	6.8	10.8	7.9	8.5	10.2	10.3	5.1
(Mother/Guardian) Slapped or spanked child at least once	Yes	3.5[P]	8.7[P]	5.7	5.8	3.1[P]	8.6[P]	2.6
Interview items		N = 2,531	N = 523	N = 918	N = 827	N = 743	N = 367	N = 44
Learning stimulation								
About how often do you read stories to your child?	Never–few/year	4.0[P,e]	8.4[P,e]	11.5[P,e]	18.0[P]	12.9[P,e]	23.8[P,e]	6.8
	Few/month–1/week	24.6	36.1	43.6	48.7	38.4	46.4	31.8
	3/week to daily	71.4	55.4	45.0	33.3	48.7	29.8	61.4
About how many children's books does your child have of his/her own?	None	.7[P,E]	1.7[P,E]	1.9[P,e]	5.8[P,e]	1.9[P,e]	12.8[P,e]	2.3
	1 or 2	.7	6.5	5.4	18.2	8.0	20.4	4.5
	3–9	5.3	17.2	24.9	36.1	22.1	28.9	31.8
	10 or >	93.4	74.6	67.8	39.9	68.1	37.9	61.4
Does your child have the use of a record player or tape recorder here at home and at least 5 children's records or tapes? (May be shared with sister or brother)	Yes	82.6[P,e]	58.9[P]	73.5[P]	50.7[P]	71.5[P,e]	48.2[P]	77.3
How often does any family member get a chance to take your child on any kind of outing (shopping, park, picnic, drive-in, and so on)?	Few/year or <	4.6[e]	7.5[e]	10.2[P]	15.4[P]	11.0[P]	20.4[P]	.0
	Once a month	6.9	10.8	11.0	15.7	10.5	10.2	15.9
	2–3/month	23.0	32.3	30.9	36.8	30.1	26.4	36.4
	Several/week	50.3	40.2	39.6	26.6	41.0	36.9	36.4
	Once a day	15.2	9.2	8.3	5.5	7.4	6.1	11.4
How often has any family member taken or arranged to take your child to any type of museum (children's, scientific, art, historical, etc.) within the past year?	Never	29.6[P]	48.6[P]	29.9[P]	43.9[P]	38.2[P]	52.5[P]	34.1
	1–several/year	62.1	45.4	56.6	45.4	53.0	39.3	59.1
	Monthly or >	8.3	6.0	13.5	10.8	8.8	8.5	6.8

(*Continued*)

Table 3 *Continued*

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Spanking								
Sometimes kids mind pretty well and sometimes they don't. About how many times have you had to spank your child in the past week?	None	33.5[P]	20.0[P]	24.1	16.8	32.1[P]	22.7[P]	41.2
	1 or 2	41.4	43.7	45.3	38.5	45.2	49.5	44.1
	3–7	21.9	30.3	26.8	39.6	21.0	25.1	14.7
	8 or >	3.2	6.0	3.8	5.2	1.6	2.7	.0
Teaching								
Circle the things that you (or another adult or older child) are helping or have helped your child to learn here at home. (Circle all that apply)	Numbers	95.9	93.5[e]	92.9[P]	86.7[P]	93.1[P]	86.7[P]	95.5
	The alphabet	94.4[P]	87.5[P]	91.9	86.39	85.5[P,e]	74.8[P,e]	90.9
	Colors	96.8[e]	92.9[e]	91.1	85.4	92.1[P]	84.4[P]	88.4
	Shapes and sizes	87.9[P,e]	78.7[P,e]	77.0[P]	63.0[P]	73.2[P,e]	57.9[P,e]	83.7
Other								
About how many magazines does your family get regularly?	None	14.6[P,e]	38.5[P]	25.3[P,e]	40.5[P]	31.1[P,e]	48.2[P]	20.5
	1	17.9	21.7	21.4	16.7	19.7	16.2	25.0
	2 or 3	44.9	30.0	36.8	29.3	36.6	25.5	45.5
	4 or >	22.6	9.8	16.5	13.5	12.6	10.1	9.1
How much choice is your child allowed in deciding what foods he/she eats at breakfast and lunch?	Great deal	31.4[e]	35.8[e]	26.0[e]	22.2[e]	23.2[P,e]	20.1[P]	22.7
	Some	60.2	50.0	52.0	48.8	57.2	50.4	52.3
	Little or no	8.4	14.2	22.1	29.0	19.5	29.5	25.0
About how many hours is the TV on in your home each day?	None	2.3[P]	1.4[P]	3.0[P,e]	2.5[P,e]	2.7[P]	3.7[P,e]	4.7
	1 or 2 hr	19.3	11.3	9.6	6.7	14.7	9.0	11.6
	3–5 hr	45.1	35.8	40.5	26.6	49.9	39.4	58.1
	6–8 hr	21.7	25.7	26.7	29.9	23.4	29.6	18.6
	9–14 hr	11.6	25.9	20.2	34.1	9.3	18.3	7.0
Most children get angry at their parents from time to time. If your child got so angry that he/she hit you, what would you do? (Circle all that apply)	Hit him/her back	9.7[P,e]	17.7[P]	23.6[e]	25.3[e]	9.5	15.5	11.6
	Send him/her to his/her room	54.6[e]	46.3[e]	32.2[e]	29.3[e]	47.0	47.1[e]	52.3
	Spank him/her	37.0[e]	43.9[e]	65.1[E]	64.5[e]	41.2	37.4[e]	40.9
	Talk to him/her	74.1	67.5	67.4[P]	56.4[P,e]	75.8	73.1[e]	84.1
	Ignore it	3.0	6.0	2.7	2.5	2.7	3.9	7.0
	Give him/her household chore	2.1	3.9	6.1	7.1	4.0	4.8	2.3
	Take away his/her allowance	12.2	7.8	8.3	5.3	11.3	10.9	18.2
	Hold child's hands until he/she was calm	1.2	2.3	4.9	5.1	3.2	4.2	.0
Does your child see his/her father or father figure on a daily basis?	Yes	90.3[P,e]	62.0[P]	76.4[P,e]	51.9[P,e]	86.8[P]	67.9[P,e]	88.1
How often does your child eat a meal with both mother and father or father figure?	Once/day or >	74.6[P]	57.7[P]	55.2[P,e]	37.0[P,E]	78.7[P,e]	66.9[P,e]	73.2
	Several/week–1/week	20.0	14.4	23.6	24.0	13.1	12.8	19.5
	1/month or <	1.4	5.4	6.7	8.7	1.3	3.4	2.4
	Never	4.0	22.5	14.4	30.3	7.0	16.9	4.9

Note: Asian Americans are combined nonpoor and poor because there were too few Asian Americans with incomes below poverty. HOME = Home Observation for Measurement of the Environment.
[e] Ethnicity effect size above .20; [E] ethnicity effect size above .50; [P] poverty effect size above .20; [P] poverty effect size above .50.

RESULTS

To provide data on the general frequency with which children were exposed to the various actions, objects, events, and conditions cataloged by the HOME-SF, the percentage of households receiving credit for each item at each of the four age periods was computed (Tables 2–5). Among the European Americans, African Americans, and Hispanic Americans, separate percentages were computed for those not living in pov-

Table 4 Percent responses to HOME Items by Ethnic Group and Poverty Status: Homes of Children from 6 to 9 Years, 11 Months

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Observational items		N = 3,927	N = 881	N = 2,000	N = 1,973	N = 1,376	N = 758	N = 83
Parental responsiveness								
(Mother/Guardian) Encouraged child to contribute to the conversation	Yes	77.6[p]	66.5[p]	74.6[p]	63.0[p]	73.8	67.7	71.4
(Mother/Guardian) Answered child's questions or requests verbally	Yes	91.3[p,e]	83.2[p]	82.7[p]	74.2[p]	83.8	79.9	92.4
(Mother/Guardian)'s voice conveyed positive feeling about this child	Yes	94.9[p,e]	86.7[p]	89.0[p]	80.2[p]	90.2	85.5	90.4
(Mother/Guardian) Conversed with child excluding scolding or suspicious comments	Yes	81.2[p]	67.5[p]	76.4[p]	65.2[p]	75.2	69.2	75.0
Physical Environment								
Interior of the home is dark or perceptually monotonous	Yes	4.3[p]	11.2[p,e]	10.9[p,e]	22.0[p,e]	4.7[p]	11.2[p,e]	3.7
All visible rooms of the house/apartment are reasonably clean	Yes	95.2[p]	85.7[p]	93.4[p]	86.0[p]	95.8[p]	85.2[p]	89.2
All visible rooms of the house/apartment minimally cluttered	Yes	86.1	79.4	85.2	81.1	84.9	80.1	84.1
Building has no potentially dangerous structural or health hazards within a school-aged child's range	Yes	75.9	68.9	71.0	63.8	72.1	67.5	76.3
Other								
(Mother/Guardian) Introduced interviewer to child by name	Yes	54.0	54.9[e]	51.5	42.5	50.5	42.9	50.0
Interview items		N = 2,599	N = 618	N = 1,198	N = 1,154	N = 844	N = 492	N = 58
Learning stimulation								
Is there a musical instrument (e.g., piano, drum, guitar, etc.) that your child can use here at home?	Yes	46.8[p,e]	28.4[p]	36.0[p]	23.1[p]	37.2[p]	25.7[p]	50.0
Does your family get a daily newspaper?	Yes	52.9[p]	30.8[p]	48.0[p]	36.0[p]	45.5[p]	30.1[p]	46.4
Do you or someone in the family encourage your child to start and keep doing hobbies?	Yes	92.5	88.3[e]	88.2	82.0	85.4[p]	75.7[p,e]	94.6
Does your child get special lessons or belong to any organization that encourages activities such as sports, music, art, dance, drama, etc.?	Yes	61.0[p,e]	36.5[p]	44.7[p,e]	34.6[p]	43.2[p,e]	23.9[p,e]	46.4
How often has any family member taken or arranged to take your child to any type of museum (children's, scientific, art, historical, etc.) within the past year?	Never	19.5[p]	33.8[p]	23.0[p]	38.7[p]	26.3[p]	43.9[p]	26.8
	1–several/year	72.3	57.6	61.8	49.7	63.8	47.0	62.5
	1/month or >	8.2	8.6	15.1	11.6	9.8	9.0	10.7
How often has any family member taken or arranged to take your child to any type of musical or theatrical performance within the past year?	Never	38.4[p]	50.4[p]	37.7[p]	50.7[p]	48.4[p]	60.9[p]	50.9
	1–several/year	58.9	47.3	53.4	41.9	46.6	35.4	47.3
	1/month or >	2.7	2.3	8.9	7.3	5.0	3.7	1.8
About how many books does your child have?	None	.3	1.6[e]	.6	5.0	.8	8.1	—
	1 or 2	.6	4.7	3.9	13.6	5.2	15.7	3.4
	3–9	4.4	13.4	20.2	33.6	18.1	32.5	27.6
	10 or >	94.7	80.3	75.3	47.8	75.8	43.7	69.0

(*Continued*)

Table 4 *Continued*

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
About how often did/do you read stories to your child?	Several/year or <	15.2[e]	19.6[e]	19.1[e]	24.1	20.3	31.3	21.4
	Several/month–1/week	39.6	44.7	50.6	48.0	45.2	47.8	33.9
	3/week–every day	45.2	35.7	30.3	28.0	34.5	20.9	44.6
Spanking								
Sometimes kids mind pretty well and sometimes they don't. About how many times have you had to spank your child in the past week?	Never	61.8	45.8	49.8	38.0	57.4	53.7	68.8
	1–2 times	26.7	32.5	35.3	38.1	31.4	31.5	18.8
	3–7 times	10.4	18.0	13.1	20.7	9.7	14.5	12.5
	8 or > times	1.0	3.7	1.8	3.3	1.5	.3	—
Other								
How often is your child expected to make his/her own bed?	> half the time	67.4	66.3	74.1	72.4	69.2	61.1	76.8
How often is your child expected to clean his/her own room?	> half the time	88.8	85.3	86.8	81.5	82.0	72.1	89.3
How often is your child expected to clean up after spills?	> half the time	89.2	87.5	94.3	91.0	90.9	85.7	92.9
How often is your child expected to bathe himself/herself?	> half the time	95.5	94.5	96.7	94.8	95.0	93.5	98.2
How often is your child expected to pick up after himself/herself?	> half the time	96.9	91.9	96.0	93.5	93.2	88.2	94.6
About how often does your whole family get together with relatives or friends?	1/year or <	2.5	5.7	8.3	9.0	3.8	9.9	10.7
	Few/year–1/month	32.2	35.0	35.1	33.7	30.8	36.3	25.0
	2–3/month or >	65.3	59.3	56.6	57.3	65.4	53.8	64.3
Does your child ever see his or her father or father figure?	Yes	98.1[P,e]	86.3[P,e]	91.7[P,e]	74.8[P,e]	93.2[P]	83.5[P]	96.4
About how often does your child spend time with his/her father or father figure?	1/day or >	77.9[P,e]	51.4[P,e]	57.0[P,e]	30.2[P,e]	71.8[P]	55.7[P,e]	76.8
	1/week–1/day	16.4	24.8	24.6	32.7	17.2	22.4	16.1
	Few/year–1/month	4.7	18.1	14.0	26.8	7.9	14.7	5.4
	DK or no dad	1.0	5.6	4.4	10.3	3.1	7.2	1.8
About how often does your child spend time with his/her father or father figure in outdoor activities?	1/day or >	23.7[P]	23.9[P]	23.1[e]	14.8	29.3	32.5[e]	21.4
	1/week–1/day	62.1	37.4	43.8	32.9	51.7	37.3	53.6
	Few/year–1/month	11.2	28.7	23.6	29.1	12.7	19.1	23.2
	DK or no dad	3.1	9.9	9.5	23.2	6.3	11.1	1.8
How often does your child eat a meal with both mother and father or father figure?	1/day or >	68.6[P]	51.9[P,e]	49.7[P,e]	28.0[P,E]	69.2[P]	58.0[P,e]	59.6
	1/week–several/week	21.5	11.6	23.4	23.1	17.7	11.5	28.1
	1/month or <	2.0	6.0	6.6	8.7	2.3	5.3	3.5
	1/month or no dad	7.9	30.5	20.3	40.2	10.7	25.2	8.8
When your family watches TV together, do you or your child's father or father figure discuss TV programs with him/her?	Yes	89.6[P,e]	79.1[P,e]	79.0[P,e]	61.7[P,e]	81.5[P]	69.6[P]	87.7
Sometimes children get so angry at their parents that they say things like, "I hate you," or swear in a temper tantrum. Please check which actions you would take if this happened. (Circle all that apply)	Grounding	30.7[P]	42.7[P]	38.8	38.5	33.8	39.8	33.3
	Spanking	27.2[e]	35.7	48.5[e]	50.0[e]	26.5	26.4[e]	24.6
	Talk with child	85.5	79.9[e]	74.9[e]	67.3[e]	83.5[P]	73.6[P]	87.7
	Give him/her household chore	9.1	11.1	13.7	15.8	11.1	16.9	15.8
	Ignore it	10.1	9.4[e]	4.2[e]	2.8[e]	6.0	6.4	14.0
	Send to room for more than 1 hr	19.9	27.9	27.8	28.6	29.0	35.1	21.1
	Take away his/her allowance	4.3	6.0	9.8	10.9	6.4	9.0	1.8
	Take away TV or other privileges	30.8	29.5	34.2	30.3	34.8	37.9	31.6

Note: Asian Americans are combined nonpoor and poor because there were too few Asian Americans with incomes below poverty. HOME = Home Observation for Measurement of the Environment; Ok = don't know.
[e] Ethnicity effect size above .20; [E] ethnicity effect size above .50; [P] poverty effect size above .20; [P] poverty effect size above .50.

Table 5 Percent Responses to HOME Items by Ethnic Group and Poverty Status: Homes of Children from 10 to 14 Years, 11 Months

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Observational items		N = 1,453	N = 318	N = 938	N = 963	N = 632	N = 322	N = 41
Learning stimulation								
About how many books does your child have of his/her own?	None	.3[P,E]	3.5[P,E]	2.6[P,e]	9.2[P,e]	2.2[P,e]	10.2[P,e]	—
	1 or 2	8.8	23.3	32.3	43.6	27.1	46.3	43.3
	3–9	17.3	22.3	23.6	21.1	23.7	23.3	6.7
	10 or >	73.5	50.9	41.6	26.1	47.0	20.2	50.0
Is there a musical instrument (e.g., piano, drum, guitar, etc.) that your child can use here at home?	Yes	55.3[P,e]	41.8[P,e]	39.1[P,e]	24.8[P]	38.1[P,e]	23.1[P]	46.7
Does your family get a daily newspaper?	Yes	52.6[P]	32.6[P]	44.4	35.3	44.8[P]	26.7[P]	50.0
Do you or someone in your family encourage your child to start and keep doing hobbies?	Yes	95.1[P]	88.6[P]	91.2	86.0	91.5[P]	77.5[P,e]	96.7
Does your child get special lessons or belong to any organization that encourages activities such as sports, music, art, dance, drama, etc.?	Yes	68.7[P,e]	54.4[P,e]	60.3[P]	48.6[P]	54.5[P,e]	31.6[P,e]	56.7
How often has any family member taken or arranged to take your child to any type of museum (children's, scientific, art, historical, etc.) within the past year?	Never	20.0[P]	32.0[P,e]	23.4[P]	42.4[P]	28.6[P]	46.7[P]	23.3
	Several/year or <	74.8	61.1	66.2	46.9	65.5	44.2	73.3
	1/month or >	5.2	7.0	10.4	10.7	5.9	9.0	3.3
How often has a family member taken or arranged to take your child to any type of musical theatrical performance within the past year?	Never	41.4	46.4	35.5[P]	50.5[P]	44.0[P]	61.4[P,e]	63.3
	Several/year or <	56.4	50.2	57.5	41.1	52.4	32.1	33.3
	1/month or >	2.1	3.5	7.0	8.4	3.7	6.5	3.3
Other								
How often is your child expected to make his/her own bed?	> half the time	84.4[e]	87.0	93.3[e]	88.9	91.3[P]	83.1[P]	100.0
How often is your child expected to clean his/her own room?	> half the time	94.1	92.1	95.2	90.5	93.2[P]	86.4[P]	100.0
How often is your child expected to pick up after himself/herself?	> half the time	96.1	94.6	96.4	92.5	95.9[P]	88.6[P]	100.0
How often is your child expected to help keep shared living areas clean and straight?	> half the time	90.9	92.4	92.3	89.4	93.6	89.0	96.7
How often is your child expected to do routine chores such as mow the lawn, help with dinner, wash dishes, etc?	> half the time	86.3	83.3	85.0	84.4	87.0[P]	77.5[P]	80.0
How often is your child expected to help manage his/her own time (get up on time, be ready for school, etc.)?	> half the time	90.3	85.1	89.5	89.4	95.4[P,e]	89.0[P]	93.3
About how often does your whole family get together with relatives or friends?	1/year or <	4.6	8.9	7.7	8.0	4.9	9.1	13.3
	1/month–few/year	37.2	36.4	39.7	35.5	33.7	36.0	36.7
	2–3/month or >	58.2	54.7	52.6	56.5	61.4	54.9	50.0
Does your child ever see his or her father or father figure?	Yes	96.8[P,e]	87.9[P,e]	89.7[P,e]	72.5[P,e]	92.5[P]	83.5[P]	97.6

(*Continued*)

Table 5 *Continued*

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Interview items		N = 1,422	N = 316	N = 922	N = 938	N = 626	N = 317	N = 41
Parental responsiveness								
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you shown your child physical affection (kiss, hug, stroke hair, etc.)?	None	3.0[P,e]	5.1[P,E]	12.2[E]	15.1[e]	6.6[P]	17.7[P]	7.1
	1 or 2	5.7	6.6	16.2	19.3	9.2	11.6	
	3–6 times	16.5	30.1	30.5	30.5	30.4	31.7	
	7–13 times	38.6	31.6	26.9	27.2	32.3	25.3	53.6
	> than 13 times	36.2	26.6	14.2	7.8	21.5	13.7	17.9
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you praised your child for doing something worthwhile?	None	3.4[e]	6.7[e]	11.7[e]	18.5[e]	13.2	22.4	—
	1 or 2 times	17.6	19.2	30.6	27.3	25.3	31.6	35.7
	3–6 times	42.8	42.8	39.3	35.3	40.1	26.5	32.1
	> than 6 times	31.3	31.3	18.4	18.9	21.4	19.4	32.1
Spanking								
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you had to spank your child?	None	89.1[P]	81.4[P]	82.1[P]	73.6[P]	89.6[P]	76.1[P]	89.7
	1–2 times	9.8	11.9	15.3	18.2	8.3	17.5	10.3
	3–7 times	1.0	4.8	2.1	6.2	1.8	5.7	—
	8 or more times	.1	1.9	.6	2.0	.3	.7	—
Other								
About how often does your child spend time with his/her father or father figure?	1/day or more	69.4[P,e]	45.9[P,e]	44.7[P,e]	24.0[P,e]	62.9[P]	41.3[P,e]	80.0
	1–7 times/week	19.8	28.4	26.0	30.4	20.5	29.0	10.0
	Few/year–1/month	8.3	21.5	20.4	23.3	10.5	18.2	3.3
	DK or no dad	2.5	4.3	9.0	22.3	6.2	11.5	6.6
About how often does your child spend time with his/her father or father figure in outdoor activities?	1/day or more	17.7[P,e]	18.0[P]	14.8[e]	12.3[e]	21.5[P]	25.6[P]	10.0
	1–7 times/wk	58.6	39.0	36.2	28.7	49.7	31.1	70.0
	Few/year–1/month	18.3	29.8	31.3	24.6	20.4	24.6	13.3
	DK or no dad	5.4	13.2	17.7	34.4	8.4	18.7	6.6
How often does your child eat a meal with both mother and father or father figure?	1/day or more	64.2[P,e]	51.0[P,e]	37.4[P,E]	25.7[P,E]	69.9[P,e]	48.2[P,e]	40.0
	1–7 times/week	23.1	11.8	25.6	19.9	13.1	14.0	53.3
	Few/year–1/month	1.2	5.6	7.7	6.0	1.8	6.5	—
	DK or no dad	11.5	31.6	29.3	48.4	15.2	31.3	6.7
When your family watches TV together, do you or your child's father or father figure discuss TV programs with him/her?	Yes	89.0[P,e]	78.9[P,e]	72.3[P,e]	58.5[P,e]	77.0[P]	62.8[P]	96.7
Sometimes children get so angry at their parents that they say things like, "I hate you," or swear in a temper tantrum. Please check which actions you would take if this happened. (Circle all that apply)	Grounding	49.9	49.7	52.2	54.4	48.2	48.7	36.7
	Spanking	17.1[e]	21.5[e]	35.8[e]	36.5[e]	12.0[P,e]	22.9[P,e]	16.7
	Talk with child	86.2[e]	85.2[e]	73.5[e]	72.3[e]	81.2	76.7	96.7
	Give him/her household chore	16.5	18.7	18.6	25.9	15.2	20.5	10.0
	Ignore it	8.8	8.6	4.3	5.6	5.8	3.3	3.3
	Send to room for more than 1 hr	24.3	32.6	24.4	30.7	28.9	34.1	23.3
	Take away his/her allowance	7.9[e]	11.3[e]	20.6[e]	26.4[e]	12.0	15.4	13.3
	Take away TV, phone, or other privileges	47.0	37.7[e]	47.4	48.7	44.4	49.2	30.0

(*Continued*)

Table 5 *Continued*

HOME Items	Coding	European American		African American		Hispanic American		Asian American
		Nonpoor	Poor	Nonpoor	Poor	Nonpoor	Poor	
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you grounded your child?	Never	79.6	71.4[e]	72.4[P]	57.0[P]	75.6[P]	62.6[P]	82.8
	Once	15.4	15.2	17.4	17.6	16.9	13.1	13.8
	2 or 3 times	4.4	7.9	7.5	17.4	5.7	16.5	3.4
	> than 3 times	.6	5.4	2.8	8.1	1.8	7.7	—
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you taken away your child's privileges?	Never	79.3	74.4	77.5	69.3	76.5[P]	67.0[P]	92.9
	Once	14.9	13.9	13.3	12.8	13.1	13.8	7.1
	2 or 3 times	4.9	7.6	6.5	12.3	8.0	12.5	—
	> than 3 times	.9	4.1	2.7	5.6	2.3	6.7	—
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you sent your child to his/her room?	Never	64.3	56.1	69.5	61.2	65.2	59.7	58.6
	Once	18.7	16.2	15.7	16.5	16.2	14.0	17.2
	2 or 3 times	12.2	17.8	11.3	14.8	13.4	15.7	10.3
	> than 3 times	4.8	9.9	3.5	7.4	5.3	10.6	13.8
Sometimes kids mind pretty well and sometimes they don't. Sometimes they do things that make you feel good. How many times in the past week have you taken away your child's allowance?	Never	97.0[P]	91.0[P,e]	92.0[P]	82.2[P]	92.9[P]	87.0[P]	100.0
	Once	2.0	4.8	4.0	7.5	4.2	6.1	—
	2 or 3 times	1.0	4.2	3.9	10.3	3.0	6.8	—

Note: Asian Americans are combined nonpoor and poor because there were too few Asian Americans with incomes below poverty. HOME = Home Observation for Measurements of the Environment; Ok = don't know.
[e] Ethnicity effect size above .20; [E] ethnicity effect size above .50; [P] poverty effect size above .20; [P] poverty effect size above .50.

erty and those living in poverty. Because relatively few Asian American families were living in poverty, only percentages for the total group of Asian Americans are provided. Although analyses were done on the total NLSY sample and on the combined poverty and nonpoverty subsamples within each ethnic group (except Asian Americans), the tables only report results for the subsamples due to space limitations (results from the total sample and each ethnic group sample can be obtained from the authors). Results are described for each of the HOME-SF item clusters described in the Methods section; specifically, learning stimulation, parental responsiveness, spanking, teaching, and physical environment. Results are also described for father involvement, although father involvement was not one of the home environment factors identified using factor analysis.

In an effort to provide a more comprehensive framework for understanding children's experiences at home, Cohen's *h* effect sizes were also computed (Cohen, 1987) for poverty and ethnicity. Specifically, for each of the six ethnic/poverty status groups (Asian Americans were not analyzed due to limited sample size and diversity) two effect sizes were calculated (tables containing the effect size for each ethnic/poverty status group on all HOME-SF items can be obtained from the first author): (1) a standardized difference between the proportion of families from the target group receiving credit on a HOME-SF item and the proportion of all families from the same income group but not the same ethnic group that received credit on the item (an ethnic group effect size for the target group), and (2) a standardized difference between the proportion of families from the target group that received credit on a HOME-SF item and the proportion of all families from the same ethnic group, but not the same income group, that received credit on the item (a poverty status effect size for the target group). Tables 2 through 5 display the six subgroups in which there was a small effect, $.20 < h < .50$, or a moderate effect, $h \geq .50$; the values for *h* correspond to the criteria for small and medium effects established by Cohen (1987). For poor families with children under 3 years of age, effect sizes for ethnicity ranged from nonsignificant to moderate, $h = .51$, with a mean of .17; for nonpoor families, effect sizes ranged from nonsignificant

to small, $h = .45$, with a mean of .16. For poor families with children ages 3 to 5, effect sizes for ethnicity ranged from nonsignificant to moderate, $h = .70$, with a mean of .16; for nonpoor families, the effect sizes ranged from nonsignificant to moderate, $h = .64$, with a mean of .17. For poor families with children ages 6 to 9, effect sizes for ethnicity ranged from nonsignificant to moderate, $h = .55$, with a mean of .12; for nonpoor families effect sizes ranged from nonsignificant to small, $h = .42$, with a mean of .12. For poor families with children ages 10 to 14, effect sizes for ethnicity ranged from nonsignificant to moderate, $h = .52$, with a mean of .16; for nonpoor families, effect sizes ranged from nonsignificant to moderate, $h = .56$. The average effect sizes for poverty were greater than for ethnicity. Among European American, African American, and Hispanic American families these were (1) .24, $h \leq .62$; .23, $h \leq .47$; and .21, $h \leq .54$, respectively, for children less than 3; (2) .29, $h \leq .69$; .23, $h \leq .57$; and .24, $h \leq .61$, respectively, for children 3 to 5; (3) .21, $h \leq .56$; .18, $h \leq .55$; and .18, $h \leq .41$, respectively, for children 6 to 9; and (4) .19, $h \leq .48$; .18, $h \leq .45$; and .25, $h \leq .55$, respectively, for children 10 and over.

Although we did not have an a priori hypothesis that the effect of poverty would be proportional across ethnic groups, additional analyses were conducted to test the interaction between ethnic group status and poverty status for each item separately. After making Bonferroni adjustments in α levels for the total number of statistical tests performed, no interaction effects were found for any item at any age period. That is, although significant differences among ethnic groups emerged on most HOME-SF items, the effect of poverty on the odds of receiving credit for an item was relatively proportional for European American, African American, and Hispanic American children.

Learning Stimulation

There were marked differences in the types of learning materials American children had access to in their home places. Likewise, there were marked age-related differences in the types of materials children had to play with and learn from. Infants and adolescents had fewer books than children in early and middle childhood. Although over 90% of children in the two middle-age groups had three or more of their own books, fewer than 70% of infants and adolescents had several books. Infants were more likely to have five or more cuddly or role-playing toys (85.8%) than to have three or more push toys (72.6%). Moreover, 3- to 5-year-old children were more likely to have access to a tape or record player (70.9%) than children ages 6 to 9 (36.2%) or 10 to 14 (39.8%) were to have access to a musical instrument.

There were also ethnic group and poverty status differences in children's access to learning materials. In all four age categories, a higher percentage of African American and Hispanic American children had no books, and a lower percentage had 10 or more books (Tables 2–5). Also, during middle childhood and adolescence, these two ethnic groups were over 10% less likely to have access to a musical instrument than European Americans or Asian Americans (Tables 4–5). However, poverty status had a greater impact on access to learning materials than did ethnicity. In general, nonpoor children were far more likely than poor children to have three or more children's books in infancy (mean effect size = .37), early childhood (mean effect size = .57), middle childhood (mean effect size = .25), and adolescence (mean effect size = .47). As a rule, nonpoor European American children were substantially more likely to have large numbers of books in the home. Likewise, European American children were substantially more likely than other children to have access to other language and learning materials (e.g., record or tape players). Conversely, both poor Hispanic Americans and poor African Americans were substantially less likely to own things such as tape players.

The majority of NLSY parents provided their children with a variety of enriching out-of-home experiences. Over 70% of infants got out of the house four or more times a week, and over 75% were taken to the grocery store at least once a week. The only age comparisons that were possible indicate that 3- to 5-year-olds were not taken to the museum as much (63.8%) as either 6- to 9-year-olds (72.3%) or 10- to 14-year-olds (70.1%). In addition, the percentages of children in middle childhood and adolescence who were taken to the theater were about the same (54.2% and 54.4%, respectively).

The percentage of infants who got out of the house and who were taken to the grocery store was not much different across ethnic groups, except for Hispanic Americans, who seldom got out of the house and were least likely to get out of the house frequently (Table 2). The reverse was true of Hispanic Americans with regard to taking their children to the grocery store. A relatively high percentage of Hispanic American infants were taken to the grocery store frequently. Few ethnic differences were observed with regard to how often children were taken to a museum and the theater, except that African American children were most likely to frequently go to a museum and theater in all age groups (effect sizes for ethnicity were always $< .20$).

Poverty status had a relatively greater effect on the variety of potentially enriching places and events that children experienced. These differences were found in

all ethnic groups and at all age periods. For all ethnic groups, nonpoor children were much more likely to be taken to the museum as poor children (mean effect size = .35). Nonpoor children were also more likely to be taken to the theater than poor children during middle childhood and late adolescence.

Parental Responsiveness

Most mothers in the NLSY sample spoke to their children during the interview and encouraged their children to talk. For children birth to 2 and 3 to 5 years old, approximately 90% of mothers spoke to their children during the home visit at least twice. Somewhat fewer mothers of 6- to 9-year-olds were observed talking to their child twice or more (74.4%). In response to the child's demands for attention, more mothers responded verbally to 3- to 5-year-olds (87.1%) than was the case for infants (78.3%) or 6- to 9-year olds (83.9%). In effect, whereas mothers of infants were more likely to spontaneously speak to the infants than to respond to them verbally (78.3%), the pattern was reversed for mothers of 6- to 9-year-olds. Few ethnic group differences emerged except that mothers of African American and Hispanic American 6- to 9-year-olds responded to their children relatively less often (Table 4). Across all ethnic groups, nonpoor mothers were more likely than poor mothers to speak to their children twice or more or to respond to their children verbally during the visit.

Approximately 90% of mothers with children in early childhood and middle childhood showed positive feelings when talking about their children. Fewer 3- to 5-year-olds were caressed, hugged, or kissed (52.7%) than infants (80.6%). In infancy and early childhood, African American children were less likely to receive physical affection from their mothers. The difference among ethnic groups was greatest among 3- to 5-year-olds. Across all ethnic groups and age groups, more affluent mothers were more likely to show both verbal and physical affection toward their children. The added effects of poverty and ethnicity meant that some subgroups of children were far more likely than other subgroups to receive demonstrations of affection. For example, more affluent Hispanic American and European American mothers were about twice as likely to show positive feelings and to caress, kiss, or hug their 3- to 5-year-olds than were poor African American mothers (Table 3).

Spanking

Observed spanking decreased as children grew older. Although mothers reported that approximately 29% of infants and children 3- to 5-years of age had been spanked three or more times in the past week, only 15% of 6- to 9-year olds, and 4% of 10- to 14-year-olds were reported to have received this amount of spanking. The decrease was also seen in the percentage of mothers who physically restricted their children during the interview. Over 20% of infants were physically restricted, and just over 8% of 3- to 5-year-olds were physically restricted. For all four age periods, African Americans had the lowest percentage in the no spanking category. In the two middle categories of spanking frequency, there was little evidence of ethnic group difference once poverty status was taken into account. No Asian Americans reported spanking their children eight or more times a week, whereas all other ethnic groups reported some occurrences of high-frequency spanking at all age levels. Parents living below the poverty line were more likely to spank their children across all age levels, and across all ethnic groups. Although a higher percentage of African American parents reported using spanking as a means of discipline, it was poor European Americans who most often reported spanking their children eight or more times per week. The added effects of ethnic group status and poverty status were most pronounced among families with children 10- to 14-years of age. For example, a higher percentage of poor African American parents (26.4%) and poor Hispanic American parents (23.1%) reported spanking their children three or more times a week than other parents.

Teaching

Although just over one half of all mothers read to their infants (51.6%), and 3- to 5-year- olds (55.0%) at least three times a week, the percentage dropped when the children were between 6 and 9 years of age (35.6%). The pattern of increase from infancy to early childhood was followed by a decrease in middle childhood for all ethnic groups. However, from infancy to early childhood, the percentage of Asian Americans who read to their child three or more times a week increased considerably (17%) compared with Hispanic Americans (7%), European Americans (5%), and African Americans (2%). Whereas European Americans were much more likely to frequently read to infants (63.7%) than were Asian Americans (44.2%), African Americans (37.9%), and Hispanic Americans (34.9%), the dramatic increase among Asian Americans closed the gap by the time children went to school. At all three age levels, both African Americans and Hispanic Americans were significantly less likely to read to their children than European Americans and Asian Americans (Tables 2–4).

There were clear ethnic group and poverty status

differences in the percentage of mothers who read to their children, especially prior to school entry when effect sizes were typically in the .30 to .50 range. During infancy and early childhood, and for each ethnic group separately, nonpoor mothers were twice as likely to read to their children three or more times a week than were poor mothers. In middle childhood, although nonpoor mothers were still more likely to read to their children than were poor mothers, the impact of poverty status subsided somewhat in middle childhood. Furthermore, the added effects of ethnicity and poverty status were more pronounced than either demographic variable alone. For example, nonpoor European Americans were more than twice as likely to read to their children at least three times a week during infancy and early childhood (about 70%) compared with poor African Americans and Hispanic Americans (<⅓).

Approximately nine out of ten 3- to 5-year-olds were helped by a family member to learn numbers, colors, and the alphabet. Just over 75% were helped to learn shapes and sizes. Although there were not large differences among ethnic groups, $h < .30$, a lower percentage of Hispanic American children were helped with the alphabet, and lower percentages of both Hispanic American and African American children were helped with shapes and sizes (Table 3). Once again, for all ethnic groups, and for each type of help from family members, those not in poverty were more likely to spend time helping their children learn.

For children in middle childhood and adolescence, mothers were asked if their child was encouraged to have hobbies, if their child was provided special lessons, and whether parents discussed TV programs with their child. For each age period, and for each ethnic group, nonpoor families were roughly twice as likely as poor families to provide these extras. A higher percentage of children 10 years of age and older were provided with special lessons (56.6%) than were children ages 6 to 9 (46.1%). Approximately three quarters of the parents discussed TV programs at both age levels, and approximately 90% of the children were encouraged to have hobbies at both age levels. At both age periods a higher percentage of European Americans and Asian Americans was credited for all three of these questions than were either African Americans or Hispanic Americans (most effect sizes were $< .30$). Nonpoor European American families were more likely than all other groups to discuss TV programs at both age levels.

Physical Environment

A smaller percentage of 6- to 9-year-olds had a safe play environment (71.0%) than did children in early childhood (92.1%) and infancy (87.0%). There were no meaningful ethnic group differences in safety hazards observed in the homes of children under age 6. Although not substantial, there were small ethnic group differences among homes of 6- to 9-year-olds, $h < .30$, with African American homes the least likely to be safe (67.3%), and a higher percentage of Asian American and European American homes judged to be safe by the interviewer (76.3% and 74.4%, respectively). Poverty status appeared to have a greater effect on home safety than did ethnic group. Across all ethnic groups and across all three age groups assessed, those not in poverty were more likely to have a safe home environment than were those who were poor (mean effect size $> .30$). The effect of poverty status on home safety was stronger during infancy and early childhood than during middle childhood.

There were no meaningful differences in the aesthetics of children's home environments from early childhood to middle childhood: homes were essentially the same with regard to dark and monotonous interiors (10.1% and 10.3%, respectively), clean interiors (91.6% and 91.3%, respectively), and minimally cluttered interiors (82.2% and 83.7%, respectively). There were also no noticeable ethnic group differences in cleanliness and clutter for either age period. At both age periods, however, a considerably higher percentage of African American homes were rated dark and monotonous (approximately 16.0%) than any other ethnic group (Tables 3 and 4). However, the homes of poor families were judged to be dark and monotonous and unclean more often than the homes of nonpoor families (effect sizes ranged from .24–.43). They were also judged as having more clutter (effect sizes ranged from .11–.21). Although greater than 80% of poor homes in every ethnic group were judged to be reasonably clean, more than 90% of nonpoor homes were judged to be clean. Nonpoor homes were also three to four times less likely to be judged dark and monotonous than poor homes.

Father Involvement

Because there were variations in the HOME-SF items that dealt with father involvement at each of the four age periods assessed, the same items did not consistently emerge as a separate factor in the factor analyses done on HOME-SF items. Nonetheless, because of the presumed importance of paternal involvement in children's lives, we decided to describe findings pertaining to the two questions asked concerning fathers at all four age periods: (1) Does child ever see father? and (2) How often does child eat with both mother and father? A lower percentage of children saw their

father during the first two age periods (84.4% and 78.2%, respectively) than the second two age periods (90.3% and 88.0%, respectively). Likewise, regardless of ethnic group, a smaller percentage of children ate with both their mother and father at least once a day as they grew older (birth–age 2 = 66.6%, age 3–5 years = 65.3%, age 6–9 years = 57.5%, age 10–14 years = 49.9%). Given the well-documented absence of many African American fathers, it was not surprising that a much smaller percentage of African American children had both forms of contact at all age periods. However, the difference was due primarily to the fact that such a high percentage of African American families lived in poverty. Nonpoor African American children were 1.2 to 1.4 times as likely to see their father daily as compared with all other subgroups of children combined. Nonpoor children of all ethnic groups were four to five times as likely to see their father daily during the first three age periods, and three times more likely in adolescence to see their father daily than were their poor counterparts. Effect sizes for poverty were generally greater than .40. Of all groups examined, poor African American children were most likely to be isolated from their fathers; that is, a higher percentage of poor African American children either never had contact with their fathers or had contact less than once a month. The differences among ethnic groups however, were not as great for spending time with father at least once a week as they were for seeing father daily.

Although the percentage of children spending time with father at least once a week was higher in adolescence (48.5%) than early childhood (37.1%), the percentage of children who spent time with fathers outdoors decreased slightly from middle childhood to adolescence (90.8% and 84.3%, respectively). Notably, there were no ethnic group or poverty status differences in how often children saw family and friends.

DISCUSSION

Data from the NLSY made it possible to describe what children in the United States experience in their home environments with regard to marker indicators of environmental quality most often used in developmental studies. The population of the United States is very diverse—and growing more so (U.S. Department of Commerce, 2001). That diversity makes it difficult to draw generalizations about what children in the United States experience and how their experiences connect to the course of development. Thus, the NLSY offers a frame of reference that developmentalists can use to interpret findings from smaller studies on home environments. The NLSY sample, although not completely representative of the U.S. population, is valuable in that the original cohort (women between the ages of 14 and 21) was selected in such a way as to be a generally representative cohort of the U.S. population in 1979. Nonetheless, it is important to note that the oldest mothers were 36 at the time of the 1994 data collections. For the 14-year-old children, mothers' age at the time of the child's birth ranged only from 15 to 23. Thus, the sample is less representative of the home environments of children in early adolescence than is the case for children at younger ages. By the same token, one of the advantages of the NLSY sample is the oversampling of poor African Americans and Hispanic Americans. The oversampling made it possible to derive more reliable estimates of children's experiences in these two large demographic groups. Few, if any, studies have examined the number (N = 124) and breadth of home environment indicators for such a diverse sample from infancy through midadolescence.

The large number of home environment indicators included in the four versions of the HOME-SF, coupled with the large number of analyses performed on these data, makes it difficult to summarize the findings briefly. So, we begin by discussing findings as they relate to age, poverty, and ethnicity.

One of the clearest—and least surprising—findings from this study is that the frequency with which children are exposed to particular actions, objects, events, and conditions in their homes changes markedly from infancy through adolescence. For example, during the visit when HOME-SF data were collected, mothers were somewhat more likely to talk to children under the age of 6 than to children ages 6 to 9. They were more likely to respond to bids for attention from 3- to 5-year-olds than at any other age. Infants were more likely to be kissed or caressed than were older children. The amount of spanking also declined with age, as did the percentage of children who had safe play areas. Infants and adolescents had fewer books designed just for them than did children from intermediate age groups; reading to children peaked during early childhood and declined thereafter. Not surprisingly, the types of toys and learning materials available in the home changed with age. Likewise, children in middle childhood and adolescence were also more likely to be taken to places such as museums than were younger children. As children got older, they were increasingly less likely to eat a meal every day with both their mother and father. Finally, children in early adolescence were expected to take more responsibility for household maintenance than were children in middle childhood. These age-related trends are consistent with reports on less representative samples in other studies; and, in the aggregate, make it

clear how daily life experiences for children change as they mature. There is a reasonable degree of consensus among developmentalists that there is a dynamic interplay between children and their environments, but there is some divergence of opinion regarding the degree to which children's experiences affect the course of development and the degree to which children determine the experiences they get. (For a discussion of these various points of view, see Lewis, 1997; Scarr & McCartney, 1983; Wachs, 2000.) Part 2 (Bradley et al., 2001) of this study examined relations among aspects of the home environment and various components of development from infancy through adolescence.)

Results with respect to poverty status and ethnicity made two things abundantly clear: (1) there were differences in the likelihood that children would be exposed to particular experiences in the home environment as a function of both their ethnicity and their family's economic circumstances, and (2) there was variability on each indicator examined in every major economic and ethnic group. Diversity was greater on some indicators than others (e.g., almost all children between 10 and 14 were expected to pick up after themselves more than one half of the time; whereas the percentages of children expected to make their own beds over one half of the time ranged from 84% for European American children to 100% for Asian American families). However, variability was present for all indicators. Taken as a whole, this variability corroborates the assertion of García Coll and colleagues (1995, 1999) that measures of central tendency often belie the diversity present within demographic groups.

There are several ecological–developmental models that link economic hardship to the quality of parenting children receive (Brody & Flor, 1998; Conger et al., 1997; McLoyd, 1990, 1999). According to these models, parents who experience the stresses connected to economic hardship often display less responsiveness to their children and more harsh punishment. Results from this study both confirm and expand on these propositions. For example, poor mothers were less likely than nonpoor mothers to communicate effectively with their children and less likely to show both verbal and physical affection toward their children. Nonpoor mothers tended to choose forms of discipline such as talking and ignoring, and were less likely to ground or spank their children, give them a chore, send them to their room, or take away their allowance. At all age levels, and across all ethnic groups, parents living below the poverty level were more likely to spank their children and less likely to monitor them. Nonpoor mothers were also more likely to expect their children to perform a number of chores around the house. Importantly, nonpoor children were substantially more likely to have meaningful contact with their fathers than were poor children. The absence of fathers in the lives of poor children is noteworthy, both because of its generally negative consequences for child well-being and the fact that the impact of poverty on well-being is exacerbated in single-parent homes (Cabrera, Tamis-LeMonda, Bradley, Hofferth, & Lamb, 2000; Hanson, McLanahan, & Thomson, 1997; Lamb, 1997). On the positive side, there were no poverty status differences in how often children saw family and friends, except that more poor European Americans reported being severely isolated (i.e., seeing family and friends less than once a year) than did nonpoor European Americans (5.7% versus 2.5%). A similar pattern emerged for Hispanics (9.9% versus 3.8%), but no such pattern emerged for African Americans.

There is a long history of research indicating that economic hardship equates to less access to material goods and services, fewer opportunities for stimulating experiences, and a greater likelihood of exposure to potentially damaging conditions (Bradley & Whiteside-Mansell, 1997; Huston et al., 1994). This study, like others before, shows that poverty decreases the likelihood that children will be exposed to developmentally enriching materials and experiences, both inside and outside of the home. Across all ethnic groups, nonpoor children were much more likely to have 10 or more developmentally appropriate books than their poor counterparts. They were also much more likely to have a family member read to them, teach them school-related concepts, and provide them with special lessons to increase their skills. Likewise, for all ethnic groups, nonpoor children were approximately twice as likely to be taken to the museum as poor children, and 1½ times as likely to be taken to the theater. Such findings are consistent with recent intensive investigations on differences in the daily experiences of children living in different socioeconomic strata (Hart & Risley, 1995).

Results from this study show that being poor affects nearly every aspect of children's home lives. Poverty effects were prevalent in all six environmental domains examined: from parental responsiveness to parental teaching, from the quality of the physical environment to the level of stimulation for learning present, and from the likelihood of being spanked to the likelihood of having significant contact with one's father. Indeed, of the 124 HOME-SF items examined, nonsignificant poverty effects were noted on only 15 (or 12% of the total), even when adjusting α levels for the number of statistical tests conducted. Moreover, poverty status made a difference irrespective of whether the mother reported on what happened at home or whether the home visitor obtained informa-

tion via direct observation. The mean effect size for poverty status across all ethnic groups and all age periods was small, $h = .22$, but on about one fourth of the indicators, the effect size was greater than .30. It was also proportional across ethnic groups for every item. Taken as a whole, these findings confirm, in a far more detailed way, how different the daily lives of poor children tend to be than the daily lives of children who are more affluent (Bradley & Whiteside-Mansell, 1997; Duncan & Brooks-Gunn, 1997; Huston et al., 1994).

Current theories about ethnic and racial differences in how parents parent and how the home environments of one group differ from those of another suggest quite complex relations (Gjerde, 2000; Masten, 1999). When predicting the impact of ethnicity on the likelihood a child will be exposed to a particular action, object, event, or condition, one is confronted not only with differences that emerge from culture, but also with the fact that members of American minority groups are playing out their cultural beliefs and traditions against a dominant majority culture, and ethnicity is confounded with socioeconomic status and (for some) issues connected with recency of immigration (García Coll et al., 1996, 1999). Results from this study show both similarities and differences across ethnic groups in terms of the percentage of children who were exposed to various acts, events, objects, and conditions within their home environments. For example, about 90% of all mothers (regardless of group) spoke to their infants during the time of the visit; and the immediate play environments of about 85% to 90% of infants (regardless of group) appeared safe. In addition, relatively few mothers (5% to 11%) restricted their preschoolers during the visit, between 90% and 95% reported helping their children learn numbers, about 70% of elementary school-age children (regardless of group) were encouraged to talk during the visit, and most homes (90%) in all groups were judged to be reasonably clean. For children in early adolescence, there were few reported differences in the frequency with which children were sent to their rooms for breaking a family rule.

For most indicators, however, there was evidence of ethnic group differences. There were indicators on which every group had a high percentage of families receiving "credit" for the item, yet some groups were even higher than others (e.g., at least 70% of all families of elementary school-age children reported discussing TV programs with their child, but nearly 88% of European Americans and Asian Americans reported this activity). There were other indicators for which the majority of families in every group did not receive "credit," yet some groups were even lower than others (e.g., 32% of poor Hispanic families reported that fathers spent time outdoors with elementary school-age children every day, whereas <24% of families in the other ethnic groups made this claim). Overall, European American families and Asian American families more often received credit on HOME-SF items than did African American and Hispanic American families, within both poor and nonpoor groups. Sometimes the differences were great; more often they were small (the mean effect for ethnicity was <.20 for all age periods). For the most part, the differences observed among ethnic groups reproduced differences reported in other studies. For example, African American mothers displayed overt physical affection during the visit less often and reported using physical punishment more often (Kelley et al., 1992). European American and Asian American households contained materials for learning and recreation more often. European American mothers also tended to read to their children more often, albeit the percentage of Asian American mothers who read to their children was equal to European Americans after infancy. Fathers were present in the homes of African American children less frequently than for the other three ethnic groups. Group differences were less however, for seeing father at least once a week than for seeing father daily.

One of the distinct advantages of the NLSY dataset was that it made possible the examination of variability within ethnic groups and increased the likelihood of separating effects due to ethnicity from effects due to other demographic factors. The results with respect to spanking were interesting in this regard—in effect, they ran somewhat counter to the prevailing assumption that African American children are spanked more frequently than children from other ethnic groups. Although a higher percentage of African American mothers reported spanking their children than was the case for the other ethnic groups, for children ages 3 to 5, poor African American mothers were actually observed hitting or restricting their children less often (5.8% and 8.5%, for children ages 3 to 5 and 6 to 9, respectfully) than poor European American (8.7% and 10.8%, for children ages 3 to 5 and 6 to 9, respectively) or poor Hispanic American mothers (8.6% and 10.3%, for children ages 3 to 5 and 6 to 9, respectively). This finding is significant in light of research showing negative consequences of harsh punishment by European American parents but not by African American parents (Deater-Deckard, Dodge, Bates, & Pettit, 1996). Although it is true that African American families, regardless of income, were more likely to use spanking as a means of discipline, they were no more likely than European American families to spank their

infants three or more times per week; and poor European American families were the most likely to spank children eight or more times per week. The pattern for frequent spanking was similar, although not as robust, for children ages 3 to 5. These results highlight the advantage of using more precise estimates of spanking frequency than simple yes or no options (Day et al., 1998).

Although in certain instances it can be useful to note differences among cultural (ethnic) groups, those differences may be "secondary to accounting for the relevance of the variables within a particular group" (Cocking, 1994, p. 402)—in effect, understanding the meaning within context. It is important to bear in mind that the indicators on the HOME-SF, although carefully drawn because of their presumed importance for children's development, have emerged in an historical/ethnic context that is dominated by modern Western thought (see discussions by Berry, Poortina, Segall, & Dasen, 1992; García Coll et al., 1995, 1999). Moreover, a number of factors likely contribute to the differences observed between ethnic groups on the HOME-SF items, including differences in goals, beliefs, and practices that are part of ethnic legacy and differences in macro-level social and political forces facing certain groups, such as racism and other elements of social stratification (García Coll et al., 1996).

For people of color, coping with discrimination and oppression from the dominant culture may also contribute to differences in parenting practices and environmental conditions within the home (McAdoo, 1993; Ogbu, 1994). Part of the ethnic group differences observed on the HOME-SF probably reflects family income and neighborhood of residence as well. Even though poverty status was controlled in the analyses examining ethnic differences, poverty was entered into the analyses as a two-level variable (poor versus nonpoor). Within both the poor and the nonpoor levels, the average family income of African Americans and Hispanic Americans was lower than that of European American families, leaving open the possibility that some additional small effects of income could be connected to the observed ethnic group differences. Furthermore, greater percentages of these two groups lived in impoverished urban settings, a factor that has a negative impact on parenting (Bradley & Whiteside-Mansell, 1997; Duncan & Brooks-Gunn, 1997; Huston et al., 1994).

The primary purpose of this study was to provide information on how frequently children in the United States are exposed to the kinds of acts, objects, events, and conditions cataloged on widely used measures of the home environment. The results showed substantial diversity across families within every major ethnic and income group. There were both similarities and differences across ethnic groups, differences that we conceptualize as reflective of both historic ethnic legacies and current macro-level contextual conditions. The most pervasive differences were those related to poverty. The findings, although generally in line with findings from previous studies, are valuable for their breadth and for the fact that they are based on thousands of cases, carefully drawn to represent the U.S. population. There are, however, limitations in the sample, given the sampling frame for the NLSY and the fact that children of mothers who began giving birth later in life had not yet reached age 14. Finally, as useful as information from the NLSY is in describing the family experiences of children in the United States, the HOME-SF contains only a limited census of indicators on the child's total range of experiences in the home. For example, relatively little attention is paid to experiences with siblings and extended family—experiences known to be associated with the course of development (Dunn & Plomin, 1990). The census of indicators contained in the HOME-SF Inventories may be more meaningful for some groups of families and less meaningful for others (Bradley et al., 1997). Correspondingly, it may be more predictive of children's development for some groups than others (Bradley et al., 1989; Dubrow et al., 1996). Alternatively, as stipulated by Wachs (2000), there may be great variability in child outcomes for children who experience similar environments. These issues were examined in Part 2 (Bradley et al., 2001) of this study. Hopefully, the information provided by the HOME-SF is a useful first step in mapping the topography of children's experiences in the home. A more complete understanding of the child's home environment will require an even more detailed mapping of those exchanges and conditions.

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Scores on the MacArthur Communicative Development Inventory of children from low- and middle-income families

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ABSTRACT
This study compared the language skills in a group of very low-income toddlers with those of a middle-income sample matched on age and sex. The assessment instrument was the MacArthur Communicative Development Inventory (CDI) for toddlers, a parent report form. The scores for the low-income group were strikingly lower on the three key indices evaluated: size of expressive vocabulary, age of appearance of word combinations, and complexity of utterances. The entire low-income distribution was shifted about 30% toward the lower end of the middle-income distribution for both productive vocabulary and grammatical development. The magnitude of these income/social class effects was larger than reported in most prior reports for children in this age range. This finding underscores the cautionary note issued by the CDI developers, which states that the published CDI norms, based on a middle-class sample, may not be directly applicable to low-income samples.

A considerable body of evidence indicates that a moderate to strong negative relation exists between language skills and socioeconomic status (SES). The literature is much more complete and more definitive for children over 3 or 4 years of age: children from low-SES families perform at a lower level on both language tasks and a variety of cognitive tasks (Allen, Wasserman, & Seidman, 1990; Greenwood, Carta, Hart, Kamps, Terry, Arreaga-Mayer, Atwater, Walker, Risely, & Delquadri, 1992; Greenwood, Terry, Utley, & Montagna, 1993; Hess & Shipman, 1965; Lawrence & Shipley, 1996; Lesser, Fifer, & Clark, 1965; Morisset, Barnard, Greenberg, Booth, & Spieker, 1990; Snow, Blondis, & Brady, 1988; Walker, Greenwood, Hart, & Carta, 1994; Warren-Leubecker & Carter, 1988). In some instances, the magnitude of the differences between the skills of middle- and low-SES children has been quite large. For example, St.

Pierre, Swartz, Gamse, Murray, Deck, and Nickel (1995) reported that percentile scores on the Peabody Picture Vocabulary Test averaged 9% for a group of 200 4-year-old children upon entry into the Even Start program (St. Pierre & Swartz, 1995). SES level has been found to be of predictive significance in multiple regression analyses where an index of language development is the dependent variable (Diamond & le-Furgy, 1988; Largo, Graf, Kubdu, Hunziker, & Molinari, 1988; Mishra & Mishra, 1992; Wells, 1985).

A restricted range of available instruments and procedures for assessing language skills prior to about 3 years of age has limited the amount of information available on the relation between SES and language skills in younger children. The available studies generally parallel the findings for older children in finding a negative relation between SES and language skills, though most studies provide little indication of the size of the effects. Vohr, Garcia Coll, and Oh (1989) found higher SES to be associated with higher Peabody Picture Vocabulary Test scores at 2 and 3 years of age. Laosa (1984) found that low-SES children scored significantly lower than middle-SES children on the McCarthy Verbal Abilities Scale (McCarthy, 1978) at 2½ years of age. Using the Hollingshead SES index (Hollingshead, 1965), which includes a weighted index of parents' education and vocations, Siegel (1982) reported a significant positive relation between SES level and scores on the Reynell Language Comprehension measure at 3 years of age. A study by Rescorla (1989) is one of the few that provides some indication of the magnitude of SES effects. Across several samples of 24-month-old children, 16 to 23% of low-income, inner city minority children were identified as language delayed, compared with substantially lower percentages in middle-class samples, based on data stemming from a parent-completed vocabulary checklist.

Wells (1981, 1985) reported more qualified support for SES influences on language in his sample of 128 British children between 1 and 5 years of age. He found that SES differences between children on language measures resulted from a clustering of high scores for a subset of four high-SES children and a clustering of very low scores for a subset of five very low-SES children; when these children with extreme scores of either greater or less than two standard deviations from the mean were excluded, no SES effects were present.

Whether based on differential distributions for extreme scores or more pervasive effects, the causes of lower overall scores on language measures for low-SES populations are probably quite varied, ranging from a higher proportion of premature births (Smith, Ulvund, & Lindemann, 1994) to less opportunity for social and verbal interactions between parent and child to bilingualism in the household (Bradley, Caldwell, & Lock, 1988; Garcia Coll, 1990; Hart & Risley, 1992; Laosa, 1984). Some of these factors (e.g., premature birth) would be expected to have an impact on language acquisition from the outset; other factors (e.g., reduced exposure to printed materials) may operate through cumulative effects that manifest themselves much more slowly. Because different factors exercise their effects at different rates, inconsistencies are inevitable in the literature for younger as well as older children. Additionally, many inconsistencies are no doubt attributable to variations in criteria for assigning SES levels, the measures used, and variability in level of the samples being compared.

This study compared the language profiles of very low-income children with those of middle-class children in the 16- to 30-month age range using the MacArthur Communicative Development Inventory (CDI), Word and Sentences (Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994). This form, commonly referred to as the CDI toddler form, is a parent report instrument designed for 16- to 30-month-old children. Normative data permits the computation of percentile scores for each of the major scales (Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, & Reilly, 1993).

The developers of the CDI reported only a very small negative correlation between vocabulary production and SES for 16- to 30-month-olds. They noted, however, that the general absence of a relation between SES and language development may have reflected the limited SES range of their sample, which was composed mostly of middle-class to upper middle-class respondents, a high proportion of whom were college educated. They cautioned that the norms may not be representative of low-SES groups. This article focuses on the toddler version of the CDI, which assesses expressive vocabulary as well as several major aspects of early grammatical development. In the present study, a sample of children drawn from the CDI normative data was compared with an independent group of toddlers from very low-income families, allowing a more adequate test of the extent to which income level is related to CDI scores than was possible with the CDI normative data.

Because the CDI is a parent-completed instrument, it makes feasible the collection of data on a large number of children, a desirable feature for studies investigating the influence of a variable as complex as SES. The availability of normative data including percentile scores for the CDI also increases its utility in studying the possible effects of SES. This information permits an appraisal of the entire distribution of scores for a population and of measures of central tendencies such as mean and median scores. Consequently, it becomes possible to test the generality of Well's finding (1981, 1985) that SES differences in language skills are principally due to a higher proportion of middle-income children at the upper end of the distribution and a higher proportion of lower income children at the lower end, rather than resulting from a more pervasive downward shift of the entire low-income distribution.

METHOD

Subjects

A total of 103 younger siblings (59 males, 44 females) of Head Start children composed the low-income sample. These children were participants in a literacy intervention project (Cronan, Walen, & Cruz, 1994). In order to compare the low-income sample with the CDI middle-income norms, three independent samples were drawn from the normative study ($N = 1,130$) of the CDI (Fenson et al., 1993). Three samples were assembled because we were not certain how representative a given sample of 103 children would be. Previous analyses of the CDI normative sample had revealed extensive variability in these measures (Fenson et al., 1994). Each of the three middle-class samples was constructed

Table 1. *Annual salaries for the low-income families*

Income ($)	Sample (%)
Less than 10,000	35.42
10,001 to 15,000	50.23
15,001 to 20,000	11.34
20,001 to 25,000	3.01

Table 2. *Demographic profiles of the low- and middle-income samples*

	U.S. 1990 census (%)	Middle-income sample (%)	Low-income sample (%)
Ethnicity			
Asian	2.8	3.2	4.1
Black	11.8	2.6	25.7
Mexican American/Latin	9.0	4.5	43.2
White	75.6	87.1	24.3
All others	0.8	2.6	2.7
Parent education			
Some high school or less	23.2	4.5	36.5
High school diploma	42.0	17.9	37.7
Some college education	16.9	24.3	21.7
College diploma	17.9	53.3	4.1

in the following manner: (a) for each low-income child, all of the children in the normative sample of the same age and sex were identified; (b) three children were randomly drawn from this pool, one for each of the three middle-class samples. The normative data were collected in three different cities (New Haven, Seattle, and San Diego) using university subject pools at each location (see Fenson et al., 1993). Each of the four samples contained 44 females and 59 males, with a mean age of 23.49 months ($SD = 4.23$).

Table 1 shows the income levels of the Head Start families. The mean income of these families was about $13,000. Just over 85% of these families reported annual incomes of $15,000 or less. Table 2 presents other pertinent demographic measures for the U.S. population, the middle-income sample drawn from the normative sample originally reported in the CDI technical manual (Fenson et al., 1993), and the low-income sample.

The low- and middle-income samples also differed sharply in ethnic composition, education, and linguistic environment. The middle-income sample was composed mostly of white parents, while the low-income sample was principally nonwhite. The low-income sample had less formal schooling than the general U.S. population, whereas the CDI sample had more schooling; more than 36% of the low-income parents had not received their high school diploma. A higher proportion of the low-income sample (28.4%) was exposed to a second language, relative to the middle-class sample (14.0%).

Measures

The three CDI toddler form measures offering the broadest sampling of young children's language skills were examined. Each child's expressive vocabulary was assessed by means of the 680-item productive vocabulary checklist. A second measure was based on the parent's response to a question about how frequently the child combined words, the options being "not yet," "sometimes," and "often." The CDI sentence complexity scale served as our index of the children's grammatical skills. This scale offers a broader sampling of grammatical abilities than the other CDI measures and also yields percentile scores. The scale employs a forced-choice recognition format in which parents are asked to choose a member from each of 37 pairs of sentences which best exemplifies the child's present language. The second item of a given pair is the more sophisticated form of a specified utterance. The child's score for this scale is obtained by summing the number of pairs in which the parent selects the more complex response; thus, the scores can range from 0 to 37. Scores on both the vocabulary production and sentence complexity scales were converted to percentiles, using the normative tables furnished in the CDI technical manual (Fenson et al., 1993).

Procedure

The CDIs on the low-income sample were collected within the context of a literacy intervention project. The forms were completed at the outset of the study, prior to intervention. Details of this study are described elsewhere (Cronan et al., 1994). The CDI was given to the family on the first of two visits. At that time, the instructions for completing the CDI were read to the parent. The instructions urged parents to mark only those items they had heard the child utter spontaneously (versus prompting the child to say a given word). The CDI was picked up on the second assessment visit, a day or two later. These visits preceded the initiation of intervention activities.

RESULTS

The three middle-income samples presented quite similar profiles for each of the three CDI measures. Thus, to maximize stability and representativeness, the three samples were combined for the statistical comparisons with the low-income sample.

Expressive vocabulary

Table 3 presents the expressive vocabulary raw scores for the low- and middle-income children. The raw score for each child was converted to percentiles, based on the normative tables in the CDI technical manual (Fenson et al., 1993). These scores are shown in Table 4. A two-way ANOVA of the percentile scores confirmed that the mean percentile score for the low-income group (29.74) was significantly lower than the mean for the aggregate CDI normative sample (50.04), $F(1, 404) = 44.36$, $p < .001$. There was no main effect for sex, $F(1, 404)$

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Table 3. *Vocabulary raw scores for the low- and middle-income samples*

	N	Mean	*SD*	Median	Range
Low income					
Girls	44	212.50	172.89	183	3–671
Boys	59	210.07	176.21	175	1–679
Combined	103	211.11	173.95	182	1–679
Middle income					
Girls	132	359.31	200.03	399	6–667
Boys	177	276.37	191.86	255	6–662
Combined	309	311.80	199.35	314	6–667

Table 4. *Vocabulary percentile scores for the low- and middle-income samples*

	N	Mean	*SD*	Median	Range
Low income					
Girls	44	22.82	20.67	15	5–99
Boys	59	34.90	28.71	30	5–99
Combined	103	29.74	26.17	25	5–99
Middle income					
Girls	132	50.83	27.90	55	5–99
Boys	177	49.45	26.51	50	5–99
Combined	309	50.04	27.08	50	5–99

= .38, n.s. An interaction was found between income level and sex, $F(1, 404) = 4.97$, $p < .05$. A follow-up one-way ANOVA indicated that scores for middle-class males ($M = 49.45$) and females ($M = 50.83$) were equivalent $F(1, 307) = 1.96$, n.s.; however, in the low-income sample, the mean for females (22.82) was significantly lower than the mean for males (34.90), $F(1, 102) = 5.61$, $p < .05$.

Figure 1 contrasts the distributions of vocabulary scores for the low- and middle-income samples. A total of 82.5% of the low-income group received vocabulary scores that fell below the median score for middle-class children (based on CDI norms). This contrasts with 51.1% of the middle-income sample.

Table 5 permits a finer grained appraisal of these two distributions. The table shows the percentage of children in each group who fell below the middle-class normative values for the 10th, 20th, 50th, 75th, and 90th percentile scores, as reported in the CDI manual (Fenson et al., 1993). A total of 55.3% of the low-income sample fell below the 25th CDI percentile mark. Similarly, 35.9% of the low-income sample fell below the 10th CDI percentile level, compared with only 11.7% of the middle-income sample.

In contrast to Well's (1985) findings, the low mean and median scores for the low-income group were not simply a function of a disproportionate number

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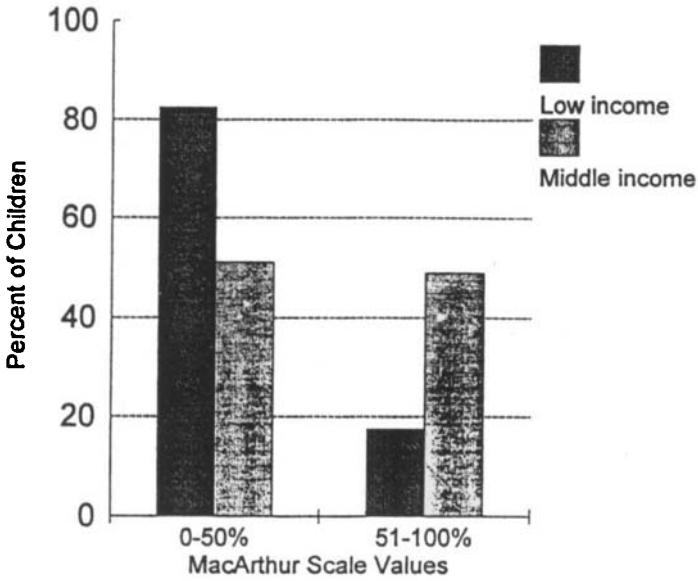

Figure 1. Distribution of scores on the CDI expressive vocabulary scale, relative to the MacArthur norms.

Table 5. *Comparison of the distribution of the low- and middle-income vocabulary scores to the MacArthur norms*

		Percentile scores				
	N	10th	25th	50th	75th	90th
Low income						
Girls	44	40.90	65.90	93.20	98.08	99.23
Boys	59	32.20	47.50	74.60	88.67	94.90
Combined	103	35.90	55.30	82.50	92.75	96.10
Middle income						
Girls	132	12.90	24.20	49.20	81.10	93.90
Boys	177	10.70	24.90	52.50	83.60	94.90
Combined	309	11.70	24.60	51.10	82.50	94.50

of very low scores for that group and a disproportionate number of very high scores for the middle-income children. Rather, the effect was quite pervasive among these children; the entire low-income distribution had shifted in the negative direction by about 25%. Despite this fact, the range of scores for the low-income sample encompassed the entire middle-class distribution. The contrast between the middle- and low-income groups was even larger for females than for males: for example, 93.2% of the low-income females scored at or below the median, while 74.6% of males were at this mark.

Table 6. *Percentage of children in the low- and middle-income samples reported to be combining words* (Ns *in parentheses*)

Month	Low income (%)	Middle income (%)
16	0 (4)	25 (12)
17	33 (6)	50 (18)
18	0 (5)	40 (15)
19	29 (7)	75 (20)
20	71 (7)	81 (21)
21	33 (9)	85 (27)
22	57 (7)	81 (21)
23	86 (7)	86 (21)
24	80 (5)	93 (15)
25	89 (9)	96 (26)
26	100 (4)	92 (12)
27	70 (10)	100 (30)
28	100 (8)	100 (24)
29	100 (6)	100 (18)
30	100 (9)	100 (26)

Combining words

Table 6 shows the percentage of children reported to be combining words. Children were classified as combining if the parent checked either the "sometimes" or "often" category. The wider month-to-month fluctuations in the low-income sample were probably due to the smaller *N*s. For the low-income sample, combining words increased irregularly, from a mean of 0% at 16 months to nearly 100% by 26 to 28 months. The pattern appeared to accelerate in the middle-income sample by 4 or 5 months.

Sentence complexity

Table 7 shows the sentence complexity raw score data for all the low- and middle-income children who were 22 months of age or older. The sentence complexity scores for the younger children were excluded because many of them (particularly in the low-income sample) were not yet combining words; this applied to 68% of the low-income sample and 36% of the aggregate middle-income sample in the 16- to 21-month range. The inclusion of the younger children would, therefore, have distorted the data.

Table 8 shows the sentence complexity scores after conversion to percentile values. A two-way ANOVA was performed on the percentile scores, with income level and sex as the factors. The analysis yielded a significant main effect of income level, $F(1, 256) = 35.34$, $p < .001$. The main effect was qualified by an interaction between sex and income level, $F(1, 256) = 16.91$, $p < .001$. An analysis of the interaction showed that the gender effect was limited to the low-income group; in this group, the mean percentile score for boys (42.71) was

Table 7. *Sentence complexity raw scores for the 22- to 30-month-old children in the low- and middle-income samples*

	N	Mean	*SD*	Median	Range
Low income					
Girls	30	5.43	6.94	2	0–27
Boys	35	9.49	10.03	4	0–36
Combined	65	7.62	8.91	4	0–36
Middle income					
Girls	90	18.92	11.73	19	0–37
Boys	105	12.66	11.99	9	0–37
Combined	195	15.55	12.24	14	0–37

Table 8. *Sentence complexity percentile scores for the 22- to 30-month-old children in the low- and middle-income samples*

	N	Mean	*SD*	Median	Range
Low income					
Girls	30	17.67	15.52	15	0–60
Boys	35	42.71	27.21	35	5–95
Combined	65	31.15	25.71	25	0–95
Middle income					
Girls	90	54.36	27.47	55	5–99
Boys	105	49.40	25.16	50	5–99
Combined	195	51.69	26.30	50	5–99

significantly higher than that for girls (17.67), $F(1, 63) = 19.86$, $p < .001$. In the middle-income sample, the mean percentile scores for girls (54.36) and for boys (49.40) were equivalent, $F(1, 193) = 1.73$, n.s.

Figure 2 illustrates the differences between the distributions of the sentence complexity percentile scores of the low- and middle-income samples, relative to the norms reported in the CDI manual. The shift of the low-SES distribution toward the lower end of the normative sample is slightly less for vocabulary (as shown in Figure 1), but it is still substantial.

More detail on the distributions of the low- and middle-income scores for the grammatical measure is provided in Table 9. For the sexes combined, 78.5% of the children in the low-income sample fell below the 50th percentile mark (based on the CDI normative sample), compared with 82.5% of the low-income sample who fell below the 50th percentile for vocabulary.

DISCUSSION

This study compared the language skills of a group of very low-income 16- to 30-month-old children with those of three middle- to upper middle-class samples matched on age and sex. The children's language skills were assessed with

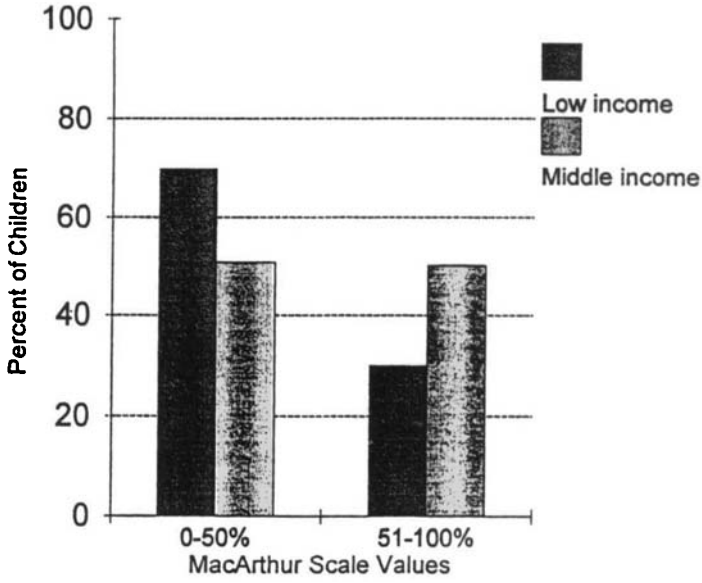

Figure 2. Distribution of scores on the CDI sentence complexity scale, relative to the MacArthur norms.

Table 9. *Comparison of the distribution of the low- and middle-income sentence complexity scores to the MacArthur norms*

		Percentile scores				
	N	10th	25th	50th	75th	90th
Low income						
Girls	30	43.30	60.00	83.30	100.00	100.00
Boys	35	8.60	37.10	65.70	85.70	94.30
Combined	65	24.60	58.50	78.50	92.30	96.90
Middle income						
Girls	90	6.70	23.30	46.70	77.80	90.00
Boys	105	9.50	25.70	53.30	84.80	96.20
Combined	195	8.20	24.60	50.30	81.50	93.30

the MacArthur CDI toddler form, a parent-report instrument (Fenson et al., 1993). The middle-class samples were drawn from the CDI normative study. The developers of the CDI reported a very small negative correlation between vocabulary production and SES for 16- to 30-month-olds on the MacArthur CDI toddler form. They noted that their ability to test for social class effects was limited by the restricted range of their sample and cited the need for more definitive studies on SES using the MacArthur scales.

Our results indicated that, as a group, the low-income toddlers scored strikingly lower than the middle-class normative sample on the three major features of language ability we assessed: vocabulary production, combining words, and sentence complexity. These effects are among the largest that have been reported in the literature in children under 3 years of age. The difference between the low- and middle-income samples was not restricted to an overrepresentation of middle-income children at the upper end of the distribution and an overrepresentation of low-income children at the lower end (i.e., the pattern reported by Wells, 1985). Rather, the entire low-income distribution was shifted toward the lower end, even though scores for this group spanned the entire range from 5 to 99% for each sample. These findings underscore the CDI authors' caution that the published CDI norms may not be directly applicable to children from low-education/low-income families.

What factors account for the notably lower scores of the low-income children, relative to their middle-class counterparts? One possibility is that the low-income children are developing linguistically (and possibly cognitively) at a slower rate, perhaps due to a lower level of adult verbal input and interaction and/or other opportunities to develop language skills. Support does exist in the literature for an environmental deficiency hypothesis. Researchers have found that low-SES parents differ from middle-SES parents in the quality and/or quantity of verbal input and interaction with their young children (Barnes, Gutfreund, Satterly, & Wells, 1983; Snow, Arlman-Rupp, Hassing, Jobse, Joosten, & Vorster, 1976). The lower level of interaction has often been suggested as the source of SES effects on language acquisition (Bradley et al., 1988; Clarke-Stewart, 1973; Gottfried, 1984; Greenwood et al., 1992; Hart & Risley, 1992; Walker et al., 1994).

If the rate of language development is strongly influenced by sociocultural factors, the effects of SES would be expected to increase with age, at least during periods when language development is most rapid; that is, environmental influences should be progressive and cumulative (Klineberg, 1963). SES effects on language and cognition are generally more apparent after ages 3 or 4 than earlier in development. Morisset et al. (1990) offered two explanations that could account for this often-reported age-related increase in SES effects. One is based on the assumption that development is highly canalized during stages of rapid growth such as infancy; under such constraints, children might be biologically buffered from all but extreme deviations in environmental input (McCall, 1981; Rutter, 1985; see also Bertenthal, 1991). Another possibility is that tests such as the Bayley may not be sufficiently sensitive at ages 2 or 3 to adequately tap individual differences in cognitive and linguistic growth.

Our findings with the CDI indicate that a middle-income advantage was present for each of the three scales well before 3 years of age. The early presence of these effects calls into question the canalization hypothesis and is more consistent with the position that the insensitivity of the measuring instruments may have obscured SES effects in very young children in some studies. To attribute these differences to environmental deficiency, one must be willing to assume that sociocultural effects begin quite early in development – earlier than the age at which most studies have first noted SES effects on language skills.

The parent-report format on which the present study was based requires the consideration of parental misjudgment hypothesis for explaining why the average scores of the low-income children in the present study were so much lower than those of middle-income children. A child's score on the CDI is a product of the parent's ability to appraise the child's language and the child's language skills per se. The misjudgment hypothesis could take either of two forms. One possibility is that lower income parents might underestimate their children's verbal abilities, perhaps because they are less verbally interactive with them (Garcia Coll, 1990). If this is the case, the strikingly lower scores for the low-income group may be, partly or largely, a product of the parents' underappraisals rather than lower abilities of the children. Another possibility is that the social desirability of advanced language might lead middle-SES parents to overestimate their children's linguistic abilities.

A limited amount of data is available on the relation between parent appraisal and experimental measures of children's language skills. Judging from these studies, neither low- nor middle-SES parents seem prone to underestimating or overestimating their children's performance. Arriaga, Hicks, Cronan, and Fenson (1992) reported that lower SES parents tend to underestimate the verbal comprehension of children with low expressive vocabularies, but Fenson, Sweet, and Jimerson (1996) found exactly the same pattern with middle-class parents. Cross (1977) reported that middle-class parents were more attuned to what children say than to what they understand and were as likely to underestimate as to overestimate language comprehension. Gullo (1988) found no differences in the ability of low- and middle-SES mothers of 1-year-olds to predict the time of emergence of second-year developmental milestones (including linguistic skills); moreover, under- and overestimation were equally likely in both groups.

In the present study, boys from low-income families scored higher than girls from low-income families on both the vocabulary and sentence complexity measures. No sex differences occurred in the middle-income groups. Reznick (1990) reported a related pattern for word comprehension based on a vocabulary checklist completed by parents: that is, a negative correlation between comprehension scores and SES for boys, but not for girls. He speculated that many low-SES parents may have higher expectations or aspirations for their sons than for their daughters, and that those views (or hopes) may be reflected in their estimates or comprehension.

The environmental deficiency and parental misjudgment hypotheses are not mutually exclusive. Differentiating between these two sources of influence in middle- and low-SES children would require a comparison of parent-report measures with child language indices that were independent of parents' judgments. Based on the evidence to date, however, the present findings suggest that the many negative factors associated with poverty begin to create impediments to communicative development well before 2 years of age, but that our measuring devices often fail to detect these differences until some later time.

The implications of the present findings for the use of the CDI norms with low-SES children are largely dependent upon the source of the differences. If the lower scores of the low-income children in the present study are principally

a function of differences in the reporting style and/or the accuracy of the parents, resulting in a systematic tendency to underestimate their children's language skills, then the use of the CDI norms with this population is not appropriate. If, on the other hand, low-SES children as a group acquire language skills more slowly than middle-SES children, then the CDI norms may have some relevance. Clearly, if the CDI normative sample had been more demographically balanced, lower raw scores would be associated with any given percentile score (i.e., the low-SES children would score higher than in the present tables). That is the conventional manner in which normative tables are constructed and used. However, the present middle-class based norms may have some use for low-SES samples, in that they permit the assessment of language status of a child from a low-income or low-education family, compared with that of children from middle-class families. Given that, by school-age (if not earlier), middle-class developmental-academic standards are those to which all children are expected to measure up, a low-SES child's standing with respect to those standards may provide a measure of how far the child is from the level of performance to which he or she will ultimately be expected to conform. That is, regardless of the source of the gap (if it is, indeed, real), the low-SES child's standing relative to middle-class norms conveys information of significance.

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Identifying Pathways Between Socioeconomic Status and Language Development

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Keywords

parent–child interaction, learning materials, language trajectories, verbal ability, early intervention

Abstract

Children from low-income backgrounds consistently perform below their more advantaged peers on standardized measures of language ability, setting long-term trajectories that translate into gaps in academic achievement. Our primary goals in this review are to describe how and why this is so, in order to focus attention on ways to enrich early language experiences across socioeconomic strata. We first review the literature on the relation between socioeconomic status (SES) and language ability across domains in early childhood. We then identify three potential pathways by which SES might influence language development—child characteristics, parent–child interaction, and availability of learning resources—recognizing the complicated interaction between the child's own language learning skill and his/her environmental support. Finally, we review interventions that target these three pathways with an eye toward best practice. Future research should focus on the diversity of contexts in which children acquire language and adopt methods of language measurement that are sensitive to cultural variation.

1. INTRODUCTION

Language ability in early childhood is among the best predictors of school readiness and later school success (Hoff 2013, Burchinal et al. 2016). By school entry, however, many children from lower-socioeconomic-status (SES) homes perform well below their peers on standardized measures of language comprehension and production (Ginsborg 2006). Much attention has been directed toward Hart & Risley's (1995) seminal research, which estimated that, by the time they are 4 years old, children reared in poverty have heard 30 million words fewer than their more affluent peers. Recent research corroborates that SES-related differences in early language environments are not limited to the quantity of input, but extend to the quality of interactions and language learning opportunities as well (Rowe 2012, Cartmill et al. 2013, Goldin-Meadow et al. 2014). These early disparities in language experience and exposure translate to gaps in language ability that remain stable or widen over time (Walker et al. 1994, Fernald et al. 2013) and are predictive of academic trajectories during elementary and secondary education (Entwisle & Alexander 1999, Burchinal et al. 2002).

Together, these findings amount to a growing national concern at the intersection of education, economics, and social policy that has inspired a number of widespread initiatives designed to set positive language learning trajectories for underprivileged children. Even so, the ways in which SES shapes child development in general, and language ability in particular, are far from straightforward. Although it is widely accepted that childhood SES is correlated with language ability and academic achievement, much less is known about the pathways by which SES exerts its well-established influence. And despite the proliferation of programs and services aimed at improving school readiness and academic outcomes for children from low-SES homes, the evidence base that identifies malleable factors for successful language intervention is quite thin.

Because SES and verbal ability are multidimensional constructs (LARRC 2015), and because many factors that influence language development covary with SES, the causal relations between SES and verbal ability may be difficult to uncover (Hoff et al. 2002b). Not surprisingly, recent research suggests that socioeconomic circumstances may have a more nuanced effect on verbal ability than previously thought (Mol & Neuman 2014, Noble et al. 2015) and that there is wide variability even within socioeconomic strata (Hoff 2013, Hirsh-Pasek et al. 2015a). Contemporary theorists of language socialization have also voiced legitimate concerns about scholarly emphasis on the verbal limitations of children from low-income families without considering areas of strength (Miller & Sperry 2012, Johnson 2015, Sperry et al. 2015), as well as the need for widespread adoption of ethnographic approaches that are sensitive to cultural variation (Ochs & Schieffelin 1984).

In this review, we begin to tease apart the complex relation between SES and verbal ability by integrating two broad and often disparate approaches to the study of development. The first, traditionally psycholinguistic approach considers the processing systems through which linguistic input is translated into language acquisition and development (Crain & Lillo-Martin 1999). The second, bioecological approach focuses primarily on the external social contexts in which a child develops, from proximal (e.g., family, child care, peer groups) to distal influences on outcomes (e.g., culture, history, SES; Bronfenbrenner & Morris 1998). A few notable exceptions have integrated both approaches to address the relation between language development and language environments (Hoff-Ginsberg & Shatz 1982, Gallaway & Richards 1994, Hoff 2006). As both perspectives are increasingly recognized as interdependent, these cited papers represent an important contribution. Even so, much of the empirical research on language development remains rooted within one camp or the other, with little overlap.

To bridge these rich developmental perspectives, we consider three pathways through which SES exerts its influence on verbal ability, beginning with the individual child's characteristics,

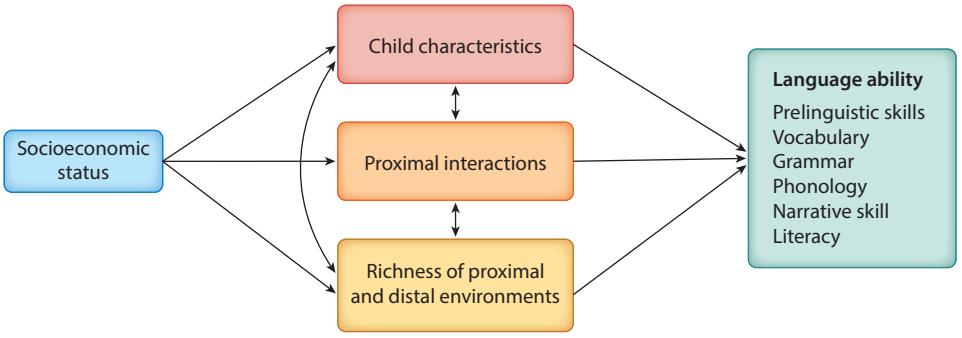

Figure 1

Three possible pathways for the association between socioeconomic status and language development.

progressing to the quantity and quality of parent–child interactions, and ending with the availability of materials for language learning in the home (e.g., books and toys) and informal learning opportunities outside the home (e.g., the quality of day care and visits to places like the zoo or the park) (**Figure 1**). Although we separate these factors into three categories for purposes of discussion, we are aware that they continually interact and are not easily separated. And though this trilogy is far from exhaustive, it provides a framework for disentangling the complex relation between SES and verbal ability throughout early childhood.

This review is organized as follows. First, we consider the definition and measurement of SES and describe the demographics of the children in the United States currently living in low-SES families. Next, we describe dimensions of language that reflect SES differences, taking care to address inconsistencies in the literature by presenting empirical evidence for strengths as well as weaknesses within and across socioeconomic groups. Then, we explore the three aforementioned pathways by which SES might exert some influence on verbal ability within these dimensions and consider evidence from interventions that specifically target language outcomes through these unique pathways, both independently and in concert.

2. SOCIOECONOMIC STATUS: DEFINITION AND MEASUREMENT

SES refers to one's access to financial, educational, and social resources, and the social positioning, privileges, and prestige that are derived from these resources (Mueller & Parcel 1981, Entwisle & Astone 1994, Duncan et al. 2015). Although SES is recognized to be a multidimensional construct that has been measured in various ways (Oakes & Rossi 2003), most contemporary investigations center on parental education, family income, and parental occupation, or some combination of these three indices (Bradley & Corwyn 2002, Ensminger & Fothergill 2003).

Maternal education—usually measured as a categorical variable representing groups with various levels of formal schooling, ranging from no high school education or limited high school education to high school education, some college, or an earned college degree—appears to be the component of SES most strongly related to child development outcomes (Hoff et al. 2002a, Magnuson et al. 2009). Income-based measures of SES—such as annual salary—allow researchers to classify families as above or below the federal poverty threshold (FPT; Taylor et al. 2004), whereas income-to-need ratios reflect the amount of poverty or affluence experienced in comparison to the FPT and therefore may more accurately depict a family's need (Duncan et al. 1994, McLoyd 1998). For instance, a family living at or above the FPT may still experience adversity because income is not commensurate with expenditures.

Although studies examining the relation between SES and verbal ability among young children have yet to reach consensus on the most effective measure of SES (Bornstein & Bradley 2003), as single variables all three of these indices are supported with evidence that validates their application as proxies of SES (Brooks-Gunn & Duncan 1997, McLoyd 1998, Rindermann & Baumeister 2015). Despite uncertainty regarding the optimal index, the association between SES and language development is sufficiently robust that it appears across different measurement approaches. The relation of SES to early language also appears within and across different ethnic groups, suggesting that, although SES and minority-group status are frequently confounded, the effects of SES are not merely ethnic differences in the guise of a socioeconomic construct (Hoff 2006). Although more systematic analyses are needed to uncover the way in which SES appears to operate across different developmental domains and periods (e.g., infancy versus adolescence), this review includes empirical research that relies on multiple variables known to approximate SES.

3. WHO ARE THE CHILDREN FROM LOW-SOCIOECONOMIC-STATUS HOMES?

The statistics for children living in low-income and poor families are appalling. The United States has among the highest levels of childhood poverty outside of the developing world, with one in five of all children—close to 15 million in total—living below the FPL of $24,250 for a family of four in 2015 (Kena et al. 2015). In 2013, 22% of children under age 18 in the United States lived in families with incomes below the FPL (i.e., $23,624 for a family of four), and 44% lived in families with incomes below 200% of the FPL. Furthermore, the percentage of children living in poverty has grown in recent decades, from 16.2% in 2000 to 22% in 2013 (see figure 5 of DeNavas-Walt & Proctor 2015).

Children under age 5 are more vulnerable to poverty than are older children. One in four infants, toddlers, and preschoolers currently live in poor families, compared with only 19% of children between 12 and 17 years. There are also striking racial/ethnic differences in the poverty rate among children. The percentage of low-SES infants and toddlers is twice as high for Black, Hispanic, and American Indian children (more than 60%) than for White and Asian children (31%). Higher levels of parental education and parental employment status are protective factors for childhood poverty. Children whose parents have less than high school education are four times more likely (55% versus 13%) to live in poor families than their peers with at least one parent who has some college or higher education. Seventy-two percent of children with unemployed parents live in poor families. In contrast, only 9% of children with at least one parent who has a full-time job year-round live in poverty (Jiang et al. 2015).

Children living in poverty are exposed to a variety of toxic stressors, such as food insecurity, abuse, and neglect, as well as limited educational resources and opportunities. These children are at higher risk of having physical health problems, such as lead poisoning and low birth weight, and have a higher mortality rate during infancy and childhood than their more affluent peers (Brooks-Gunn & Duncan 1997, Shonkoff 2000). At home, poor children are exposed to more violence, household chaos, separations from family members, and instability (Evans 2004). More than half of low-income mothers with infants have some form of depression, and 11% have severe depression (Vericker et al. 2010). Mothers with higher levels of stress and depression talk less with their children (Lovejoy et al. 2000), and have children with slower vocabulary growth (Pan et al. 2005).

At school, children from low-income families have higher suspension and grade-repetition rates, and are seven times more likely to drop out of high school than their peers from high-income

families (Brooks-Gunn & Duncan 1997, Chapman et al. 2011). Many studies have demonstrated the lifelong negative impacts of poverty on developmental outcomes, including brain structure; physical and mental health; and language, cognitive, behavioral, and emotional development (Blair & Raver 2012, Shonkoff et al. 2012).

4. THE RELATION BETWEEN SOCIOECONOMIC STATUS AND VERBAL ABILITY ACROSS LANGUAGE DOMAINS

Children from low-SES backgrounds, in general, lag behind their more affluent peers on measures of language comprehension and production from infancy through high school (Walker et al. 1994; Bowey 1995; Hart & Risley 1995, 1999; Arriaga et al. 1998; Rodriguez & Tamis-LeMonda 2011; Fernald et al. 2013). Such SES-related language gaps emerge early in life and are closely linked with later academic achievement and school success (Burchinal et al. 2002). Less explored, however, are potential strengths such as narrative or pragmatic aspects of language (Corsaro et al. 2002). Before investigating the factors that influence this complex association, we explore the impact of SES on various domains of language ability in early childhood.

4.1. Prelinguistic Development

Although an infant may not produce a single word until on or around her first birthday, the foundation for communication begins to develop even before birth (DeCasper & Fifer 1980, Kisilevsky et al. 2003). Over their first 12 months, infants develop several foundational communication skills that support positive language development and predict later language trajectories, such as gaze following (Brooks & Meltzoff 2005), pointing (Tomasello et al. 2007), and gesturing (Iverson & Goldin-Meadow 2005). Although SES effects on standardized language assessments do not emerge in the child development literature until early in the second year of life, there is evidence for earlier differences in the brain areas that subserve language acquisition as well as the behavioral precursors to language acquisition, such as the proclivity to explore the physical environment, produce gestures, and communicate with nonverbal intentionality.

As infants become mobile, they explore their worlds through sensorimotor experiences of sight, sound, smell, taste, and touch. Between the ages of 6, 9, and 12 months, infants from low-SES families demonstrated reduced overall levels of oral and manual object exploration (Clearfield et al. 2014). Differences in early gesture production, known to predict later language learning (Rowe & Goldin-Meadow 2009a), also reflect SES disparities (Rowe & Goldin-Meadow 2009b). As early as 14 months, children from high-SES families were exposed to and used more gestures during parent–child interaction, compared with their low-SES counterparts. These SES differences in gesture use further predicted differences in vocabulary skills at 54 months (Rowe & Goldin-Meadow 2009b) and appear to be mediated by the parents' use of gesture. Findings from behavioral research have been corroborated by neuroimaging studies that identified significant SES differences in regional brain volume in areas that are associated with language and executive function (Farah et al. 2006, Hackman & Farah 2009, Noble et al. 2012, Hanson et al. 2013).

Perhaps surprisingly, there is limited evidence regarding SES-related differences in children's ability to follow gaze or establish and maintain joint attention within the first year, and existing findings are inconclusive, showing reduced interaction in some mother–child dyads but increased interaction in others (Cohn et al. 1986); still other studies find relatively few significant group differences (Hammer & Weiss 1999). Given the high prevalence of maternal depression in low-SES families (Lyons-Ruth et al. 1990, McCue Horwitz et al. 2007, Turney 2012) and the negative

relation between depressive symptomatology and growth in toddler vocabulary production (Pan et al. 2005), this is a critical area for future research.

4.2. Vocabulary Development

The most striking evidence of SES disparities is observed in children's expressive and receptive vocabulary. As early as 18 months, infants in high-SES families had larger expressive vocabularies compared with their peers in low-SES families (Fernald et al. 2013). By the age of 3 years, children from high-income households already produced twice as many words as did their peers from low-income households, according to well-known research by Hart & Risley (1995). Despite concerns regarding the small sample size, limited geographical scope, and overall generalizability of these data (Dudley-Marling & Lucas 2009, Johnson 2015, Sperry et al. 2015), SES has been positively associated with vocabulary development across a number of subsequent investigations. Recent studies based on standardized tests and nationally representative samples have demonstrated these SES disparities in the global context (Bradbury et al. 2011). For example, an analysis by the Comprehensive Child Development Program (CCDP) suggested that children living in poverty in the United States scored 15 months behind the national norm on a receptive vocabulary test by the age of 5 years (Layzer & Price 2008). Data from the UK Millennium Cohort Study (MCS) showed that preschool children from low-income families were 15 months behind their more affluent peers in expressive vocabulary, and had slower vocabulary growth during preschool years (Blanden & Machin 2010). Similarly, the Longitudinal Study of Australian Children (LSAC) indicated an 8-month gap in children's receptive vocabulary growth between children from low- and high-SES families (Taylor et al. 2013).

These disparities are important not because of the number of words per se but because when children know more words they have more concepts and more ways to categorize their world. Having a smaller vocabulary also impedes children's ability to express their feelings and desires as well as to control their impulses (Roben et al. 2013). However, other researchers have argued that equating language with abstract thinking and knowledge could be problematic (Miller & Sperry 2012). The majority of standardized vocabulary tests are highly structured and deeply embedded in the mainstream, middle-class culture, and might therefore depress the test performance of children from lower-SES backgrounds (Gutierrez-Clellen & Peña 2001). As a result, SES disparities might reflect cultural differences in language socialization, rather than the language deficits of children from lower-SES homes (Miller & Sperry 2012). New assessment tools that are validated for use with culturally and linguistically diverse children will be necessary in order to gain a more accurate examination of their language skills (e.g., dynamic assessment; Gutierrez-Clellen & Peña 2001).

4.3. Grammatical Development

In additional to vocabulary, SES-related differences also exist in grammatical development. SES predicted the complexity and diversity of syntactic structures children produced during mother–child interaction (Vasilyeva et al. 2008, Huttenlocher et al. 2010), as well as children's performance on standardized tests of grammatical development (Morisset et al. 1990, Dollaghan et al. 1999). Recent findings from a normative sample of preschool children tested on a computerized language assessment indicated that children from low-SES homes had syntax comprehension scores at age 5 that were not significantly different from children from higher-SES homes at age 3, revealing a gap of nearly 24 months on test items including *wh*-questions and embedded clauses (Hirsh-Pasek et al. 2015b).

4.4. Phonological Development

Phonological awareness, which refers to children's understanding of the sound structures of words (e.g., the ability to combine 'bat' and 'man' into 'batman,' or say 'bike' without 'k'), provides a crucial foundation for later literacy development (McDowell et al. 2007). Children with low phonological awareness are at risk of having reading difficulties (Lonigan 2003), which further leads to negative attitudes toward reading (Oka & Paris 1986), less engagement in reading practices (Allington 1984), and lower reading comprehension skills (Brown et al. 1986). Children from high-SES backgrounds also showed a higher level of phonological awareness (Bowey 1995, Lonigan et al. 1998, McDowell et al. 2007) than children from low-SES homes.

4.5. Narrative

Compared with children from low-SES homes, those from middle-SES households needed fewer prompts to produce long and informative narratives, referred to temporal and causal relationships more often, and were more likely to organize their narratives logically and chronologically (Peterson 1994). All of these narrative features match the expectations of teachers, and may allow middle-class children to have a smoother transition to school than their disadvantaged peers (Michaels 1991). However, ethnographic research has suggested a rich oral tradition in many low-SES communities (Miller & Sperry 2012). Children from these communities are exposed to and engage in personal storytelling at an early age, thereby developing culture-specific narrative skills (Burger & Miller 1999, Miller et al. 2005). There is evidence that children from low-SES homes engaged in more costorytelling in daily life, produced narratives of higher quality, and had better narrative comprehension than their middle-class counterparts (Burger & Miller 1999, Gardner-Neblett et al. 2012). Unfortunately, low-SES children's strength in narrative skills is often underestimated by teachers, because of the mismatch between home cultures and the mainstream method of instruction in schools (Dyson & Genishi 2009).

4.6. Literacy Development

When children start to read and write, the SES-related disparities in language skills feed into gaps in literacy achievement (Walker et al. 1994, Lee & Burkam 2002). An analysis by the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K) showed that, at the time of school entry, children from the lowest SES quintile (20%) were 1.2 standard deviations lower in reading skills than children from the highest SES quintile (Lee & Burkam 2002). Strikingly, more than 80% of children from low-income families cannot read proficiently by the end of third grade (Annie E. Casey Found. 2013). From third to eighth grade, low-SES students also had a higher risk of reading difficulties than did students from middle- or high-SES backgrounds (Kieffer 2010). In a representative sample of the National Educational Longitudinal Survey (NELS), twelfth-grade students from high-SES backgrounds were two to four times more likely to score at the proficient or advanced level on standardized reading tests than were students from low-SES backgrounds (Camara & Schmidt 1999). A similar achievement gap is observed in children's writing skills. In first grade, children from different SES backgrounds already varied in the quality and productivity of their writing (Kim et al. 2015). By the end of high school, students from low-income families scored one standard deviation lower than their peers from middle- or upper-class families in the SAT writing test (CollegeBoard 2013).

Where do these SES disparities in literacy development come from? Although differences in basic language skills such as vocabulary size and language processing partially explain the

variations, Neuman (2001, 2006) argued that knowledge inequality is key to the widening literacy gaps. Children organize their previous language experiences into schemas of knowledge, which further allow them to process and gain new information quickly and easily. One study showed that children's general knowledge at the entrance to kindergarten was a stronger predictor of reading skills at fifth grade than their early reading scores (Grissmer et al. 2010). Similarly, children who are frequently read to develop a concept of "story grammar" (a typical story has a setting, problems, solutions, an ending, etc.), which further helps them to comprehend and remember stories better (Stein & Glenn 1979, Anderson & Pearson 1984). In contrast, the lack of a story grammar schema makes it difficult to process stories and then to remember the important components that are commonly measured on standardized reading assessments.

Additional research suggests that children whose home and school dialects differ are at greater risk for reading difficulties because tasks such as decoding rely heavily on Standard American English (SAE; Brown et al. 2015). Whereas children from middle- and high-SES backgrounds may acquire knowledge that can be transferred to a classroom/test setting seamlessly, children from low-SES backgrounds might experience a mismatch between expectations in their home and classroom environments (Dyson & Genishi 2009). As a result, a Matthew effect occurs (i.e., the rich get richer and the poor get poorer) as high-income children profit more from the same classroom instruction than their low-income peers. Of the many questions for future research, the most pressing are how to measure literacy skill and how to improve classroom literacy instruction in a way that is sensitive to the diversity of preliteracy practices found in different socioeconomically and culturally defined family systems.

5. THREE POTENTIAL SOURCES OF SOCIOECONOMIC-STATUS-RELATED DIFFERENCES IN LANGUAGE DEVELOPMENT

SES-related differences in language learning opportunities, experience, and exposure exert varying levels of influence on language development in childhood, depending on the child's characteristics, the quality and quantity of input available in parent–child interactions, and the provision of age-appropriate materials in the home environment and rich experiences outside the home (**Figure 1**). In this section, we examine this trilogy of factors as potential sources of influence on the association between SES and language.

5.1. Child Characteristics

Despite consistent milestones in typical development, children bring unique variability to the task of language acquisition. Many child characteristics are important for language development, including physical and mental health, social–emotional skills (e.g., temperament, affect, internalizing and externalizing behavior, self-efficacy), approaches to learning (e.g., openness, curiosity, persistence, attentiveness, cognitive learning style), and executive functioning skills (e.g., working memory, attentional flexibility, inhibitory control, self-regulation). It is outside the purview of this article to explore each factor. Instead, we focus on a potential source of variation that is relatively underexplored in relation to SES, but may have important implications for language development—the child's learning processes.

Language ability can be measured in terms of an individual's knowledge of lexical or grammatical content (product) or in terms of real-time ability to access and apply this knowledge for comprehension and production (process). Comparatively little is known about the ways in which learning processes may influence language development. We borrow a psycholinguistic definition to characterize process-dependent skills as "the mental operations required to manipulate

linguistic units" (Campbell et al. 1997, p. 520) and include two distinct forms of process that have been discussed in the literature. The first form centers on processing efficiency, which refers to the speed and accuracy with which children listen to and comprehend the language input they hear. A child with high processing efficiency, for example, might rapidly understand and respond appropriately to her mother's passing comment, "Look! I see a blue car!", whereas a child with low processing efficiency would miss the opportunity as the car speeds past. The second form includes learning processes, which refer to the strategies with which children acquire new vocabulary words and grammatical structures such as fast mapping (Carey & Bartlett 1978) and syntactic bootstrapping (Naigles 1990), respectively. A young child proficient in fast-mapping skills might hear an unfamiliar word such as *yellow* only once, as in, "The banana is yellow," and demonstrate subsequent comprehension of this color term (Golinkoff & Hirsh-Pasek 2006, Swingley 2009). To date, it is unclear whether SES-related factors exert similar influence on processes and processing in the same way they influence the products of language knowledge.

One body of research suggests that SES may differentially affect the products of language knowledge and the learning processes that support language growth. Undoubtedly, differences in language learning environments shape a child's specific language knowledge. A child who grows up with a pet dog, for example, may learn the word *dog* before a child who has no animals at home. However, the child's capacity to learn the word *dog* may not be affected by his or her linguistic environment (Dollaghan & Campbell 1998, Weismer & Evans 2002). Evidence for this perspective comes from research in which word learning skill (e.g., fast mapping; Carey & Bartlett 1978) in preschool children from low-SES families was not correlated with receptive vocabulary knowledge (i.e., the specific product of language experience; Spencer & Schuele 2012). Additional evidence comes from research that showed no significant differences in children's ability to engage in syntactic bootstrapping on the basis of the dialect they spoke, whether it be SAE or African American English (Johnson & de Villiers 2009). That is, these children were equally good at learning something about a novel verb's meaning from its argument structure when it was used in a sentence. This research suggests that the products of language experience (the words and grammatical structures a child knows) may be distinct from the processes and processing (the strategies and efficiency) that support language acquisition.

Other recent research on this topic, in contrast, suggests that SES-related differences in processing skills may already be present in infancy. Specifically, differences in vocabulary and language processing efficiency between infants from higher- and lower-SES families were evident at 18 months, and by 24 months there was a 6-month gap between SES groups (Fernald et al. 2013). This language gap predicted children's processing speed such that young children who received less language input actually processed incoming speech less efficiently, often taking longer to identify the meaning of a word in the context of sentences and conversations (Fernald et al. 2013). Preliminary findings from a cross-sectional study investigating language products and language learning processes revealed that 5-year-old children from lower-SES backgrounds fast-mapped nouns, adjectives, and verbs in a way that was not significantly different from 3-year-old children from higher-SES homes (A. Pace, G. Morini, R. Luo, R.M. Golinkoff & K. Hirsh-Pasek, manuscript in preparation). Additional research is needed to clarify the relation between a child's language proficiency as measured by standardized tests and the processes a child uses to acquire new vocabulary and grammatical structures.

Together, these findings suggest that probing learning processes will be important to fully understand the impact of SES on verbal ability. Because the majority of the available research is correlational, we do not yet know whether children from lower-SES homes begin with lower levels of processing skill or whether they develop different processing skills due to lesser levels of input, exposure, and experience. Future research that experimentally manipulates the level of

input required to improve children's potential to acquire new vocabulary words and grammatical structures will be essential if we are to accurately characterize the relation between what children know about language and how they learn new language. This research should not only ask how early these SES-related differences become apparent but also investigate the pathways by which they influence language development. Data of this sort will be invaluable for testing hypotheses about experience–outcome relations and about optimal levels of input and language exposure to improve rates of acquisition or at least boost children's language acquisition skills to the levels of their peers.

5.2. Parent–Child Interaction

A second body of research suggests that certain components of SES may influence the ways in which caregivers communicate with their children, which in turn results in variations in children's language development. There is some evidence that the sheer amount of language input affects language growth (Huttenlocher et al. 1991), whereas other studies suggest that the quality of language input, such as the diversity and complexity of vocabulary and grammar (Huttenlocher et al. 2010, Rowe 2012), the contingency of language addressed to children (Bornstein et al. 2008), the use of questions (Aram et al. 2013), and language that goes beyond the here-and-now (decontextualized language; Rowe 2012), is also important. Recent research examining both quantity and quality simultaneously suggested that quality might be the primary predictor of language outcome (Rowe 2012, Hirsh-Pasek et al. 2015a), and different qualitative characteristics might play a role in different developmental periods (Rowe 2012, Tamis-LeMonda et al. 2014). For example, the diversity and sophistication of vocabulary facilitate toddlers' lexical growth, whereas decontextualized language is more beneficial for later vocabulary growth in preschool (Rowe 2012).

Several studies have shown that particular aspects of the language addressed to children accounted for the SES differences in children's verbal outcomes. In a study of middle-SES and high-SES families, Hoff (2003) assessed maternal speech and children's productive vocabulary during mother–child interaction at 21 months and 10 weeks later, and found that the length of maternal utterances in MLU (mean length of utterance) at Time 1 fully mediated the relation between SES and children's vocabulary growth from Time 1 to Time 2. In another study, Huttenlocher et al. (2010) assessed the lexical diversity and syntactic complexity of the speech of caregivers and the speech of children between the ages of 14 and 46 months. They found that the lexical and syntactic diversity of caregivers' speech, such as the number of different words and different combinations of clauses, partially explained the associations between SES and children's lexical and syntactic growth. Together, these findings suggest that SES differences in children's language outcomes are due, in part, to SES-related disparities in language input at home. Therefore, for those low-SES children who hear limited child-directed speech at home, having access to high-quality language outside the home can be especially beneficial. Research has shown that positive caregiver–child language interactions in child care buffered low-SES children from poor language outcomes, and such a buffering effect is especially strong for those children who received limited language input at home (Vernon-Feagans et al. 2013).

In addition to child-directed speech, the quality of parental care in general may contribute to the SES gap in language development. Life stress and unsafe living environments associated with low SES might result in more negative, punitive, and authoritarian parenting, which in turn leads to adverse language and literacy outcomes (Hoff et al. 2002b). Although there is well-documented evidence of the relation between SES and parenting style and between parenting style and child language and cognitive outcomes, only a few studies examined these three constructs simultaneously. In a study based on a National Institute of Child Health and Human Development (NICHD)

sample, Raviv et al. (2004) found that maternal sensitivity (as measured by a composite score of hostility, supportiveness, and respect for autonomy) partially mediated the associations between SES and children's expressive and receptive language skills at age 3 (Raviv et al. 2004). Another study showed that maternal supportiveness (as measured by a composite score of sensitivity, cognitive stimulation, and positive regard) partially explained the association between SES and 3-year-old children's language and cognitive outcomes in both immigrant and native families in the United States (Mistry et al. 2008).

New research has gone beyond the construct of maternal sensitivity to probe the specific features that influence language development. A review of this literature reveals several important qualities of parent–child interaction, including the timing of the parent's response to the child (i.e., temporal contingency) and the relatedness of the parent's response (i.e., semantic contingency) so that actions or language meaningfully build on the child's conversational bid (Tamis-LeMonda et al. 2014). Recent research conducted by Hirsh-Pasek et al. (2015a) demonstrated that three specific features of early parent–child communication at age 2 (i.e., episodes of joint engagement infused with words and gestures, routines and rituals such as book reading, and the back-and-forth fluency and connectedness of conversation) were powerful predictors of expressive language at age 3 and may have served as a buffer against poverty in a sample of low-income families. These findings suggest that there is wide variability in the quality of parent–child interactions even within socioeconomic strata that accounts for significant differences in later language ability.

Complementary research from anthropology and sociolinguistics suggests that it may be important to take a broader view of language learning contexts that include multiparty participation frameworks in which many family members—including siblings, grandparents, and other caregivers—engage with the child (De León 2011, Sperry et al. 2015). Although adults who take turns in interactions with young children, share periods of joint focus, are sensitive and responsive, and express positive affect provide children with the scaffolding needed to facilitate language and cognitive growth (Clarke-Stewart 1973, Bradley et al. 1989, Bronfenbrenner & Morris 1998, Howes 2000, Katz 2000, Landry et al. 2001, Tamis-LeMonda & Bornstein 2002, Hirsh-Pasek & Burchinal 2006), limiting observational studies of joint engagement to the American middle-class model of sustained speech directed to the child in dyadic interaction may not allow full appreciation of the complexity and heterogeneity of family systems in which children are fully capable of developing culturally appropriate communication styles and verbal competence (Vogt & Mastin 2013).

Taken together, these studies suggest that the relation between SES and verbal ability cannot be explained by a simple causal vector through which low SES leads directly to poor language outcomes. In fact, recent research suggests that there is substantial within-SES variability in the quality and quantity of language exposure and that many important features of parent–child interaction modulate the effects of SES on children's language development. Additional research on variation in parenting and language socialization practices will contribute to a more holistic understanding of how high-quality engagement supports language growth across cultures.

5.3. Availability of Learning Materials: Resources at Home and in the Community

Another source of variation through which SES influences children's verbal ability is the availability of learning materials—not only within the home, but also in the community at large. Research suggests that, compared with children from middle- or high-SES families, children from low-SES backgrounds are exposed to limited language and cognitive stimulation both in the home and in the community. According to one national study (NICHD), only 25% of 3- to 5-year-old children from low-income families had 10 or more books at home, whereas almost 50% of children from

more affluent households did (Bradley et al. 2001). SES disparities are also seen in the quality and variety of books and the richness of linguistically and cognitively stimulating toys (e.g., crayons, alphabet blocks) that children have at home (McGill-Franzen et al. 2002, Rodriguez et al. 2009, Froiland et al. 2013). Such inequality in children's access to learning materials expands from the home setting to the school and community.

Dangers in children's physical and social environments, such as neighborhood violence and lead exposure, may make it difficult for children from lower-SES communities to play outside (Brooks-Gunn & Duncan 1997) and hinder cognitive development (Caughy et al. 2007). Children from lower-SES families may have limited opportunities to go to zoos, children's museums, high-quality libraries (Pogash 2016), and well-designed parks, all of which spur new vocabulary and language growth (Neuman & Celano 2001). For example, Neuman & Celano (2001) compared children's access to print in middle- and low-SES communities, and found that middle-SES communities had many more locations that sold children's books and magazines, more readable signs on the street, and more public spaces for reading than low-SES communities. There were also striking differences in the availability and quality of books in preschool classrooms that served low- and middle-SES children.

Learning materials, especially literacy resources, allow children to engage in language and literacy activities, which further facilitate a variety of emergent literacy and language skills, including receptive vocabulary, oral language skills, letter-word identification, and concepts about print (Payne et al. 1994, Christian et al. 1998, Park 2008, Farver et al. 2013, Froiland et al. 2013). For example, a national representative study of low-income families suggested that the richness of the literacy environment across the first 3 years of life was associated with children's receptive and expressive language skills at 14, 24, and 36 months (Rodriguez et al. 2009). Access to learning materials also covaries with other aspects of the home learning environment that support language growth. For example, mothers who provided children with rich literacy materials tended to model reading behaviors themselves and had a high level of reading ability (Johnson et al. 2008).

Studies simultaneously assessing SES, learning materials, and children's language and literacy development further support the mediating role of learning materials. For example, an analysis of the ECLS-K showed that SES predicted parents' provision of books and learning materials and involvement in learning activities, which were further linked to children's language and academic skills at age 6 (Gershoff et al. 2007). Research on summer reading loss, the phenomenon that students' reading scores drop after summer vacation, also highlights the role of home literacy resources in SES gaps in children's literacy skill. According to the "faucet theory" (Entwisle et al. 2000), during the school year, access to literacy resources is "turned on" for all children, whereas during summer recess, the school resources faucet is "turned off," and children need to rely on home learning materials. Consequently, the inequalities in home educational resources lead low-income children to engage in reading activities less frequently and experience a greater summer reading loss than their middle-class peers (Kim 2004). Providing book resources for summer is an effective intervention strategy to increase reading activities and promote reading proficiency, especially for children from economically disadvantaged families (Allington et al. 2010).

6. CHANGING LANGUAGE TRAJECTORIES THROUGH EARLY INTERVENTIONS

Emerging consensus suggests that changing language trajectories will require a multitiered model of intervention that provides services at the individual, community, and broader population levels. Current interventions include intensive home-visitation programs for high-risk families, service

delivery in primary-care settings such as pediatricians' offices, high-quality early care and education (ECE) programs, and scaling efforts to community and population levels. Below, we extend our three-part framework to consider recent interventions that take critical steps toward addressing language gaps by targeting children's skills to support language development, as well as external environmental supports that enhance language outcomes.

6.1. Enhancing Skills and Strategies for Language Acquisition: Can Targeting Learning Processes Support Language Growth?

Language begets language. Research suggests that what children know about language, as reflected in the vocabulary words and grammatical structures they use, supports how they learn new language, and vice versa. There is limited evidence, however, that interventions have capitalized upon this reciprocal relation. Whereas many intervention approaches directly target the content to be learned (e.g., a set of vocabulary words or a new syntactical construction), a smaller number have directly targeted the skills and strategies that support language learning, though a few notable exceptions exist (Gershkoff-Stowe & Hahn 2007, Gray & Brinkley 2011). One study asked whether 16- to 18-month-old children who were exposed to a high-practice set of unfamiliar words over 12 weeks would show an increased ability to learn a second set of low-practice words compared with a control group (Gershkoff-Stowe & Hahn 2007). Children in the high-practice group not only learned more words but were essentially "primed" to acquire a second set of less intensely practiced words at a more rapid rate than children who were matched on productive language ability but did not receive extended practice with the first set of words. This suggests that interventions aimed at "boosting" the word learning system with extended practice may support subsequent word learning. This model has not yet been tested on a large scale or with children who vary by SES.

Other important language interventions address the underlying processes that support word learning—in particular, phonological knowledge, working memory, and attention (Alt et al. 2012, 2014). One promising intervention with children from low-SES families found that targeting children's attention skills had a large impact on attention (as measured by event-related potentials) and led to gains in the children's receptive language abilities (Neville et al. 2013). Other studies have addressed the role of phonological or working memory training in word learning (Alt et al. 2012, 2014; Ellis et al. 2015). However, most of the research investigating cognitive contributions to language acquisition involve language-impaired children from middle- and high-SES backgrounds. These models have not yet been extended on a large scale to explore their efficacy or feasibility with children from low-SES families. In light of the evidence for early differences in processing efficiency between low-SES children and their more affluent peers (Fernald et al. 2013), exploring interventions that target skills and strategies that support language acquisition is a critical direction for future research.

6.2. Enhancing the Input: Interventions Targeting the Quantity and Quality of Parent–Child Interaction

Given the mediating role of early language experiences on the associations between SES and language outcomes, other interventions have been devoted to closing the SES-related gap by educating caregivers on the importance of early language input and improving the quality and quantity of language and literacy interactions. For example, preliminary evidence from the Thirty Million Words Initiative (**http://thirtymillionwords.org/**) suggested that instructing parents to talk more and providing parents with feedback on the quantity of child-directed language in daily life effectively increased the number of words and conversational turns they produced during

parent–child interactions at home (Suskind et al. 2013). In another intervention based in the United Kingdom, instructing parents to engage in contingent talk with their infants for 15 minutes a day was shown to affect language development across socioeconomic strata (McGillion et al. 2014). Similarly, shared book-reading and joint writing interventions, in which caregivers engaged in these activities with children several times a week, successfully improved children's vocabulary, language comprehension, and emergent literacy skills (Levin & Aram 2012).

Promising results were also observed in interventions facilitating the quality of parenting practices, such as parental sensitivity, contingency, and responsiveness. For example, in the Play and Learning Strategies intervention (PALS; Landry et al. 2006, 2008), low-income mothers of 6-month-olds were trained to respond to children's communication signals in a sensitive, warm, and contingent manner. Compared with children in the control group, children in the intervention group had greater receptive vocabularies, initiated conversations more often, and produced more words during mother–child interactions (Landry et al. 2006).

Other interventions have focused on the content of parental language input. Dialogic reading, a book-reading technique emphasizing parents' use of open-ended questions, is a widely used approach to improving children's language outcomes (Valdez-Menchaca & Whitehurst 1992, Whitehurst et al. 1994, Lonigan & Whitehurst 1998), although the magnitudes of effect are stronger for European American families than for Latino and African American families (Manz et al. 2010). Training parents on providing elaborative and enriched language input during shared reminiscing also benefits children's narrative skills and language comprehension, especially for children from ethnic minority families (Reese et al. 2010).

Interventions that focus on the quality and quantity of parent–child interactions are also evident at the community and population level. For example, Providence Talks (**http://www.providencetalks.org/**) is a city-wide initiative designed to increase the number of words spoken to children and the number of turns taken during conversations. The Talking Is Teaching multimedia campaign (**http://talkingisteaching.org**) is designed to help parents understand that talking about daily activities is a way to boost vocabulary development. And the Bezos Family Foundation's project VROOM (**http://www.joinvroom.org**) offers brain-building tips and texts that help parents focus on learning with their children. Similarly, the text4baby project (**https://www.text4baby.org**) uses text messages to inform pregnant women and new mothers of ways to support children's learning and growth. Other models, such as the Video Interaction Project, have focused on training parent-guided interactions during pediatric visits that foster positive cognitive, linguistic, and social development (Mendelsohn et al. 2007, Weisleder et al. 2016). Bringing interventions to scale through this type of broad, population-based model is a critical next step if language trajectories are to be changed for the nearly 15 million children living in poverty in the United States today.

6.3. Interventions Targeting Learning Resources

Another factor that hinders children's language development in low-SES families is the lack of learning resources. Providing children and families with greater and easier access to literacy materials has been recognized as an effective strategy to increase children's engagement in language and literacy activities and ultimately foster language outcomes. There is some evidence that a single trip to the library has a significant impact on children's reading experiences. In an intervention, second- and third-graders from low-income families were allowed to explore a public library and check out 10 books, whereas their peers in the control group were able to check out only 1 book from the school library. Children in the intervention group reported reading more and having a more positive attitude toward reading than those in the control group (Ramos & Krashen 1998).

Books and learning materials also make a difference in children's language and literacy experiences in the home and classroom contexts. For example, an intervention study provided children with age-appropriate, high-quality books recommended by early childhood educators and children's literature experts. Allowing children to take one book home every week for 12 weeks significantly increased book-sharing interactions at home (Robinson et al. 1995). Likewise, providing book resources for summer reading resulted in greater engagement in reading activities during the summer months and a higher level of reading proficiency in fall, especially for those children from economically disadvantaged families (Allington et al. 2010).

In child care centers, exposing children from low-SES homes to high-quality books at a ratio of five books per child resulted in greater language interactions around literacy, longer book-reading time, and more physical access to books, which in turn led to greater receptive vocabulary and better concepts of writing and print in children (Neuman 1999). Notably, other studies have suggested that provision of high-quality books is not sufficient for facilitating children's language outcomes. Rather, access needs to be coupled with training caregivers in how to use these books to be effective (McGill-Franzen et al. 1999).

The last decade has seen a steady increase in the use of digital educational devices, such as electronic books (e-books), tablets, laptops, and smartphones, in both home and school settings. To date, the majority of research examining the effects of digital devices on language development has focused on e-books, and has yielded mixed findings. Some studies suggested that, just like traditional books, e-books can serve as educational tools to support language growth, and they are especially beneficial for low-SES children (Korat & Shamir 2008, Korat et al. 2014). In contrast, other studies showed that the presence of electronic features might distract children's attention and hinder their learning during book-reading interactions (Parish-Morris et al. 2013). It appears that the key factor is not whether learning materials are digital or print based, but whether they successfully elicit high-quality language interactions between children and caregivers to support children's engagement with the learning materials (Gong & Levy 2009, Segal-Drori et al. 2010, Smeets & Bus 2015). Given concerning evidence regarding the growing "digital divide" between those who have access to digital resources and those who do not, understanding how social and economic inequalities extend into the sphere of new technologies is of the utmost importance (Ragnedda & Muschert 2013).

Opportunities to improve the quantity and quality of children's language experiences are not restricted to the home or classroom contexts. Ridge et al. (2015) took an innovative approach to spark parent–child conversations in supermarkets by putting up signs such as "What is your favorite vegetable?" and "Where does the milk come from?" The presence of these signs increased the quantity of talk between caregivers and children in supermarkets located in low-SES neighborhoods, supporting the language experiences for these families (Ridge et al. 2015). Another innovative approach melds the science of learning with architecture to create "puzzle benches" at heavily used bus stops so that families can talk and learn together while waiting for public transportation. Activities that foster storytelling and impulse control are also built into aesthetically pleasing structures that dot the urban landscape. This intervention, called Urban Thinkscape, is currently under way in Philadelphia (B. Hassinger-Das, I. Palti, K. Hirsh-Pasek & R.M. Golinkoff, project in preparation). Taking communities and neighborhoods as a learning canvas, these initiatives are designed to spark language learning every day and everywhere.

7. GENERAL DISCUSSION

SES is strongly associated with language outcomes. This association is robust, appearing across cultures, ethnicities, and home languages. This association is also pervasive, demonstrating links

across multiple domains of language from vocabulary to pragmatics. And this association begins early, revealing language differences from infancy through adolescence and beyond. However, this association is not universal, nor is it impervious to effective intervention. On the contrary, compelling new evidence suggests that in countries where social policies ensure more uniform access to high-quality education and health care (e.g., Australia), the effects of childhood SES on intelligence and academic achievement can be nullified or even reversed (Tucker-Drob & Bates 2015). Complementary research is focusing on understanding the relation of language experience to language development and uncovering additional factors that might modulate the impact of varying socioeconomic circumstances on how children learn to communicate. Future research is needed to identify how early we can observe, and thus protect against, the negative effects of poverty; to refine our methods of language assessment so that they are sensitive to individual differences and unique strengths; to investigate the impact of SES on foundational skills such as joint engagement; and to assess the generalizability of interventions within culturally and linguistically diverse populations.

This review has explored three pathways through which SES may influence children's language development: the child's learning processes, the quantity and quality of caregiver–child interaction, and the broader availability of learning materials and resources at home and in the community. First, typically developing children show incredible individual variability with respect to their learning processes, which in turn influences their language acquisition. Although some of these processing differences may result from variations in language input, they are nonetheless associated with different trajectories of language development. Second, SES is associated with several key features of caregiver–child interactions that facilitate language development, including the quantity and quality of language input, the contingency and reciprocity of interaction, and parental warmth and sensitivity. Third, children from different SES groups vary in their access to books and other literacy resources, as well as in the prevalence of environmental hazards (e.g., lead exposure, violence), which further provide or hinder opportunities for language learning.

A better understanding of the multiple mechanisms underlying SES disparities will help us identify malleable factors that facilitate language development and buffer against poverty. However, to date, studies on these three pathways have typically been separate. Much is unknown about the interactions among these pathways and whether some pathways are more salient during certain developmental periods. In addition, the majority of work in this area is correlational. More research is needed to understand the casual relationships among SES, mediating factors, and language outcomes. Finally, although these pathways have been documented both across SES groups and within SES strata, little is known about the extent to which they are generalizable across different cultural and linguistic contexts.

Language trajectories are malleable. Converging evidence has demonstrated this fact by illustrating how language environment affects language outcomes. Only recently, however, has research begun to pull apart the complex tangle of factors that contribute to the relation between SES and language development and to uncover the underlying mechanisms by which this relation can be changed. Although ongoing research has identified multiple pathways by which SES influences language growth, concerted time, effort, and resources need to be dedicated to developing multitiered interventions at the individual, community, and population levels to target changes that support positive language trajectories for all children in ways that validate the rich and generative language capacities of children from diverse socioeconomic, cultural, and linguistic backgrounds. To accomplish this task, practitioners should adapt interventions for language-minority families; develop inclusive models that involve fathers, mothers, and other caregivers; start early by educating parents and caregivers on the importance of rich language experiences well before children begin to speak; scale language interventions to the population level by using innovative

technologies (e.g., text messaging), delivery methods (e.g., internet training or teletherapy), and community resources (e.g., public spaces); and develop deep community partnerships during all phases of design and implementation to increase ecological validity and maximize positive impact.

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Errata

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