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Communication and Social-Cognition in 12-month-olds
from Low- and Middle-Income Homes

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy in
Language and Communicative Disorders

By

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2006

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2006

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ABSTRACT OF THE DISSERTATION

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by

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Doctor of Philosophy in Language and Communicative Disorders

University of California, San Diego, 2006

San Diego State University, 2006

Professor Donna J. Thal, Chair

There are many well-demonstrated and detrimental effects of low-socioeconomic status (SES) on language and cognition by two years of age. Since similar effects are not usually detected during the first year of life, some suggest that early stability in this population is followed by developmental decline. This dissertation was designed to test the hypothesis that early effects of income *would* be detected if subtle and early-appearing social-cognitive and communicative foundations for language were thoroughly examined. A set of four studies explored this hypothesis and examined related issues pertaining to maternal input and accuracy of maternal report. Participants were an ethnically-diverse group of fifty 12-month-old infants from low-income (n=27) and middle-income (n=23) homes. Study 1 relied on four sources of data (parent report, communication sample, and two behavioral tasks) to measure comprehension vocabulary and gesture use. No differences were detected in the number of words understood or the number of different gestures used by infants, though both groups performed at-chance on

the comprehension task. Infants from low-income homes used gestures significantly less often to communicate with the tester. Study 2 measured joint attention and related behaviors via the Early Social-Communication Scales (ESCS; Mundy et al., 2003). No effects of SES were detected, suggesting equivalence in the measured skills. Study 3 validated the results obtained via parent report on the MacArthur-Bates Communicative Development Inventory (CDI; Fenson et al., 1993) in Study 1, by comparing parent report to infant behaviors during tasks. No effects of income or education were detected on the accuracy of parent report. A fourth study explored verbal and nonverbal aspects of mothers' communication during 10 minutes of play with their infants. Mothers with lower income produced fewer words, and mothers with lower education produced significantly more gestures than mothers with higher education, possibly reflecting a greater tendency toward directiveness. A relation was found between maternal input and the number of communicative gestures used by infants. These studies add to our understanding of the effects of a low-SES environment during infancy. I stress the need for longitudinal studies of low- and middle-income infants that may complement the present work.

CHAPTER 1

Introduction

According to a recent report by the National Center for Children in Poverty (<http://www.nccp.org/pub>, 2004), 44% of all infants and toddlers in the United States live in low-income families. Furthermore, the percentage of young children living in low-income homes increased by 11% between the years 2000 and 2004, suggesting that an already dire situation may be growing even worse. There are both moral and legislative obligations that demand concern for the well-being of these young children. The lack of financial and material resources available to low-income families often makes it difficult for parents to meet even the basic needs of their children. In addition to these more tangible correlates of poverty are income-related differences that often manifest in the cognitive, social, behavioral, and linguistic domains. By the teenage years, for example, poverty is strongly correlated with poor academic achievement, decreased performance on standardized tests, and an increase in school dropout and crime rates. Rather than assessing the long-term developmental *outcomes* of children who have grown up in low-income homes, this dissertation asks whether income-related differences exist in infancy, when social-cognitive and communicative behaviors are first emerging.

Chapter 2 explores the early language and cognitive development of infants and preschool-aged children from low-income homes, and re-examines the “developmental trend” that has been witnessed in many studies. The trend has been toward average or slightly above-average scores for low-income infants in the first year and into the second year of life, followed by significantly lower scores on most measures of language and

cognition by three years of age. Two accepted explanations for this pattern of results are presented, and I stress the need for considering an alternative interpretation altogether.

Chapter 3 provides a brief overview of the challenges that confront low-income families; these range from limits in basic resources (e.g., shelter and food) to broader community-level challenges (e.g., reduced access to libraries and parks in poor neighborhoods). Because the importance of the early home environment for the development of language and cognition is particularly well-established, this dissertation is concerned with the *immediate social context* in which infants grow up and first learn language. Low- and middle-income parents have been found to interact with their children in ways that are quantitatively and qualitatively different from one another. Maternal characteristics and features of parent-child interactions are accordingly explored in some depth.

The first year of life constitutes a critical developmental period in which the earliest social-cognitive and communicative functions emerge, and the basic foundation for language learning is established. Chapter 4 examines the precursors to and predictors of language production, and points to *communicative gestures* and *vocabulary comprehension* as variables that are tightly linked with later language. Communicative gestures and language comprehension in the first year have been shown to be strongly related with language production in the second and third years of life. In spite of the established importance of these foundational skills, neither has been systematically explored with low-income infant populations. I suggest that a comprehensive assessment of gestures and language comprehension in the earliest stages of development is critical

to an improved understanding of the developmental communicative course for children from low-income homes.

At first glance, it may seem to be “splitting hairs” by investigating twelve-month-old infants, because income-related differences have already been clearly established in the literature by as early as two and three years of age. However, Chapter 5 provides ample evidence to suggest that an understanding of the first year is particularly critical to furthering our knowledge of how and when the environment may first come to exert effects on communicative development. The impetus for this work derives from a constructivist theory, in which the foundations for language are thought to be laid well before a child’s first birthday. By this interactionist theoretical account, the emergence of *joint attention* at the end of the first year of life establishes a critical foundation upon which future language is constructed. In spite of the demonstrated importance of early joint attention behaviors, very little is known about any effects of income on the emergence or development of these behaviors in infants from different socioeconomic strata.

The scientific rationale for the set of studies reported here is grounded in the framework of an interactionist social-cognitive theory of language learning (i.e., constructivism). The methods and procedures of the studies reflect this theoretical orientation. Chapter 6 sets forth the research objectives and predictions for four interrelated studies. Chapter 7 describes the general methodological design, including a detailed account of the participants, procedures, and tasks. The findings are presented in the subsequent chapters, each with its own set of hypotheses, results, and conclusions.

Chapter 8 examines vocabulary comprehension and gesture use in low-income and middle-income infants and tests the hypothesis that there will be significant group differences in these precursors to language production. Chapter 9 asks whether there is a relation between income group and infants' behaviors during a standardized observation measuring joint attention and related social-cognitive behaviors. Chapter 10 compares parent report on a communication checklist with infants' performance on behavioral tasks, and asks whether parents with low levels of income and/or education provide information that is consistent with the behavioral data. Chapter 11 explores the verbal and nonverbal communicative behaviors witnessed in mothers during 10 minutes of play with their infants. Qualitative and quantitative differences in the language and gestures of low-income and middle-income mothers are discussed as well as the potential importance of these maternal differences for infants' language-learning experiences. I conclude the dissertation with a brief overview that integrates key findings from the four individual studies. Chapter 12 provides these general conclusions, my interpretation of the overall results, and suggests additional directions for future research.

CHAPTER 2

Early Language and Cognitive Development in Children from Low-Income Homes

2.1. Introduction

More than one-third of children in the United States live in low-income families, and the very youngest children are over-represented in the low-income demographics than any other age group, with 42% of all infants and toddlers living in low-income homes (<http://www.nccp.org/pub>, 2004). These statistics suggest a very real and pervasive problem for the youngest children of our nation, given the strong relation between social status of families and intellectual performance of children. Children born into low-income homes are at greater risk of obtaining below-average scores on measures of intelligence, and they often experience academic difficulties by the school years (Sameroff, Seifer, Baldwin, & Baldwin, 1993; Brooks-Gunn, Klebanov, & Duncan, 1996). Smith and Zaslow (1995) report that two of the most powerful predictors of poor cognitive outcome are poverty and low levels of maternal education. Furthermore, socioeconomic status has been shown to predict more than 20% of the variance in IQ scores of children (White, 1982), and poverty has been shown to be the primary correlate of mild mental retardation (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987).

2.2. Review of the literature

The trend for less than optimal development for children living in low-income homes holds especially true within the domain of language development, and as early as the preschool years. For example, children with lower socioeconomic status have been shown to build their vocabularies at slower rates than children with higher socioeconomic status (e.g., Dollaghan et al., 1999; Morisset, Barnard, Greenberg, Booth, & Spieker,

1990; Hart & Risley, 1995; 1999). A considerable body of evidence indicates that the direct statistical relationship between socioeconomic status and child language ranges from moderate to strong with children from the lowest socioeconomic strata having significantly lower scores on measures of comprehension and production of oral language than their middle-SES counterparts (e.g., Bradley & Caldwell, 1984; Sameroff et al., 1987; Smith & Zaslow, 1995). A more detailed review of studies that explore language and cognitive development of low-income children is presented first for preschool-aged children and then for infants and toddlers.

2.2.a. Preschool-aged children

The language and cognitive development of children has been studied primarily via standardized tests, parent report, and behavioral observations. Differences in language and cognition as a function of socioeconomic status have been consistently detected in children by three years of age, irrespective of method of assessment. Studies that have employed these techniques to explore the cognitive and language development of preschool-aged children from low-income homes are presented in the following sections.

2.2.a.i. Standardized tests

The Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997) measures vocabulary comprehension which is an important early indicator of a child's linguistic and cognitive development (Dunn & Dunn, 1997). Washington and Craig (1999) administered the PPVT-III to a group of African-American children who were considered "at-risk" on the basis of income or social status variables. The 4-year-old children in their study performed significantly below the PPVT-III mean, and on average at the 27th percentile.

Fish & Pinkerman (2003) similarly reported that a majority (60-70%) of low-SES four-year-old children scored more than 1 standard deviation below the mean on all three subscales (Auditory Comprehension, Expressive Communication, and Total Language) of the Preschool Language Scale-3 (PLS-3; Zimmerman, Steiner, & Pond, 1992). It is important to note that the low-income children performed significantly below the established standard mean score—yet still well within normal expectations for the instruments. Although low-income children as a whole scored in the lower percentiles on standardized assessments and significantly worse than children from more advantaged homes, they did not perform so poorly as to suggest the presence of a language delay or impairment.

In one study, though, an inflated percentage of children with low-income backgrounds scored in the clinically significant delayed range by the preschool years. Qi and colleagues (Qi, Kaiser, Milan, Yzquierdo, & Hancock, 2003) found that a group of low-income African-American preschoolers (aged 3- 4 ½ years) performed on average one standard deviation below the expected means on both the Expressive Communication and Auditory Comprehension subscales of the PLS-3. Using a conservative applied cutoff score (2 SD below the normative mean) as a marker of delay resulted in a much higher percentage of children being identified as language-delayed relative to the normative sample (10% vs. 2.5%). Although only 10% of the total low-income sample met the criterion for delay, this is still four times the percent delay in the predominantly middle-income normative sample. These findings suggest that there may be increased risk for clinically significant language delay in children growing up in low-income homes.

The Home Observation for Measuring Environment inventory (HOME; Bradley & Caldwell, 1984) was created in order to measure such variables as provision of appropriate play materials, organization of physical environment, and mother responsiveness. When the HOME was administered with a group of primarily low-income parents when their children were 24 months old, the total HOME score was significantly correlated with the children's scores on the Stanford-Binet Intelligence Scale at 3 years ($r=.71$) and at 4 ½ years of age ($r=.57$). The Stanford-Binet (Thorndike, Hagen, & Sattler, 1986) tests intelligence across four major domains of verbal reasoning, quantitative reasoning, abstract/visual reasoning, and short-term memory.

The Wechsler Primary and Preschool Scales of Intelligence (WPPSI; Wechsler, 1989) is another test developed for use with children between the ages of 4 and 6 ½ years. It is designed to measure aspects of children's cognitive functioning and yields composite scores on a Performance Scale and a Verbal Scale. With a socially heterogeneous group of 4-year-old children, Sameroff and colleagues (Sameroff et al., 1987) found that socioeconomic status explained 35% of the variance in scores on the Verbal Scale of the WPPSI. Those children deemed to be at "high-risk" were more than 24 times as likely to have verbal IQ scores below 85, or more than one standard deviation below the mean, than were children who were not socially at-risk.

There is clearly a well-established positive relation between socioeconomic status and children's performance on a number of different standardized tests that measure verbal intelligence and cognition by the preschool years. However, there may be something implicit in formal testing situations that poses particular problems for young children from low-income homes. These children may not have been exposed to the

materials or interactions like those employed in the testing situation. In fact, one of the major disadvantages of most standardized tests is the potential cultural bias of instruments that were developed and normed primarily on Caucasian children from middle-class backgrounds. Concerns have been raised about using standardized, norm-referenced tests for identification of language disorders in minority children from low-income backgrounds—particularly at the ages of 36 to 47 months (Qi, et al., 2003; Rodekohr & Haynes, 2001; Washington & Craig, 1992, 1999). The content found in many tests (such as the words and pictures children are to identify) has been criticized due to its irrelevance or inappropriateness for children with different ethnic or socioeconomic backgrounds (e.g., Reynolds, 1982). For example, an early version of the PPVT (PPVT-R: Dunn & Dunn, 1981) was found to be racially and economically biased (Washington & Craig, 1992).

Campbell and colleagues (Campbell, Dollaghan, Needleman, & Janosky, 1997) also reported that children from ethnic minorities performed significantly worse than their Caucasian counterparts on standardized tests that tap into acquired knowledge (i.e., “*knowledge-dependent*” measures). In contrast, the groups did not differ in their performance on measures designed to minimize the contributions of prior knowledge on performance (i.e., “*processing-dependent*” measures). As opposed to traditional knowledge-dependent measures that reflect the different backgrounds and life experiences of children, the authors posit that processing-dependent measures hold considerable promise for providing unbiased assessment of fundamental psycholinguistic skills. To rule out the possibility that a cultural or socioeconomic *bias* in standardized tests is driving the pattern of results established thus far, the following section explores

similar results yielded through observations of children during interactions with a parent or caregiver.

2.2.a.ii. Quasi-naturalistic observation

Hart & Risley (1995) conducted a landmark study with 13 professional-class parents, 23 working-class parents, and 6 parents who reported very low incomes and were receiving welfare. Their children were observed for a one-hour period in the home environment on a monthly basis from 9 to 36 months. An ever-widening gap in the vocabulary usage of children from the different income groups was witnessed, beginning as early as 24 months. The group differences were clearly significant by the end of the study when children were three years old. By the final observation at three years of age, the socioeconomic status of the families accounted for 42% of the variance in the children's rate of vocabulary growth ($r=.65$) and 29% of the variance in IQ scores on the Stanford-Binet Intelligence Scale.

Dollaghan and colleagues (1999) studied the effects of certain sociodemographic variables on children's spontaneous speech at three years. There was a significant linear trend for larger vocabulary in children that was associated with increased maternal education (which is often used as a marker for socioeconomic status). Specifically, higher maternal education was associated with more words, a greater variety of words, and longer utterances by children. The PPVT-R was also administered, and children with lower socioeconomic status performed significantly poorer on this standardized test when compared to the children with higher socioeconomic status. The group of children whose mothers had less than a high school diploma scored significantly lower ($M=90$) on the PPVT-R than the children with college-educated mothers ($M=110$).

Both standardized assessments and informal observations provide brief snapshots of children's knowledge or abilities. Results obtained through these methods may be highly dependent on factors such as child fatigue or boredom, unfamiliarity with task demands, and an unwillingness to perform for strangers. Even if the testing or observation methods are equivalent for low-income and middle-income children, the contexts may have very different effects on the children with different socioeconomic backgrounds (Watson, Crais, & Layton, 2000). For this reason, researchers and clinicians advocate the use of ecologically valid assessments of the nature originally proposed by Bronfenbrenner (1977). Ecologically valid assessments include multiple measures and sources of information and recruit the primary caregiver(s) as a participant in any assessment process. Parent report of child language is one ecologically valid measure that has the inherent advantage of reflecting "what a child knows, whereas free speech reflects those forms she is more likely to use" (Bates, Bretherton, & Snyder, 1988, p. 57). Studies that have explored early language in low-income populations via parent report are presented next.

2.2.a.iii. Parent report

Some clinicians and researchers have advocated the participation of caregivers in all assessment processes (e.g., Crais, 1995) and the efficiency, affordability, and accessibility associated with the parent report method make this a particularly attractive option. Parent report instruments typically employ a recognition format and rely on parents to provide information on their child's current linguistic and communicative functions. A host of studies have confirmed the ability of parents to provide accurate descriptions of the words their children understand and produce during the first 2 ½ years

when assessment is limited to current or emergent behaviors and when a recognition format is used (Bates, et al., 1988; Ring & Fenson, 2000; Dale, 1991; Marchman & Martinez-Sussman, 2002; Rescorla, 1989; Dale, Bates, Reznick, & Morisset, 1989). The MacArthur-Bates Communicative Development Inventories (CDI's; Fenson et al., 1993) are among the most widely-used parent report inventories and can be completed by most parents in 10-30 minutes.

Some researchers have also reported markedly lower CDI scores for children with low-SES backgrounds. Roberts and colleagues (Roberts, Burchinal, & Durham, 1999) administered a short-form version of the CDI and found no effect of income on vocabulary production at 18 and 24 months, but more than 45% of their low-income sample scored at or below the 10th percentile at 30 months. Another study (Feldman, et al., 2003) used a version of the CDI (CDI-III; Oliver, Dale, Saudino, Petrill, Pike, & Plomin, 2002) with three-year-old children. They found significantly lower scores were associated with the less-privileged children on all three of the major domains measured at that age (Vocabulary, Sentences, and Using Language). However, it should be noted that this relatively new short-form version of the CDI is considered experimental by some researchers, as it has not been rigorously tested or validated.

Converging evidence from standardized assessments, naturalistic observations, and parent report suggests that income and socioeconomic status may exert influence on child development by the preschool years. Irrespective of the method by which the data are gathered, findings are robust and clearly point to detrimental effects of an impoverished environment by age three. In contrast, effects of income on cognitive and language development during infancy and early toddlerhood are not clear-cut.

2.2.b. Infants and toddlers

Although the literature that focuses on infants and toddlers is less extensive than the literature for preschoolers and older children, there are a number of studies that speak to the relevant issues. Findings are reported separately for standardized tests, naturalistic observations, experimental tasks, and parent report.

2.2.b.i. Standardized tests

Standardized tests that exist for children younger than two years of age generally yield composite scores that encompass motor, daily living, and cognitive skills. The Bayley Scales of Infant Development (BSID-II; Bayley, 1993) are among the most commonly used scales for measuring development in the first years of life. The BSID-II contains a Mental Development Index (MDI) subscale that is designed to measure language, cognitive, and personal-social development. Bradley et al. (1989) reported only a slight correlation ($r=.16$) between SES and the MDI at 12 months. However, socioeconomic status was modestly and significantly correlated with the MDI by 24 months ($r=.52$) and with 30 month performance on the Stanford-Binet Intelligence Test ($r=.47$).

Black, Hess, & Berenson-Howard (2000) conducted a cross-sectional study with 87 infants and toddlers from low-income families. During infancy, scores for low-income infants (at a mean age of 6 months) on the BSID-II were in the expected range relative to the norms for the instrument. In contrast, the low-income toddlers (at a mean age of 20 months) received lower scores on the MDI ($M = 86$) relative to the normative sample. The authors concluded that “these findings are consistent with longitudinal studies demonstrating a decline in developmental performance among toddlers from low-income families” (Black et al., 2000, p. 655). It should be noted that the majority of mothers were

African-American, so it is possible that a cultural or racial bias impacted children's scores. To date, though, there are no reported ethnic group differences for the MDI, suggesting that it is culturally fair (Wallace, Roberts, & Lodder, 1998).

The Bayley Infant Developmental Neuroscreener (BINS; Alyward, 1995) assesses basic neurological functions, comprehension and production vocabulary, and cognitive processes in children ages 3-24 months. The BINS is adapted from the Bayley Scales of Infant Development and it assesses basic neurological functions/intactness, receptive functions, expressive functions, and cognitive processes. Cut scores are used to classify children as low, moderate, or high risk for future developmental delay. Hess and colleagues (Hess, Papas, & Black, 2004) conducted a longitudinal study in which children of low-income, adolescent mothers were assessed via the BINS at 6 and 13 and the BSID-II at 24 months. On the basis of BINS scores at 6 months, 74% of the children were at low risk, 21% were at moderate risk, and 6% were at high risk for delay. The distribution at 13 months was similar, with 79%, 20% and 1% classified as low, moderate, and high risk, respectively. Very few of the infants were classified as being at high risk for future developmental delay, but when the BSID-II was administered at 24 months as the "gold standard," 43% of children scored at least one standard deviation below the normative mean. Those children scoring below 85 were classified as "mildly delayed in mental skills" (as indicated by the BSID-II manual), suggesting that clinically significant delays were present in nearly half of the low-income sample by 24 months. The authors concluded that, "consistent with findings reported from other samples of low-income toddlers, the detrimental effect of environmental risk factors on children's development was evidenced at 24 months" (Hess et al., 2004, p. 326).

A very important contribution to our understanding of effects of income at different stages of development has been provided by a longitudinal study in which 161 low-income African American children were monitored between 6 months and 8 years of age via the BSID and Stanford-Binet (Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997). Growth curve analysis indicated that average to above-average scores during infancy were followed by a marked dip between 18 and 24 months, notably at a time when the tests become more verbal in nature. One interpretation of these results has been that the environmental effects of poverty increasingly come to bear on development through time and experience. Although there was significant variability within this group, the tendency in these data was for normal cognitive performance during infancy and low-normal cognitive performance during the preschool years and beyond.

The Abecedarian Project (Ramey & Campbell, 1991) is another large-scale research program that has contributed a wealth of information about the developmental trajectory witnessed in children from low-income homes. The goal of this particular investigation was to determine whether high-quality intervention services from an early age could promote intellectual competence during the preschool years. Infants were randomly assigned to either a control or intervention group. Children in the control group scored squarely at the mean on the MDI at 6 months ($M=100$), and slightly above the mean at 9 ($M=107$) and 12 months ($M=105$). A sudden drop was witnessed at 18 months ($M=90$) and again at 24 months ($M=85$). The children in the preschool intervention group performed significantly better than the control group at 6 months ($M=107$), at 9 months ($M=108$), and continuing to 12 months ($M=111$), 18 months ($M=108$) and 24 months ($M=96$), possibly indicating favorable effects of the intervention.

In summary, existing data suggest that a relation between poverty and language or cognition is not readily observed in infancy when standardized measures are used. By about the second birthday, however, modest or strong relations are evidenced between socioeconomic status and child performance on most standardized tests. Because children's performance on standardized tests may be affected by extraneous variables that are unique to the testing situation, results obtained through other modes of assessment are also considered.

2.2.b.ii. Quasi-naturalistic observation

Hart and Risley (1995) employed quasi-naturalistic observation techniques to examine language growth in very young children from low-, middle-, and upper-class families. Vocabulary was measured during monthly home observations starting at 9 months of age. There were no detectable differences between the groups in the total number of words produced in the first year and into the second year, but the authors reported "a widening gap beginning as early as 24 months" (p. 234; see Figure 2.1). The children with the highest SES consistently used more words than the other groups by 18 months of age, though it was not until 24 months that the welfare- and working-class groups could be differentiated from one another. From that point forward, the differences became more marked with time and in favor of the children whose parents had better jobs and higher income. This trend remained consistent until the end of the study at 36 months. This study has provided an abundance of information on the development of language in children from families with very low levels of socioeconomic status.

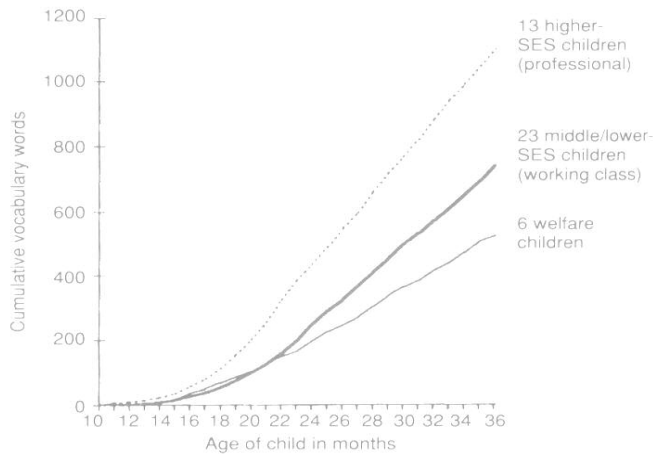


Figure 2.1. Number of different words produced by children from low-, middle-, and high-SES homes.

2.2.b.iii. Behavioral tasks

Rodrigue (2001) recruited a group of 44, 18- to 32-month-old children from low- and mid-to-high-income homes for participation in a study that included an experimental task designed to assess vocabulary comprehension and production. Children were asked to look at books and identify certain nouns, verbs, or adjectives either by pointing to the picture (comprehension task) or by saying the word aloud (production task). The low-income children performed equivalently to the middle-income children on both of these tasks. On the vocabulary comprehension task, the low- and middle-income children responded correctly on 73% and 74% of trials, respectively. The low- and middle-income children were correct on 48% and 53% of total trials, respectively, on the production task.

It is important to note that the children in this particular study spanned the ages where income differences are usually *not* reported (e.g., 18-24 months) and ages where income differences usually *are* reported (e.g., 24-32 months). Thus, the broad range of

ages represented in this study may have masked any meaningful differences that would have been evidenced in one age group or the other (i.e., normal-to-high scores by the younger group may be balanced out by low scores in the older group.) Although the regression model used to test this possibility was not statistically significant, a trend in the expected direction is certainly seen in the data for comprehension vocabulary (see Figure 2.2).

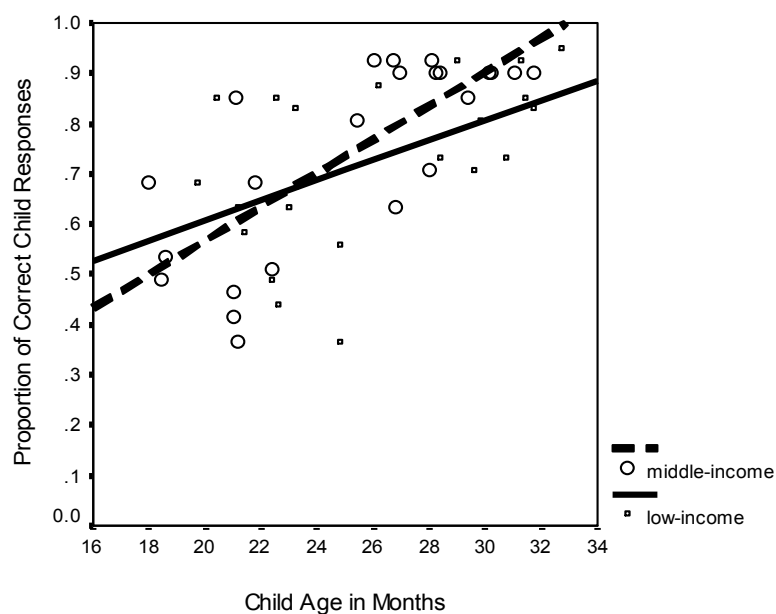


Figure 2.2. Correct responses on a comprehension task by income and age.

The same trend was witnessed for vocabulary production (see Figure 2.3). The youngest low-income children performed at or above the level of the middle-income children. By two years of age, however, the more advantaged children produced more words on the behavioral task. Although it was not statistically significant, possibly due to the low number of subjects, this trend continued through to the oldest ages represented in the study (32 months). The developmental trend seen here meshes well with the evidence

that has been summarized thus far: equivalent or even higher scores associated with low-income infants in the first year followed by lower scores by the end of the second year.

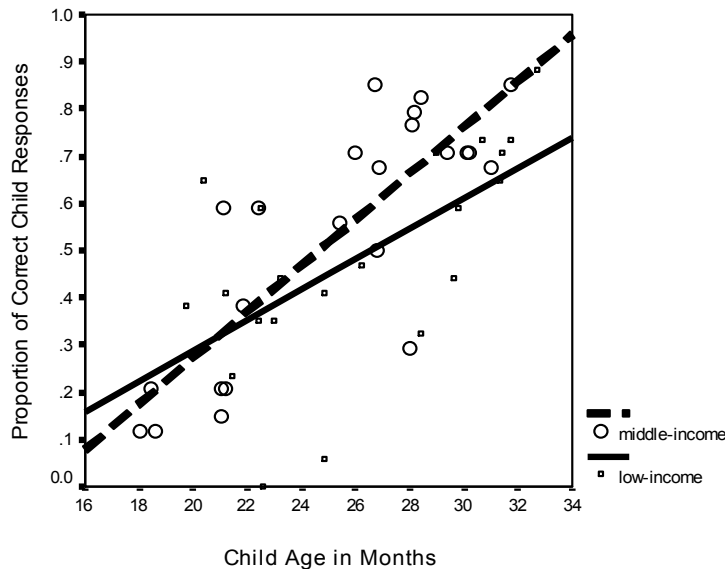


Figure 2.3. Proportion of correct responses on the production task by income and age.

2.2.b.iv. Parent report

The literature that explores CDI scores obtained from parents with low socioeconomic status and 8-30 month-old children suggests that parent accuracy may be affected by the specific variables measured and the age of the child. In the original CDI norming study, Fenson and colleagues (1993) reported an unexpected inverse relationship between maternal education and reports of child comprehension for 8-12 month-old children, but not for 13-16 month-old children. Specifically, mothers with only a high school education reported higher scores for their children's comprehension vocabulary in the first year of life than did mothers with more extensive schooling. Reznick (1990) also found a slight but reliable tendency for parents with low socioeconomic status to assume higher vocabulary comprehension in their sons, relative to parents with higher socioeconomic

status. A similar pattern was reported by a team of researchers who found that lower parent education and income were associated with higher comprehension and production vocabulary on the CDI for 10-13 month-old children (Feldman, Dollaghan, Campbell, Kurs-Lasky, Janosky, & Paradise, 2000). Potential explanations for this pattern are discussed in greater detail in Chapter 10.

Arriaga and colleagues (Arriaga, Fenson, Cronan, & Pethick, 1998) found that 16-30 month-old children from very low-income homes performed “strikingly lower” than children from more privileged homes on Vocabulary Production, Word Combinations, and Sentence Complexity; the three major features measured on the CDI. Fish and Pinkerman (2003), on the other hand, found that 15 month CDI scores in a low-income rural Appalachian sample were similar to those obtained in a predominantly middle-class norming sample. No significant differences were found between the Communicative Gestures, Words Understood, or Words Produced by the low-income children. Recall, also, that a strong effect of income was found by Roberts and colleagues (Roberts et al., 1999). These researchers did not find significantly lower vocabulary scores for low-income children at 18 and 24 months on an abbreviated version of the CDI; but more than 45% of their low-income sample scored at or below the 10th percentile by 30 months. These findings parallel those from other studies that show no effects or very weak effects of social class on language production at the earliest ages (e.g., Wells, 1985; Fenson et al., 1993; Fish & Pinkerman, 2003).

The Language Development Survey (LDS; Rescorla, 1989) is another parent report vocabulary checklist that functions as a screening tool and requires only about 10 minutes to complete. Rescorla and Achenbach (2002) administered the LDS to a national

probability sample of children (18% low-SES, 45% middle-SES, and 31% upper-SES, and 6% unknown) who ranged from 1 ½ to 3 years of age. Only a slight correlation ($r=.14$) was detected between SES and vocabulary scores. When included as a covariate in age by gender ANCOVAs, SES accounted for less than 3% of the total variance.

In summary, studies that use parent report instruments have shown either no effect or inverse effects of SES (low SES=high scores) when children are approximately 8-16 months, but low or equivalent scores (low SES=low scores) when children are between 16-30 months of age. These results are compatible with the findings for similar age-groups that have been obtained via other methods of assessment.

Taken together, the findings from standardized assessment, naturalistic observations, and parent report are consistent with one another in showing minimal effects of income in the first two years of life when standardized tests and language production are measured. Regardless of the method of assessment, very few differences have been witnessed prior to 24 months in the language and cognitive skills of low-income infants and toddlers. These findings are markedly different from the robust and detrimental effects of poverty on development that are consistently witnessed by three years of age. It seems obvious that the relation between poverty and the development of children's language and cognitive skills is not uniform across ages. Potential explanations for this developmental trend will be explored in the following section.

2.3. How to explain the “developmental trend?”

The previous sections provide compelling evidence that children from low-income homes have normal mental developmental scores early in life, followed by a significant decline. This notion is reflected in Hoff & Lian's (2005) conclusion that “children from lower

socioeconomic strata show slower rates of development...beginning within the second year of life and continuing through the school years” (p. 272). In summary, the studies reviewed here have led some to conclude that infants at environmental risk tend to experience developmental declines after infancy (e.g., Hess, Papas, & Black, 2004).

Since early family influences are more strongly related to IQ at 3-5 years than with developmental quotients in the first two years, Rutter (1985) concludes that the early family environment seems less influential when compared with the later years. This idea is also endorsed by McCall (1981), whose “canalization hypothesis” predicts that very early development may be less susceptible to environmental influence than later development. The canalization hypothesis predicts that during periods of rapid maturation and growth (i.e., infancy), children are biologically buffered from all but extreme deviations in environmental input. This provides one potential explanation for the seeming lack of a relationship between environment and measures of children’s language and cognition in the first and into the second year of life.

Others have made the very different claim that socioeconomic factors exert their *most* powerful effects during early childhood and that these early influences contribute to sustained effects on children’s achievement throughout the school years and beyond (e.g., Duncan & Brooks-Gunn, 2000). Rather than concluding that family environment is less influential in the earliest years, it may be that socioeconomic status does impact children’s development soon after birth, but these influences are not witnessed on traditional assessments until well into the second year of life. Any effects of socioeconomic status may be minimal in and of themselves at the earliest ages, but accumulate and compound and reach statistical significance (in a research setting) and

meaningful significance (vis a vis academic achievements or performance on cognitive and language assessments) only over time.

2.4. Conclusion

It may also be the case that the most informative variables have not been measured in many of the studies that have sought to determine whether there are effects of socioeconomic status on cognitive and language development in the first two years of life. Indeed, investigators may be “barking up the wrong tree” by placing such an emphasis on assessing children’s language production and by administering traditional IQ tests in the first years. Standardized intelligence tests show effects of income once they tap verbal, quantitative, and reasoning abilities (Smith, Brooks-Gunn, & Klebanov, 1997), and only at about 4 years of age do standard IQ tests become reliable predictors of later IQ (Shonkoff & Phillips, 2000). Furthermore, language production is not the primary mode of communication for children at the very earliest stages of communicative development, so examining language production may not provide particular insight into the first year of life.

I propose an alternative interpretation of the early developmental literature and propose that researchers must examine the “right things” at the “right time” in order to provide a more accurate estimate of the developmental course for young infants from low-income homes. The results obtained to date may be an artifact of researchers focus on behaviors that are not consistently witnessed in early infancy (e.g., language production) or use of measures that are designed for use across a wide range of ages (e.g., most standardized assessments). I suggest the need for limiting additional research foci to the skills and behaviors that are most critical to and characteristic of social-cognitive and

language development in the first year. Chapters 4 and 5 provide a review of the particular skills and knowledge that I believe are most worthy of investigation. First, Chapter 3 provides a more thorough description of the unique issues that are common to many children who are growing up in low-income homes.

CHAPTER 3

Characteristics of Low-Income Families

3.1. Introduction

Household income alone does not provide sufficient explanation for the differences in child development that are well-documented in the literature. Consider, for example, a scenario in which two graduate students (living on a small stipend that places them at poverty level) give birth to a child. Few would suggest that the newborn would be at high risk for poor performance on cognitive or linguistic measures in the future, solely on the basis of the family's current income. This is because income simply serves as a proxy for a host of variables that are usually highly correlated with poverty. A severe limitation in monetary funds in and of itself may not be the most critically-important aspect of low-income homes. Rather, there are a host of other variables that are tightly linked to family income and which may uniquely or collectively contribute to developmental outcomes of children.

3.2. Review of the literature

There are many potential explanations for how it is that growing up in a low-income home impacts child development. The following section provides a brief review of some well-documented features that tend to coincide with low socioeconomic status.

3.2.a. Caregiver interactions

Researchers have identified a host of factors that are associated with socioeconomic status and could adversely impact child development. Some have posited that the relation between socioeconomic status and child language is primarily a function of parent characteristics and interaction styles. With regard to sheer *quantity*, children from low-

income homes are consistently exposed to fewer words than are children from families with higher income (Hart & Risley, 1995; 1999) and the amount of speech that mothers direct to their children has been shown to be strongly and positively associated with the rate of children's vocabulary growth.

Hart & Risley (1995; 1999) reported in their landmark study that socioeconomic status made an “overwhelming difference” (p. 62) in the amount of talking parents did during daily activities with their children. During one-hour recorded observations when children were beginning to produce occasional words, professional-class parents addressed an average of 487 utterances per hour to the child—in stark contrast to the average 178 utterances in the welfare-class families and 301 utterances in the working-class families. Accordingly, by four years of age the average child in a welfare family was estimated to have 13 million fewer words of cumulative language exposure from parents than the average child in a middle-class family (Hart & Risley, 1999). These meaningful differences in the relative sociability of parents in the three SES groups remained “astonishingly stable” (p. 67) across observations over a period of more than two years (see Figure 3.1). Hart & Risley (1995) also reported that the number of words parents said to their children per hour was strongly related ($r=.84$) to the children's language and cognitive skills at 3 years.

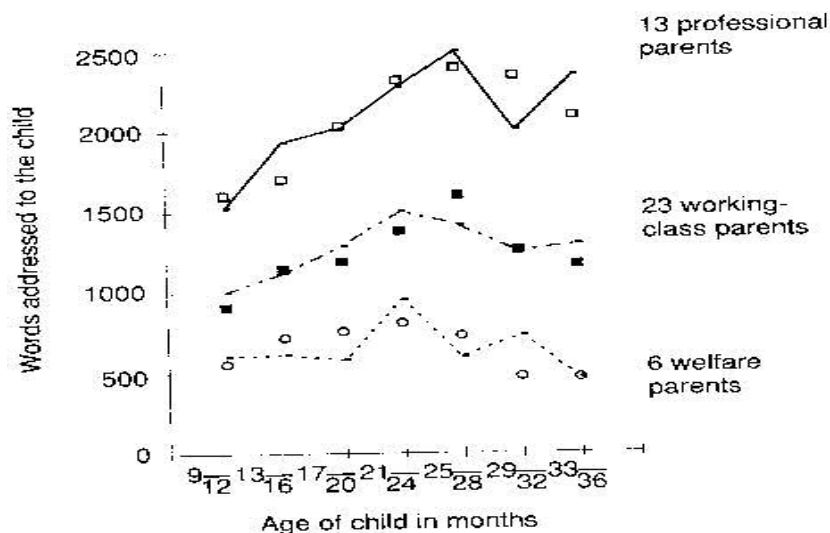


Figure 3.1. Average number of words parents addressed to children during monthly observations.

There is also research that suggests the number of *different* words used by mothers may have a particularly strong effect on child vocabulary production during the early stages of language development (e.g., Hart & Risley, 1995). A longitudinal study by Pan and colleagues explored the relation between maternal speech and growth in children's productive vocabulary (Pan et al., 2005). They found that children whose mothers consistently used more varied vocabulary had faster and more linear growth between 14 and 36 months than children whose mothers consistently used less varied vocabulary. They conclude that the "effect of maternal word types is particularly strong during the infant and toddler years but begins to be overshadowed" (p. 775) by other factors (e.g., literacy skills and depression) as children near 3 years of age.

With regard to the *quality* of parent-child interactions, there are a number of characteristics that have been shown to be associated with positive child outcomes.

Prompt and contingent behaviors in response to a child's actions (i.e., *maternal responsivity*) are associated with better social, cognitive, and language skills in children (Landry, Smith, Swank, Assel, & Vellet, 2001). For example, one study with a group of children of middle- to upper-SES parents found that maternal responsivity toward 4- and 5-month-old infants was related to higher children's competencies more than 3 ½ years later (Tamis-LeMonda & Bornstein, 1989). Maternal encouragement of infant attention during a home observation at 5 months uniquely predicted a small but significant portion of the variance (9%) in language comprehension at 13 months (measured via parent report). Tamis-LeMonda and Bornstein conclude that maternal encouragement and responsivity can explain a moderate portion of the variance in child language and cognition at later assessments.

Although few differences are detected in the language and cognitive skills of low-income *infants* in the first year and into the second year of life, research suggests there may be early differences in *maternal input*. Olson, Bates, and Bayles (1984) observed mother-child interactions when children were 6, 13, and 24 months of age and found that mothers' warmth and responsiveness during interactions with their children were positively correlated with child performance at 24 months on the Bayley MDI. Approximately 40% of the variance in 24 month cognitive performance could be explained by socioeconomic status and the quality rating of mother-child interactions at the three assessment points. These results support the notion that early parent-child interactions are related to cognitive development of very young children.

Low-income parents have been found to be less verbally responsive to objects or scenarios their children display interest in (Morisset et al., 1990; Smith & Zaslow, 1995).

Low-income parents may also give many more directives or commands when talking to their children (Lawrence & Shipley, 1996; Hoff-Ginsberg, 1991), and such highly directive parenting styles are associated with negative impacts on children's cognitive and language development. Hart & Risley report that after initiating a statement or answering a child's question, very low-income parents continued talking to their children less than half as often as did working-class parents. Furthermore, professional-class parents gave their children affirmative feedback more than five times as often as did the welfare parents; children in welfare families heard prohibitions twice as often as they heard affirmative feedback. A directive parenting style has been shown to be related to poorer linguistic skills in young children (e.g., Hart & Risley, 1995; 1999).

In short, when compared to mothers with mid- to high-SES, mothers with low socioeconomic status tend to talk less, label fewer objects in the environment, terminate conversational topics more quickly, and encourage less talk from their children. A large body of literature suggests that there may be detrimental consequences for children who do not have sufficient access to sufficiently stimulating and responsive interactions with their primary caregivers. It is important to acknowledge that there is likely a complex interplay among children, parents, and their environments. It can not truly be determined at this time whether any one factor plays a more causal role than others, or if any do.

3.2.b. Maternal education

Maternal education has been shown to be highly and positively correlated with income (e.g., Laosa, 1984; Bradley, Caldwell, Rock, Ramey, et al., 1989). Except in cases of extreme poverty, maternal education is the variable most strongly related with interactional style. Given the established importance of the parent's interactional style,

the relation between maternal education and child development also warrants exploration. Because it may be difficult to garner sufficient information about parent's interactional styles for research or clinical purposes, it is often necessary to use maternal education as an index instead. Sameroff and colleagues (Sameroff et al., 1987) identified 10 familial risk factors that have been substantiated in the literature as having the potential to negatively impact development. These risk variables were operationally defined, and each participant in their study was categorically classified as either "low" or "high" risk for each variable (see Table 3.1). When the verbal scales of the WPPSI were administered at 4 years of age, each one of the risk variables was significantly correlated with the verbal IQ score ($p < .05$). But, it was maternal education that had the highest positive correlation ($r = .56$) with children's verbal IQ.

Table 3.1. Cumulative risk variables

Risk Variable
Mental health
Anxiety
Parental perspectives
Interaction
Education
Occupation
Minority status
Family support
Life events
Family size

Another study found that the educational attainment of mothers was independently and positively associated with the more stimulating and responsive interaction style described in the previous section—even when controlling for any history of poverty (Miller & Davis, 1997). Specifically, higher maternal education was

associated with mothers giving more verbal praise, making more verbal inquiries, using modeling strategies, and reading more books to their preschool children. Hoff-Ginsberg suggests that SES-differences in maternal speech are primarily due to fundamental differences in mothers' conversational and social skills in general—not just toward their children. She has recently (Hoff, 2003) shown that these properties of maternal speech may be independent of household income. In a group of mothers with mid-to high-SES, those mothers with only a high school education produced fewer utterances, fewer word types, fewer word tokens, had lower mean length of utterance (MLU), and produced fewer topic-continuing replies to their children than did the mothers with a college education.

To be sure, maternal education seems to be positively correlated with a host of children's outcomes (Bornstein, Hahn, Suwalsky, & Haynes, 2003). Education level of the primary caregiver is related to significant differences in children's performance across multiple domains. Children whose caregivers have not completed high school tend to achieve significantly lower scores on most measures when compared with children whose parents have more education (Brooks-Gunn, Klebanov, & Duncan, 1996). For example, Washington and Craig (1999) reported that a group of children whose parents had not completed high school had a mean score of 77 on the PPVT—compared with a mean of 94 for children whose parents had additional education. These differences had meaningful clinical significance as well as statistical significance. It should be noted, though, that it is difficult to disentangle the relation between maternal IQ and educational achievement. It may be that differences in IQ lead to differences in educational attainment, and that education simply serves as a proxy for maternal IQ. Additional

investigation of this issue is necessary prior to drawing conclusions as to the import of maternal education for children's outcomes.

3.2.c. Other caregiver characteristics

Morisset and colleagues (Morisset et al., 1990) reported that parents in low-income households experience increased emotional distress and lack sufficient interpersonal, educational, and financial resources. Additionally, low-income parents may be very young when they give birth, have poor prenatal health care and poor nutrition. As a result, these parents also have a greater likelihood of giving birth prematurely or of having a child with low birth weight. Many are raising a child without the support of a second parent. These factors are all also associated with global delays in child development (e.g., Smith, Ulvund, Stein, & Lindemann, 1994).

Low-income parents have sometimes been found to have unrealistic expectations with regard to the timing and order of children's cognitive, social, motor, and language achievements in the first few years of life (Brooks-Gunn & Furstenburg, 1986).

Accordingly, parents may not facilitate or encourage the skills that would be most developmentally appropriate for children at a given age. One study (Tamis-LeMonda, Shannon, & Spellman, 2002) has shown that although low-income mothers are generally knowledgeable about the typical *ordering* of milestones, they may be less aware of the typical timing of the same behaviors or milestones. The low-income mothers were significantly more accurate in estimating developmental onsets for cognitive, language, and motor milestones than they were at estimating milestones for play and social development. Mothers with less income and education were found to "have a very compact view of development, expecting children to achieve most abilities within a short

span of a few months, rather than appreciating the protracted course of children's achievements" (p. 99). These unrealistic expectations by low-income mothers may affect the interactions they have with their children (e.g., by not selecting developmentally-appropriate activities or experiences for their children).

3.2.d. Access to resources

Parents with very low-income may only have enough money to purchase the most basic necessities of food, clothing, and shelter. Accordingly, children from low-income homes often lack developmentally-appropriate toys and books and have fewer educational resources at their disposal. The Home Observation for Measure of the Environment (HOME; Bradley & Caldwell, 1984) was designed to assess the quality and quantity of resources available to the child. It consists of 45 items divided into six categories. The first subscale, *responsivity*, assesses the extent to which the parent appropriately acknowledges and responds to the child. *Acceptance* focuses on the parent's ability to cope with undesirable behaviors, while *organization* refers to the regularity of the family's schedule, the safety of the physical environment, and the use of community resources. The *assessment of learning materials* determines whether the child lives in a stimulating environment with developmentally appropriate toys and activities.

Involvement refers to whether the parent takes an active role in their child's cognitive development and is sensitive to their changing needs. Finally, *variety* determines whether the child is provided with opportunities for diverse experiences in their daily life without experiencing disorganization. Lota and colleagues (1992) found that income alone accounted for 41% of the variance in HOME scores. Furthermore, low scores on the HOME in the first years of life are predictive of later delays or problems in cognitive and

language development and performance (e.g., Bradley & Caldwell, 1981; 1984), demonstrating the importance of these environmental variables for child development.

Much is known about the aspects of the home environment that are correlated with low-income families. Much less is known about the relative importance of the quality of the neighborhood and community—though Bronfenbrenner’s ecological theoretical perspective would suggest that children are also impacted by the environment of the neighborhood, community, and other institutions of education and welfare. A very low income does make it difficult for parents to provide their children with safe and stimulating community environments and access to high-quality healthcare (e.g., Jackson, 2003). Poor parents also have limited housing options and may reside in neighborhoods that are plagued by crime and social disorganization, and that lack proper community resources (e.g., schools, parks, libraries). The possibility that the larger community may affect child development independent of family poverty is especially likely in large urban areas where concentrated neighborhood poverty is most severe (Duncan & Brooks-Gunn, 2000).

In situations where families have access to very few resources at home, increasing the positive and healthy experiences outside of the home may foster children’s development. One sample of 12- to 42-month-old children demonstrated “a strong, significant, and positive effect of participation in center-based programs on almost all cognitive outcomes” relative to children who were cared for by extended family members (Loeb, Fuller, Kagan, & Carrol, 2004, p. 55). Unfortunately, though, many low-income parents are constrained in their choices for childcare. Caregivers in low-income centers have been shown to be less responsive and sensitive to children’s needs (Phillips, Voran,

Kisker, Howes, & Whitbook, 1994), and to speak to children in more authoritarian and less cognitively complex ways (Evans, 2004). Although there may be benefits of enrolling low-income children in high quality programs, their parents face numerous barriers (e.g., high cost and lack of transportation) and often do not have access to such care (Oser & Cohen, 2003).

3.2.e. Concept of cumulative risk

It is likely that no one variable is singly critical to developmental outcomes. Instead, there may be a cumulative process whereby the greater the number of income correlates that are present, the greater the impact on development. Evans (2004) suggests that the “confluence of psychosocial and physical environmental risks may play a particularly important role in precipitating the developmental disarray associated with poverty” (p. 87). Two research groups have demonstrated that this may indeed be the case (Hooper, Burchinal, Roberts, Zeisel, & Neebe, 1998; Sameroff et al., 1987; 1993). Sameroff and colleagues sought to reduce the global measure of SES into a set of 10 component risk variables (see Table 3.1). After applying their risk index to a heterogeneous sample of 4-year-olds, the authors analyzed the children’s verbal IQ scores on the WPPSI. No single variable was predictive of IQ, but a combination of variables had considerable power (see Figure 3.4). The different lines in Figure 3.2 are defined by socioeconomic status, on the basis of the Hollingshead Index (Hollingshead, 1957). The Hollingshead Index yields a composite score that pertains to parent occupation and education. Of interest first is the fact that the children from the lower SES groups (SES IV, V) were impacted much more by the same number of risk factors than were the children with higher SES (SES I, II, III). This suggests that the overriding impacts of poverty are real and significant. Furthermore,

even within SES groups, verbal IQ scores on the WPPSI decreased significantly with exposure to an increased number of risk factors. For example, children within the same SES group who were exposed to 0-1 risk variables had significantly better scores than the children with 2-3 risk factors; similarly, the children with 2-3 risk factors had significantly higher scores than did children who were exposed to additional risk factors. These differences held true for children in the low and higher SES groups alike.

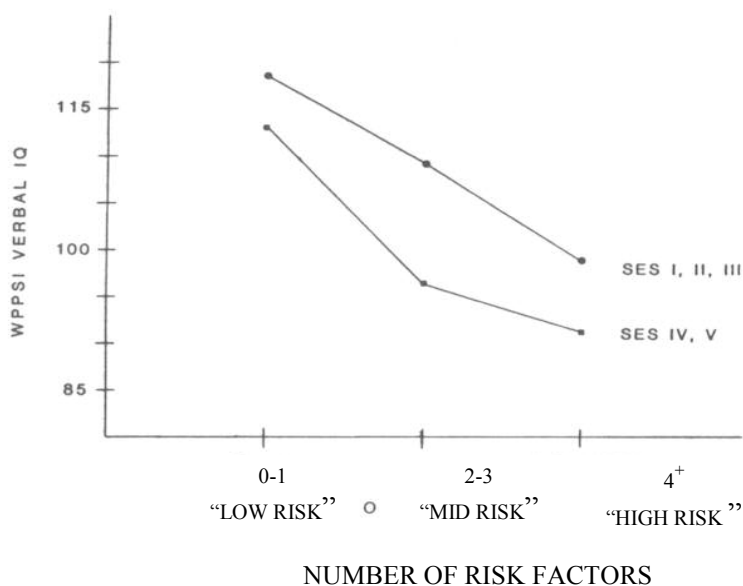


Figure 3.2. WPPSI verbal IQ scores for 4-year-old children in three risk categories.

To further illustrate the impact of multiple risks on the verbal performance of individual children on the verbal IQ test, the same data are presented in terms of the proportion of IQ scores for children in the different risk groups (see Figure 3.3). In the low-risk group, no child fell in the lowest IQ bracket—compared to almost 25% of the children in the high risk group. These data emphasize the very real challenges faced by children growing up in low-income homes. Indeed, “the accumulation of multiple

environmental risks rather than singular risk exposure may be an especially pathogenic aspect of childhood poverty” (Evans, 2004).

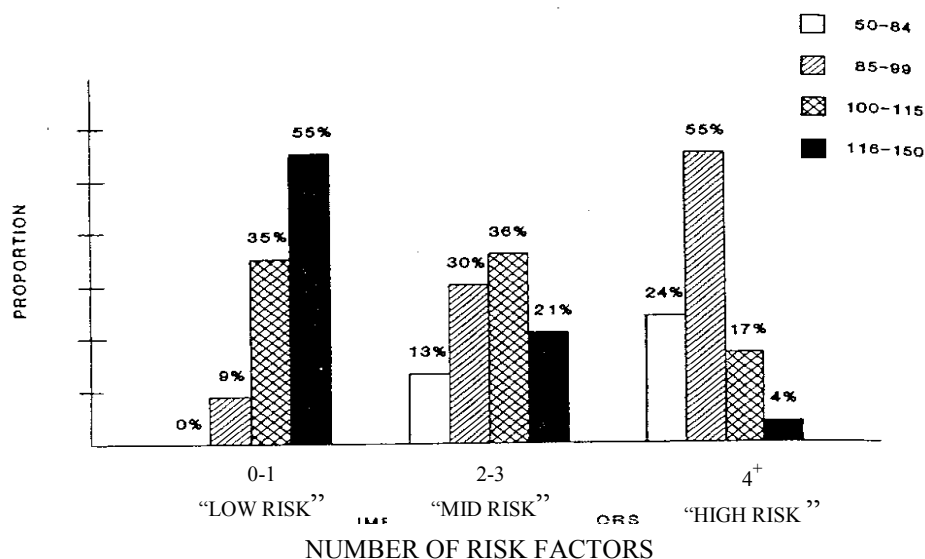


Figure 3.3. Relation between WPPSI verbal IQ scores and number of risk factors.

3.2.f. Income as a proxy for socioeconomic status

In sum, it appears that no single demographic variable is sufficient for determining whether a child is exposed to potential developmental risk factors. However, there are a number of risk factors that are strongly related to poverty, making household income a proxy that is frequently used for determining an individual's socioeconomic status. It should be recognized that even though the single measure of household income may not in and of itself be a primary determinant of children's development, income does provide a reflection of the social and material resources that likely are and are not available to children. The high correlation between income and certain characteristics of parents and the home environment suggests that investigators must continue to thoroughly measure

the related variables in order to truly understand the effects of poverty per se by teasing apart and measuring the relative contributions of each.

3.2.g. Seeking the source of income-related differences in development

Disentangling the many confounded variables in order to determine the source of variation in children's development is a difficult task. Further complicating the issue is the fact that family income is not static over time. In fact, more than 25% of the individuals living in poverty in one year report incomes above the poverty line the next, and considerably less than half of those who experience poverty remain persistently poor over many years (Duncan & Magnuson, 2001). Accordingly, poverty is not a permanent property, but is best conceived of as a characteristic that is associated with an individual at a particular point in time.

A number of environmental variables have been described here that speak to the importance of certain parent and environmental characteristics. One could argue, though, that these differences in family endowment derive directly from differences in *genetic* endowment. Studies that address this possibility differ significantly in their treatment of this issue. Some behavioral genetic studies have indicated that the "shared environment" accounts for very little (usually 5-10%) of the variation in abilities tested (e.g., Bouchard, Lykken, McGue, Segal, & Tellegen, 1990), and that effects of parenting and the environment are remarkably small (Scarr, 1992).

In contrast, other researchers have reported a very real effect of the environment. A study with children who were adopted between 3 and 5 years of age into families with varying levels of SES (Shonkoff & Phillips, 2000) provides a dramatic illustration of the effects of socioeconomic status. The compelling results indicate that quality of the home

environment (defined by parent occupation) may have a substantial impact on the cognitive development of children. The IQ of all three groups increased by the post-adoption assessment (age 11 to 18), but the children adopted into higher SES homes had significantly greater increases in IQ (see Figure 3.4). Because the children and their adoptive parents were not genetically related, these effects carry no genetic influence and point to the potentially critical role of the environment for shaping child outcomes.

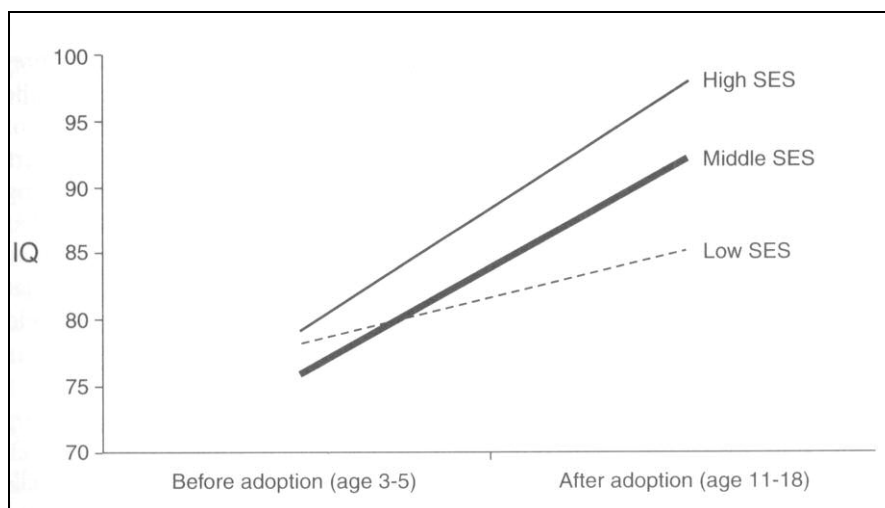


Figure 3.4. Mean differences in IQ by SES of adoptive family.

To be sure, there is no conclusive evidence that definitively supports or negates the power of genetics in determining children's development of social, cognitive, and language skills. Indeed, this is a "big" question that has its roots in the even grander and overarching question that relates to the nature of human language and cognition; namely, what is the source of language? This is a particularly important issue to address, since different theoretical positions attribute different degrees of importance to genetic endowment versus environmental conditions for children living in low-income homes.

Ultimately, few would argue that the environment plays some role, although how large of a role it plays and how much control it exerts over a genetic predisposition remains a theoretical point of contention.

CHAPTER 4

Precursors to and Predictors of Language Production

4.1. Introduction

Most of the research with infants and toddlers from low-income homes has explored children's performance on standardized IQ tests or has measured vocabulary production. Accordingly, one potential reason for the relative lack of an association between income and development in the first years of life is that the "wrong" variables have been investigated. The present chapter provides an overview of certain communicative skills that have been demonstrated to be uniquely important during the first year of life.

4.2. Review of the literature

It is increasingly clear that, soon after birth, young infants possess a number of communicative competencies—some of which are not readily apparent in their overt behavior. A child's very first associations with sound seem to be formed in-utero (e.g., Fifer & Moon, 1995) and, from the beginning, infants listen to the streams of speech that surround them and gradually learn to segment pieces of the signal and associate the pieces of sound with elements of meaning (e.g., Jusczyk, 1997; 1999). "True" production of words is first witnessed at the end of the first year and then quickly increases in pace toward the end of the second year (e.g., Bates, Bretherton, & Snyder, 1988; Karmiloff & Karmiloff-Smith, 2001; Buckley, 2003). During the first year, then, there is a very limited amount of observable language behavior available for investigation.

One potential reason for the limited findings for a relation between income and early communicative development, then, is that some very important variables have been relatively neglected in the research enterprise. During the first year of life, there is a very

limited amount of spoken language available for investigation. It is therefore not too surprising that most studies do not detect any effect of income on language in 12-month-old infants (i.e., there may be a statistical floor effect). This idea is supported by normative information available from the CDI. At twelve months, a difference of only 3 words (e.g., saying two words versus five words) distinguishes boys at the 10th percentile from boys at the 50th percentile. The lack of variability and floor effects that characterize the youngest ages make vocabulary production a particularly challenging domain to investigate for purposes of detecting individual or group differences at one year.

Although there may be limited advantages to exploring vocabulary production at 12 months, it is well-documented that children are able to convey and comprehend communicative intent from an early age—well before they are able to produce their first words. Language comprehension and gesture use are the two dominant communicative devices during the first year of life. These are reviewed separately below.

4.2.a. Language comprehension

Children typically begin to show systematic evidence of word comprehension at about 8 to 10 months of age, and this skill serves a major role in the earliest stages of communication. In fact, there is evidence to suggest that vocabulary comprehension in the first year of life may be one of the best predictors of later vocabulary production in the second and third years of life (e.g., Thal, Tobias, & Morrison, 1991; Thal, 2000). This may seem counter-intuitive at first pass, but it is in fact compatible with the notion of *heterotypic continuity of language*, which suggests that the emerging or dominant skill at one age may best predict performance on another emerging or dominant skill at a later age (Bates et al., 1988).

Heterotypic continuity refers to the correlations that exist between different content domains at different points in time. Bates and colleagues demonstrated that comprehension in 10-13 month old children was significantly correlated with productive language at 20 ($r=.53$) and 28 months ($r=.53$) of age. This relation between the newly developing linguistic skills across the different ages was much stronger than the relation between the same variable and itself (i.e., *homotypic continuity*) at different ages. For example, 13 month comprehension and 20 month comprehension were slightly correlated ($r=.11$) and 13 month production was modestly correlated ($r=.31$) with 20 month production. These findings suggest that language comprehension in the first year and into the second year of life may be particularly telling for later language (see Figure 4.2 for an illustration of heterotypic continuity from 13 to 20 and 28 months).

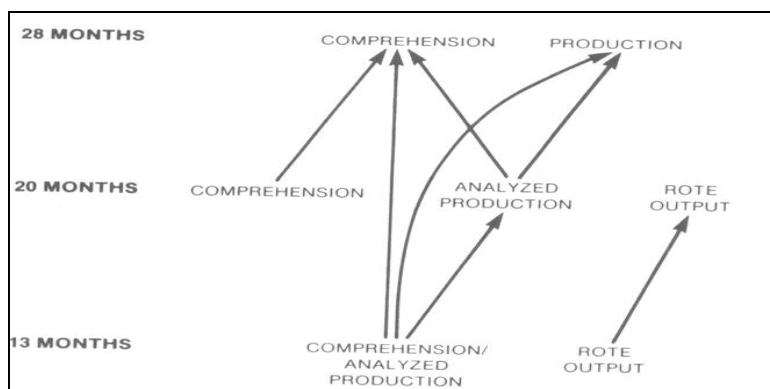


Figure 4.1. Illustration of heterotypic continuity.

Thal, Tobias, & Morrison (1991) evaluated a group of ten late talkers when they were between 18 and 29 months of age and then again one year later. Early production vocabulary and MLU did not help predict a child's later language status. However, all

four of the children who had been delayed in language comprehension at the earlier assessment remained delayed in language production at the follow-up visit. In contrast, the six children who were not delayed one year later had been delayed in production but not in comprehension at the earlier visit. These researchers concluded that delay in vocabulary comprehension in the first two years of life may be a telling early marker for determining later abilities that pertain to language production.

Thal (2000) also found that rate of growth in comprehension vocabulary (as measured by parent report) at 10, 13, and 16 months predicted the number of words produced, grammatical complexity, and mean length of three longest utterances (M3L) at 28 months of age. These results provide further support for the notion of heterotypic continuity and point to the importance of early vocabulary comprehension for predicting later language. The fact that vocabulary comprehension gathered via parent report as early as 10-16 months allowed for prediction of children's spoken language one year later is a potentially influential finding with far-reaching implications.

Even as early as 12 months of age, vocabulary comprehension is a robust process. It is one of three major indices on the CDI, and there are well-defined boundaries between major percentiles by 12 months of age. For example, a 12-month-old female at the 10th percentile understands approximately 27 words, compared with a child at the 50th percentile who understands 87 words and a child at the 90th percentile who understands 206 words. This suggests that there is sufficient variability in vocabulary comprehension at 12 months of age to make this a promising variable for future investigation.

4.2.a.i. Vocabulary comprehension in infants from low-income homes

These studies point to the importance of measuring vocabulary comprehension in the first year and into the second year of life. In spite of the demonstrated importance of language comprehension in the first year of life, very little is known about the emergence of vocabulary comprehension in low-income infants. There are some data available by parent report on the CDI, but the general skepticism associated with obtaining parent report in low-income populations makes it necessary assess comprehension through other means (as well as to further investigate accuracy of parent report of gestures in low-income populations; see Chapter 10).

4.2.b. Communicative gesture

Speakers in all cultures have been found to gesture as they speak, and gestures may relate to the maturation of cognitive skills that are also specifically linked to growth in language. Even before children are able to talk in the conventional sense, gestures may allow them to effectively interact and communicate with others (Bates, Thal, Whitesell, Fenson, & Oakes, 1989). In fact, at about 9 months, children communicate primarily through gestures (often paired with vocalizations), and these constitute the dominant form of expression for the next few months. There is a strong relation between language milestones and certain of these nonlinguistic milestones (see Table 4.1). For example, the period between 8 and 12 months is marked in part by the emergence of vocabulary comprehension and *deictic gestures* (i.e., giving, pointing, showing, requesting). Deictic gestures are used to refer to external objects or events and express communicative intent on the part of the child (e.g., Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Iverson, Capirci, & Casselli, 1994).

Table 4.1. Nonlinguistic correlates of early language milestones*

Approximate Age	Language Milestone	Nonlinguistic Correlate
8 to 10 months	Word comprehension	Deictic gestures
	Intentional communication	Shifts in categorization
11 to 13 months	Word production	Recognitory gestures
20 to 24 months	Vocabulary burst	Gestural combinations
	Word combinations	Shifts in categorization

*Adapted from Bates et al., 2001

Symbolic or *recognitory gestures* (i.e., gestural naming) are also evidenced slightly before the onset of verbal naming in most children and near the first birthday. Children begin to produce brief actions that are strongly associated with and show an understanding of certain objects (e.g., by putting a phone up to their ear or putting a hat on their head). Recognitory gestures and verbal naming are positively correlated during this period such that the children who tend to produce gestures early are the same children who tend to produce words early (and vice-versa). This relation between word production and recognitory gestures is limited to a specific period of development—during the approximate range of 12 to 18 months when children tend to produce single words but are not yet combining words.

At approximately 11 to 14 months, there seems to be an equipotentiality between the gesture and vocal channels (e.g., Volterra, Caselli, Capirci, Pizzuto, 2004; Bates, Thal, Finlay, & Clancy, 2001). In the months that follow, expressive vocabulary continues to grow, but children maintain their gesture use and create cross-modal word/gesture combinations to elaborate the points they wish to convey to others. For example, an 11-month-old child may indicate her knowledge of a “brush” by bringing her empty hand to her head and stroking her hair while looking at a picture of a brush. This

recognitory gesture may be used for both requesting (i.e., *protoimperative*) and labeling (i.e., *protodeclarative*) functions related to “brush” for a number of months. Eventually, the child may begin to combine elements by pairing the gesture with the word “mommy,” to convey the idea that mommy is brushing her hair. Most children soon come to rely almost completely on spoken words for communication (e.g., “mommy brush”) and use gestures only to complement and supplement their speech—much like adults do. “Once children have cracked the code and entered into the richly cross-referenced cue structure of a real natural language, the pace of word learning increases exponentially and eclipses the meager system of gesture symbols” (Bates & Dick, 2002, p. 296).

Research with atypical populations (e.g., children with Down syndrome, autism, or brain injury) provides additional evidence for the stability of the relation between gesture and language and suggests that recognitory gestures always precede word production—even though both gestures and words may be delayed by many months or years (Happe & Frith, 1996; Marchman, Miller, & Bates, 1991; Singer Harris et al., 1997). Similarly, one of the most robust early predictors of persistent language delay is a low level of gesture production during the earliest stages of communicative development (e.g., Thal & Katich, 1994; Iverson & Thal, 1997).

A range of gestures are employed by most children by most children at 12 months of age, and many of these are represented on the CDI. There is much less likelihood of a statistical floor effect for gestures than for vocabulary production. For example, a 12 month old boy who falls at the 10th percentile would produce approximately 14 gestures, compared with a child at the 50th percentile who would produce 24 gestures and a child at the 90th percentile who would produce approximately 38 gestures. Each of the major

percentiles is well-differentiated from another by 12 months, and this suggests that there is sufficient variability in children's use of gestures to make this a promising variable to investigate for individual and group differences.

4.2.b.i. Communicative gesture use in infants from low-income homes

In spite of their demonstrated importance, communicative gestures have been relatively overlooked in many developmental populations, including young children from low-income homes. Given the significance and strength of the relationship between early gestures and later language production, measurement of gestures used by these infants could further inform the question of how and when the poverty might come to impact social-cognitive and communicative development of children. In the only known study that has evaluated gesture use in low-income children, the author found a relation between pointing and language production in 14-month-olds; namely that low-income children who talked more also used more deictic pointing gestures during dyadic interactions with their mothers (Rowe, 2000). However, little is known about the timing or onset of gesture use in low-income children, the frequency of gesture use, and there is no research that speaks to other types of gestures (e.g., recognitory gestures and other deictic gestures such as giving, showing, and requesting). There are some data available by parent report on the CDI, but the general skepticism associated with obtaining parent report in low-income populations makes it necessary to gather information on gesture use through additional means (as well as to further investigate accuracy of parent report of gestures in low-income populations).

4.3. Conclusion

It should be clear that vocabulary comprehension and communicative gestures play a key role in early communication and that these are also related to later language production.

In spite of their established importance, very little is known about the emergence of these earliest communicative behaviors in children being raised in low-income environments.

This underrepresented research issue is explored in the studies presented in Chapters 9, 10, and 11.

CHAPTER 5

Theoretical Framework and Social-cognitive Foundations

5.1. Introduction

Theories of language organization and development vary considerably, depending on whether language is conceived of as an innate and specialized process *or* as a process that is built through (and is highly dependent on) experience. The issue of innateness of language is critical to any theoretical discussion of language learning, and it is an issue that permeates research in the field of developmental psycholinguistics.

5.2. Review of the literature

Few people believe that language is derived only through innate biological sources (nature) or that language is the exclusive result of environment and experience (nurture). Such strong-form versions of the nature-nurture debate have been shown to be empirically unsupportable. Newer, more interactive theories reflect an enriched and expanded knowledge about the nature of language and language learning in typically-developing children. There are not many who would claim that genetics or environment can truly be teased apart and treated as orthogonal and exclusive sources; instead the goal for most researchers is to assess the relative contributions of nature *and* nurture. In fact, no modern psycholinguistic theory denies that both heredity and environment play *some* role in language acquisition. Differences do exist, though, in the weight assigned to each of these variables, with “nativists” ascribing the most weight to heredity and “nurturists” ascribing most weight to learning and the environment. The polar positions will be considered below, followed by one version of a modern interactionist theory.

5.2.a. Nativism (“Nature”)

The nativist claim is often associated with Noam Chomsky (1957; 1993) and his claims that language inevitably evolves in children and is not dependent on experience or environmental input. The fact that children acquire language rapidly and without much direct instruction is taken as proof that language results from a maturational process, not a learning process. Steven Pinker, a staunch advocate for the nativist position, makes the bold claim that:

Language is not a cultural artifact that we learn the way we learn to tell time...it is a distinct piece of the biological makeup of our brains. Language is a complex, specialized skill, which develops in the child spontaneously, without conscious effort or formal instruction, is deployed without awareness of its underlying logic, (and) is qualitatively the same in every individual. (Pinker, 1994, p.4)

Pinker also maintains that language acquisition is such a robust process that “there is virtually no way to prevent it from happening short of raising a child in a barrel” (1994, p. 29).

The practical implications of the nativist perspective are far-reaching. The notion that language is part of the biological makeup of the human brain severely limits the potential to improve or change the course of an individual’s development. There are clear-cut ramifications of this theoretical position, since nativists would predict that strategies to improve or enhance characteristics of the home or social environment of a child who is at-risk (e.g., low-income) would not result in developmental gains for that biologically-predisposed child. Not surprisingly, the nativist position is at odds with the many programs that are designed to give children early opportunities to learn (e.g., Head

Start), which in turn are expected to increase their readiness for school and their later life achievements (Zigler & Styfco, 2004).

5.2.b. Behaviorism (“Nurture”)

As early as the seventeenth century, John Locke (1959) proposed that the human mind is initially a "tabula rasa" and that knowledge is only acquired through lengthy learning processes. The behaviorist or “nurturist” position advocates the important role of the environment, particularly in the form of parent input, for shaping children’s language. According to this view, language development is a gradual and cumulative process that results through imitation of others, practice, and contingent social reinforcement. No specific assumptions are made about innate biological predispositions for language acquisition in the child. Instead, environmental input and feedback are considered responsible for language learning. Adult responsiveness is certainly crucial for the development of language, but this behaviorist tradition (primarily associated with B.F. Skinner, 1957) is not embraced by many today. The nurturist position fails to acknowledge the obvious need for a biological predisposition to acquire language and ignores the fact that language truly does seem “special” in some respects.

A staunch “nurture” position attributes great importance to the social environment of the child, and the implications of this theoretical position are many. Perhaps most important, though, is the notion that within neurologically-intact individuals, there should be great potential to bolster an individual’s cognitive and language development through environmental modifications or enhancements. By this theoretical account, strategies to improve or enhance characteristics of the home or social environment of a child who is at-risk (e.g., low-income) could potentially result in solid developmental gains.

5.2.c. Constructivism (“Interaction”)

A theory of interaction proposes that children acquire language through the combination of a biological predisposition *and* a healthy and stimulating linguistic environment. In an interactive theory, language arises as the result of a dynamic system that simultaneously integrates knowledge and information from many relevant domains. By this account, language and other forms of cognition are thought to be systematically linked because they operate and rely on related cognitive underpinnings. Language “depends crucially on processes and representations from a variety of cognitive domains...and will be shaped and timed by the emergence and development of these requisite cognitive systems” (Bates, et al., 1988, p. 11).

These interactionist ideas capitalize on the early work of Jean Piaget (1954). Piaget emphasized the shared sensorimotor origins of linguistic and nonlinguistic symbols, and research in the Piagetian tradition has focused on correlations between specific language milestones and specific cognitive events. This work was greatly expanded on by Elizabeth Bates (e.g., Bates et al., 1979; 1988), Brian MacWhinney (1999), and most recently by Michael Tomasello (2003; 1999). Tomasello’s *constructivist theory* proposes that language is acquired through the development of more general social and cognitive processes, thereby eliminating the need for a hard-wired “language instinct.” Instead, the key to language acquisition is an infants’ understanding that others are trying to communicate and that language is a tool for achieving some of the most important social goals. There are two fundamental socio-cognitive skills that may be so critical as to essentially form the foundation for language: *Intention-reading* and *pattern-finding*. Both skills gradually emerge in the course of social interactions with

others and are thought to establish the child's social and cognitive capacity for concurrent and future communication. This notion relates to the broader literature on social-cognitive development and will be explored in more detail in the following section.

5.3. Social-cognitive foundations: the nine-month revolution

By a constructivist account of language, the child's first year of life sets the stage for all that follows, since future development builds upon the experiences and relationships formed during this time. The cognitive and social developments in the first year of life both allow for and stimulate the continued development of language for communicative purposes such that, "children learn the language in acts of interpretation...and children learn the language in acts of expression...so as to share contents of mind with other persons in new and different circumstances" (Bloom & Tinker, 2001, p. 76).

Soon after birth, human infants engage in social interactions in which the parent and infant focus attention on one another and express and share basic emotions through looking, touching, and vocalizing. These interactions are deeply social to the extent that they have emotional content and a basic turn-taking structure that resembles the framework of future language interactions. However, these interactions may not be truly intersubjective until the infant comes to realize that other people are also subjects of their own experiences. At about nine months of age, infants display a range of behaviors that suggest a "revolution" in the way they understand their social world (Tomasello, 1999). At that time, children begin to engage in a number of behaviors that suggest an emerging understanding of other persons as intentional agents and increased ability to regulate aspects of their own environment.

5.3.a. Development of joint attention

There are two fundamental socio-cognitive skills that may be especially critical for the emergence of language. The first of these, *intention-reading*, pertains to the ability to jointly attend to people, objects, or events and to understand the communicative intents of others. This skill is thought to be the “foundational social-cognitive skill underlying children’s comprehension of the symbolic dimensions of linguistic communication” (Tomasello, 2003, p. 31). When two individuals are embedded in the same perceptual situation, each brings their goals, attitudes, knowledge, expectations, and attention to bear on a referent event. It is the combination of these elements that determines how the utterance is grounded within a joint attentional frame.

It is through intention-reading that children begin to follow gaze of others, use others as social reference points, and imitate actions on objects. Although at six months children may interact dyadically with objects or people, it is not until about 9 to 12 months that triadic interactions emerge. This emergence of triadic interactions (adult+child+object) creates a *joint attentional frame* that allows the child to create a common ground for understanding the adults’ communicative intentions within a domain of relevance. During this period, joint attention may be evidenced by gaze following, joint engagement, social referencing, and imitative learning.

The emergence of joint attention is a coherent developmental phenomenon that seems to have special significance for many aspects of early child development, including language and other communicative forms. In fact, one study has explicitly shown that the emergence of joint attention at 9 months of age is correlated significantly with concurrent and subsequent abilities in gesture and language by 15 months of age (Carpenter, Nagell, & Tomasello, 1998). Wallace and colleagues (Wallace, Roberts, &

Lodder, 1998) also illustrate the importance of joint attention for child language outcomes. Mothers who were responsive to their children by providing verbal elaboration combined with didactic behaviors (e.g., showing how objects work) tended to have children with higher scores on measures of vocabulary comprehension at one year of age. The authors conclude that a greater number of joint attention episodes is strongly linked to children's emerging cognitive and communication abilities in the first year.

A more recent study by Dodici, Draper, and Peterson (2003) provides further support of this relationship within a group of 27 children living in low-income households. Joint attention, parent language, emotional tone, parental guidance, and parental responsivity at 14, 24, and 36 months were strongly related to children's receptive vocabulary as measured by the PPVT-III.

Another study demonstrated that dyadic involvement between mothers and children at 12 months may be an important mediator in the relation between environmental risk and scores on the Bayley MDI at 24 months the PLS at 36 months. Accordingly, the quality of interactions between parent and child during the "revolutionary" or "watershed" period of 9 to 12 months may be particularly critical for helping children establish the foundation from which all concurrent and subsequent language and cognitive skills will emerge. The finding that quality of mother-child dyadic interactions during this time mediates subsequent cognitive performance of children supports this notion, but very little is known about the development of intention-reading and joint attention in low-income families.

5.3.b. Development of pattern-detection

The second critical socio-cognitive skill in a constructivist theory is *pattern-finding*—which pertains to the ability to form perceptual and conceptual categories and to create analogies or structure mappings. Studies have shown that prelinguistic infants are able to detect abstract patterns in auditory and visual stimuli (Gomez & Gerken, 1999; Marcus, Vijayan, Bandi Rao, & Vishoton, 1999). Furthermore, Saffran and colleagues (Saffran, Aslin, & Newport, 1996; Saffran, Newport, & Aslin, 1996; Aslin, Saffran, & Newport, 1998) suggest that infants possess experience-dependent mechanisms that allow for statistical segmentation of many different elements, and this ability is particularly useful for segmenting words in spoken speech.

The general ability to detect patterns may indeed underlie an infant's ability to acquire spoken language. The ability to detect patterns in spoken language is evidenced at about nine months of age. Prior to this time, there is increasing evidence that infants gradually acquire detailed information about language by listening to and analyzing linguistic input (Jusczyk, 1997; Werker & Tees, 1999). For example, soon after birth, infants show evidence of fine-grained perceptual skills that allow them to discriminate speech sounds. This ability to resolve phonetic differences is essential for the later critical ability to detect phonotactic patterns (i.e., patterns that describe combinations of phonemes that are allowable in and characteristic of the child's native language). Because spoken words are embedded in a continuous acoustic stream with no clear boundaries between them, infants must rely on statistical relations and regularities to determine where boundaries exist between words. By nine months of age, children do begin to demonstrate that they have detected these patterns when they extract and show an understanding of individual words heard in running speech.

And so, what we have is an amazing set of necessary cognitive skills—namely, the statistical learning of concrete and abstract auditory patterns that are ready to be put to use in constructing the grammatical dimensions of language, once children’s ability to understand linguistic symbols comes on-line in the months surrounding their first birthdays (Tomasello, 2003, p. 30).

Whether its origin is uniquely linguistic in nature or not, this pattern-finding skill seems to support the infant’s ability to decipher and learn abstract auditory patterns that are necessary for an understanding and use of linguistic symbols.

A constructivist theory would posit that even if children are born with the biological capacity to acquire language, a supportive social environment is necessary in order for language to develop. Recall that Tamis-LeMonda and Bornstein (1989) showed that maternal encouragement of infant’s attention at 5 months explained unique variance in language comprehension at 13 months. This is taken as further support for the notion that maternal stimulation of young infants influences vocabulary growth, and that the framework for language may bear heavily on more general socio-cognitive skills that emerge in the context of these important social interactions.

5.3.c. Social-cognitive skills in infants from low-income homes

In summary, there are two core social-cognitive skills that are critical for language development by a constructivist theory. Very little is known about when these skills are first evidenced in low-income infants and toddlers. This seems to be a particularly important direction for future research, since the emergence of these skills is tightly linked with the emergence of other skills in both linguistic and nonlinguistic domains. In the words of Bates and Dick (2002), “The 9-month border appears to be a developmental watershed, characterized by changes in cognition, communication, and imitation that

invite speculation about underlying neural causes” (p. 295). The following section will briefly explore the literature that pertains to changes in neural organization during the first few years of life.

5.4. Developmental changes in neural organization

Recent advances in neuroscience allow for a more thorough understanding of the effects of experience on brain development. The distinction between *experience-expectant development* and *experience-dependent development* was introduced by Greenough and colleagues (Greenough, Black, & Wallace, 1987) and is relevant to the discussion of cognitive development in infancy and toddlerhood.

5.4.a. Experience-expectant development

Experience-expectant development is limited to developing skills and neural systems that are characteristic of a species. Sensory, motor, and cognitive systems develop with relative uniformity in humans because the fundamental required experiences are reliably present in almost any typical human environment. Neuroscientists have confirmed that much of the brain’s basic circuitry does not depend on experience, stimulation, or neural activity of any kind (Bailey, Bruer, Symons, & Lichtman, 2001). In the early months and years of life there is a rapid increase in the number of neural connections or synapses in the brain (i.e., *developmental synaptogenesis*). Developmental synaptogenesis results in a substantial overproduction of synapses in the young brain *prior* to some normally occurring developmental event. The event causes the related synapses to be appropriately activated by the experience and therefore become stable and survive--while synapses that have not been appropriately activated are eliminated. As development proceeds, a selection process occurs that determines which of these synapses are maintained and

which are eliminated. A significant amount of synapse formation is under intrinsic, not environmental control and is a normal and necessary part of brain development. More synapses do not necessarily equate with higher intelligence and the notion that one benefits from preserving, through early stimulation, synapses that would normally be lost has no basis in neuroscience research.

5.4.b. Experience-dependent development

In contrast, experience-dependent development is driven by experiences that are unique to an individual and derives from the physical, social, and cultural environment.

Experience-dependent changes allow humans to learn from personal experiences and form new synapses in response to experience. In experience-dependent change, synapses are not generated in advance of experience or in expectation of experience but rather are generated in response to experiences throughout the lifespan. The brain's capacity to adjust via experience-dependent change suggests that it is a dynamic organ that constantly adapts in response to learning and activities. It is important to acknowledge that the capacity for learning is fully present at birth and also that learning can change the structure of the brain. These facts support some clear conclusions about the potential impacts of the environment on the development of language and cognition in the first few years of life. "Given our current state of knowledge about the abilities of human infants and the development of the human brain, it is more than fair to conclude that input matters" (Thal & Clancy, 2001).

5.5. Practical implications and early enrichment

This chapter has explored a host of environmental variables and interactional styles that are associated with low-income families that may have undesirable effects on the

development of language and cognition in children. Given all that is known about learning and the brain, it logically follows that introducing more enriched environments should help provide low-income children with the same life chances that are available to their peers with more financial resources. Early enrichment programs may create an environment that is responsive to the presenting characteristics of a child but intense enough to provoke the establishment of new neural patterns. When this combination is present, early intervention seems to be most effective and is linked to long-lasting change (Shonkoff & Phillips, 2000).

There is a government-funded initiative to give very poor children a “Head Start” on learning through the provision of early enrichment opportunities. Toward this goal, Head Start (for preschool-aged children) and Early Head Start (for infants from birth through three years) programs were created in the 1960s to ensure that all children enter school “ready to learn.” Research demonstrates that high-quality comprehensive services for at-risk families with young children may indeed improve children’s life outcomes. Most reviews of the research on Head Start conclude that when children from low-income families participate in high-quality programs, they show notable benefits in general intelligence and language development (e.g., Ramey & Ramey, 2004; Lombardi & Bogle, 2004). Children who attended high-quality programs generally show a reduced need for special education and have improved high school graduation rates when compared with at-risk children who did not receive a similarly high-quality early childhood experience (Oser & Cohen, 2003). However, others claim that Head Start and similar compensatory preschool programs produce only short-term cognitive gains that fade out during the first few years of school (see Ramey & Ramey, 2004).

Although there is intense debate as to the effectiveness of Head Start and Early Head Start, few would claim that there are any harmful effects of placing young, at-risk children in stimulating and supportive environments while simultaneously providing their low-income parents with training and education. The issue that is most germane to the Head Start debate is whether or not the benefits warrant the significant government funding allocated to the program each fiscal year. Although there is no clear-cut answer to this question, the literature that has been reviewed here on neural development underlying communicative and social-cognitive skills in the first year of life suggest that the first years are critical for later language and cognitive abilities.

5.6. Conclusion

In spite of the demonstrated importance of the earliest social-cognitive and communicative skills, very little is known about the development of these in socially at-risk children. It is incumbent upon developmental researchers to expand the breadth of investigations to include general social-cognitive skills (e.g., intention-reading and categorization) and early communicative skills (e.g., language comprehension and gestures) in research with low-income infants and toddlers.

The literature reviewed in the first five chapters points to the need for additional research on the development of the social-cognitive and language skills that are most characteristic of the first year of life. The research objectives and predictions set forth in Chapter 6 logically follow the literature reviewed here.

CHAPTER 6

Research Objectives

6.1. Global research objectives

The literature reviewed in the earlier chapters suggests that there may not be an effect of income on developing language and cognition until approximately two years of age. I present four studies in the following chapters: Each one attempts to cast new light on this issue and to challenge the assumption that children are essentially impervious to variations in environmental input in the first year of life. This unique set of studies will test the social-cognitive and communicative foundations for language in 12-month-old infants from low-income homes.

The studies that follow are grounded in a constructivist theoretical framework, and reflect the notion that children are active builders or “constructors” of their own knowledge. By this theoretical account, children’s developmental achievements are built upon, and therefore also dependent upon, certain foundational abilities that have come before. This set of interrelated studies is designed to test whether the foundations for language are less sturdy and/or constructed later by infants from low-income homes in relation to infants from middle-income homes. Working within this theoretical framework, I propose that very early income differences will be evidenced in the more subtle communicative behaviors that serve as a foundation for later language production.

I question the notion that the poorer performance on language and cognitive measures that has been associated with low-income children “appears” at two or three years of age. Instead, I posit that the different trajectories develop gradually over time and emerge from a core set of foundational behaviors that are established during the first

year of life. The four studies presented in this dissertation are therefore designed to examine the earliest measurable foundational skills that may underlie later language and cognition in infants from low- and middle-income homes. The literature reviewed in Chapters 4 and 5 provides substantial evidence for the skills and behaviors that may constitute a foundation for later language production. Joint attention, vocabulary comprehension, and communicative gesture use are the dominant social-cognitive and communicative skills that warrant investigation at 12 months, though these are relatively neglected in research with children growing up in low-income homes.

6.2. Individual study hypotheses

The research conducted in this dissertation relies on a combination of behavioral and parent report methods employed with 12-month-olds from low- and middle-income homes. There are four specific research goals that will be accomplished through four distinct studies. The objectives are to explore:

1. Communicative precursors. Two critical communicative skills (vocabulary comprehension and use of gestures) emerge in the first year of life and have been shown to be predictive of later language production. Study 1 (Chapter 8) examines the nature and frequency of these behaviors in infants from low- and middle-income homes, in order to determine whether there are meaningful differences in these robust precursors to language production. I hypothesize that parent report and behavioral tasks will reveal subtle differences in early comprehension vocabulary and communicative gesture use, with low-income children understanding fewer words and producing fewer gestures.

2. Social-cognitive foundations for language. One particular social-cognitive skill, joint attention, emerges during the first year of life and may help create a necessary foundation upon which language is constructed. Study 2 (Chapter 9) asks whether there is a relation between income group and infants' behaviors during a standardized observation measuring joint attention and related social-cognitive behaviors. I hypothesize that the infants from low-income homes will obtain lower scores on the measures of joint attention and social interaction, but will obtain equivalent scores for responses to behavioral requests.
3. Utility of parent report. Study 3 (Chapter 10) compares parent report on the CDI with infants' performance on behavioral tasks. The study is designed to determine whether parents with low levels of income and/or education provide information that is consistent with behavioral evidence. I hypothesize that low- and middle-income parents will provide equally accurate reports of the gestures their infants use and the words they understand.
4. Verbal and nonverbal communicative behaviors of parents. Study 4 (Chapter 11) explores the verbal and nonverbal communicative behaviors witnessed in mothers during 10 minutes of play with their infants. I hypothesize that there will be quantitative and social-pragmatic differences in child-directed speech and gestures. Low-income mothers will use fewer words and gestures, and they will use these most often in directive contexts; middle-income mothers will use words and gestures most often in responsive or child-centered contexts. I further hypothesize that the number of maternal utterances used in

a responsive manner during the communication sample will be positively related to the number of gestures produced by infants during the same task.

CHAPTER 7

General Methodology

7.1. Participants

Fifty-one 12-month-old infants were recruited through written advertisements placed in monthly parenting magazines and newsletters, pediatrician offices, retail stores, and on bulletin boards at children's play centers. The study was also advertised through recruiting booths at family swap meets and personal contacts in the community. For low-income families two additional sources were tapped: WIC¹ and Welfare offices. All recruitment took place in San Diego, California.

The infant participants were 12 months of age at the time of testing. All of the infants were reported to have a normal medical history and normal hearing. None were reported to have serious complications at birth, known neurological impairments, or developmental disabilities. Participation was restricted to infants from monolingual, English-speaking homes, because there are unique profiles associated with early bilingual experience.

7.1.a. Income groups

On the basis of self-reported gross annual income, each family was assigned to one of two income groups. The low-socioeconomic status group (L-SES) included families who were living in poverty, as determined by the 2005 Federal Poverty Guidelines (see Table 7.1).

¹ WIC is a federal grant program that provides nutritious foods and nutrition counseling to low-income mothers and children who are at nutrition risk. WIC is available to low-income families, including families in poverty and the "poor" who earn up to 185% of the U.S. Federal Poverty Guidelines

Table 7.1. 2005 Health and Human Services Federal Poverty Guidelines

	Family Size					
	1	2	3	4	5	6
Annual income	\$ 9,570	\$ 12,830	\$ 16,090	\$ 19,350	\$ 22,610	\$ 25,870

These national guidelines do not take into account the extreme cost-of-living differences that exist from region to region. This issue was of particular importance since the current research took place in San Diego—the sixth most expensive U.S. city to live in the year 2005 (<http://www.coli.org>, 2005). In order to capture those families who were considered poor by regional standards, though not necessarily in poverty as defined on a national level, I also relied on information from the United States Department of Housing and Urban Development (<http://www.hud.gov>, 2005). HUD calculates a median family income (MFI) that is city-specific and then creates Income Limits² from each city's MFI. The most recent Income Limits for San Diego are set forth in Table 7.2. Using these HUD guidelines, families were included in the L-SES group if they fell in the “extremely low-income” or “very low-income” bracket as determined by family size and current gross annual income.

Table 7.2. 2003 HUD gross annual income limits for San Diego, California.

	Family Size					
	1	2	3	4	5	6
<i>Very low- income</i>	\$ 22,350	\$ 25,500	\$ 28,700	\$ 31,900	\$ 34,450	\$ 37,000
<i>Extremely low-income</i>	\$ 13,400	\$ 15,300	\$ 17,250	\$ 19,150	\$ 20,650	\$ 22,200

² San Diego's 2003 MFI for a family of 4 was \$59,900. The “extremely low-income” limits are 32% of the MFI and “very low-income” limits are 53% of the MFI.

Families were also included in the L-SES group if they received Welfare, Medicaid, Temporary Assistance for Needy Families (TANF), Food Stamps, and/or WIC. Families who received any of these services, irrespective of reported income, were assigned to the L-SES group. (Two L-SES parents received services through WIC but reported an income that slightly exceeded the HUD guidelines.) Parents that were in college or graduate school were not included in the L-SES group, even if they received government assistance or met the low-income HUD guidelines.

If the gross household income of a family exceeded the income guidelines set forth above and the family was not receiving any form of government assistance, the family was included in the middle-socioeconomic status group (M-SES). The M-SES group represented a broad range of incomes and consisted of families with moderate to very high incomes. Additional demographic information for the two SES groups is provided in greater detail in the following sections.

7.1.b. Child participants

Fifty-one infants were recruited to participate in the study. One Caucasian male in the M-SES group did not willingly participate in any of the tasks and was excluded from the study. All subsequent analyses are based on the 50 participants who did complete the tasks. Twenty-seven 12-month-old infants (14 male, 13 female) comprised the L-SES group, and the mean age at time of testing was 12 months and 15 days. Twenty-three 12-month-old infants (10 male, 13 female) comprised the M-SES group, and the mean age at time of testing was 12 months and 14 days. An independent-samples t-test confirmed no significant difference in the age of the two groups at the time of testing ($p > .05$). All mothers reported a near-term or full-term pregnancy with at least 36 weeks gestation (L-

SES $M=39.3$, $SD=1.7$, M-SES $M=39.2$, $SD=1.9$). An independent-samples t -test confirmed no significant difference in number of weeks gestation ($p>.05$). Twelve of the L-SES infants were first-born/only-children, and 15 had at least one sibling ($M=.93$, $SD=1.2$, range=1-5 siblings). Thirteen of the M-SES infants were first-born/only-children, and 10 had at least one sibling ($M=.48$, $SD=.59$, range=1-2 siblings).

Minorities were well-represented within both income groups so that the true variable of interest, socioeconomic status, would not be confounded with race or ethnicity. Caucasian participants represented only 48% of L-SES and 57% of M-SES (see Table 7.3). In the event a parent could not comfortably categorize their child into one of the four major ethnic groups, the infant was assigned to the “Mixed/Other” group. Included in this category were two L-SES infants (one was African-American/Hispanic, and the other Persian/Italian) and one M-SES infant with African-American, Hispanic, and Asian ethnicity.

Table 7.3. Number of participants per ethnic category in L-SES and M-SES

	Ethnicity				
	Caucasian	Hispanic	African-American	Asian or Pacific Islander	Mixed/Other
L-SES	13	5	6	1	2
M-SES	13	4	3	2	1

7.1.c. Parent participants

Detailed information about individual participants can be found in Appendix A (for mothers) and Appendix B (for fathers). Group-level descriptions are summarized below.

Twenty-one of the L-SES infants (i.e., 78%) lived in intact homes with both biological parents, and 6 infants (i.e., 22%) lived in a home headed by a single-mother.

All M-SES children lived in intact homes with both biological parents. Mothers in the L-SES group were significantly younger when the participant child was born ($M=25.9$, $SD=4.7$, range=19-39 years) than were the M-SES mothers ($M=32.7$, $SD=3.0$, range=26-38 years; [$t(48) = -6.05$, $p<.001$]). Mothers with M-SES were significantly more likely [$t(48)= -5.86$, $p<.001$] to have earned a 4-year degree from a university than were mothers with L-SES (see Table 7.4).

Table 7.4. Maternal education by SES group

	Did not complete High School	High School Diploma	4-year College Degree
L-SES	2	19	6
M-SES	0	3	20

Thirty percent of L-SES mothers worked part-time (vs. 44% of M-SES), 32% of L-SES worked full-time (vs. 22% of M-SES), and the remaining mothers were not employed (i.e., 38% of L-SES and 34% of M-SES). The Hollingshead Index (Hollingshead, 1975) is a widely-used instrument that can help determine whether there are qualitative differences in occupations. A numerical value reflects the education required for and the income and prestige associated with a given occupation. For example, a score of 10 reflects the category of unskilled laborers (e.g., janitor or usher), a score of 30 represents semi-skilled workers (e.g., taxi driver or telemarketer) and a score of 90 reflects the most prestigious jobs (e.g., medical doctor or college professor). Using the mother's current job description (or the most recent job if unemployed), L-SES mothers had significantly lower scores associated with their occupations [$t(48)=-6.77$, $p<.001$]. The scores for L-SES mothers ranged from 20-65 ($M=43$, $SD=15.8$) and scores

for M-SES mothers ranged from 50-90 ($M=70$, $SD=11.3$). Refer to Appendix A for more detailed information about the education and occupations of individual mothers.

Paternal information is provided only for children whose fathers were living at home with the child at the time of testing. Accordingly, the L-SES group data are based on the 21 fathers who lived with their children and all 23 of the fathers in the M-SES group. Fathers in the L-SES group were significantly younger at when the participant child was born ($M=28.1$, $SD=5.5$, range=21-40 years) than were the M-SES fathers ($M=35.6$, $SD=4.3$, range=28-44 years; [$t(42) = -5.02$, $p<.001$]). M-SES fathers were significantly more likely to have earned a 4-year degree from a university than were fathers with L-SES ($[t(42)= -4.84$, $p<.001]$; see Table 7.5).

Table 7.5 Paternal education by SES group

	Did not complete High School	High School Diploma	4-year College Degree
L-SES	2	16	3
M-SES	0	6	17

All of the fathers worked full-time, with the exception of one L-SES father who worked part-time and another who was unemployed. L-SES fathers had significantly lower Hollingshead scores ($M=37.6$, $SD=17.6$, range 10-70) associated with their occupations than the M-SES fathers ($M=71.7$, $SD=14.9$, range 30-90; [$t(42)= -6.95$, $p<.001$]). Appendix B provides more detailed information about the education and occupations of individual fathers.

Fifty-five percent of the L-SES families were uninsured or receiving Medicaid/Medi-Cal, and the remaining 45% had health insurance through their

employers. All of the M-SES families had health insurance through their employers or they funded their own health plans. Twenty percent of L-SES received Welfare, and nearly all (92%) received services through WIC. All of the L-SES families were “very low-income” by the regional HUD standards, and 20% also lived below the federal poverty level.

7.2 Procedure

Parents responded to the posted fliers in the community by calling or e-mailing the investigator who then described the study in greater detail. An interested parent scheduled an appointment for a date soon after the child’s first birthday. Approximately 10 days before the scheduled session, the researcher mailed a confirmation letter, campus map, driving directions, and the long-form version of the CDI: Words & Gestures to the parent. The confirmation letter reminded the parent of the date and time of the session and asked that the CDI be completed sometime after the child’s first birthday and prior to the scheduled lab visit. A reminder phone call was placed one or two days before the session.

On the day of the scheduled lab visit, the parent and infant were greeted and escorted to the testing room. The testing room was a 10x10’ room simply decorated in primary colors. It had an adult-sized table, three chairs, and four posters on the walls. A set of age-appropriate toys were scattered on a large rug in the center of the room and the parent was encouraged to let the infant play with the toys and get comfortable in the new environment. The experimenter joined the infant on the floor and gauged his or her willingness to interact with an unfamiliar person. If an infant appeared reluctant to interact, the experimenter initially sat on the floor at a distance and then gradually

increased her interaction with and proximity to the child. Infants readily engaged with the experimenter and the toys in the majority of instances. The research assistant retrieved the completed CDI from the mother while the infant and experimenter played together on the floor. (Only one mother in the M-SES group forgot to bring the CDI; she sent it by mail the following day.) The research assistant then gave the mother a copy of the informed consent. She asked the parent to carefully review the document and ask any questions she had about what was going to happen during the session. In every instance the parent signed the consent form and the study was initiated. The parent was informed that the session would be videotaped in its entirety by two cameras mounted in the testing room. The cameras were remotely operated by a research assistant in an adjacent room.

After parent consent was obtained, the research assistant conducted an oral interview with the mother in order to gather information about the family and about the child's medical history (see Appendix C). The oral interview was completed in 5-10 minutes, thereby giving each infant approximately 15 total minutes of warm-up play with the experimenter before the first task. When the oral interview was complete and the child appeared comfortable, the first set of toys was removed from the testing room. The parent was asked to join the child and experimenter on the rug, and the first task was initiated. The order of tasks was consistent across all participants: (a) spontaneous labeling task, (b) communication sample, (c) looking-while-listening, and 4) Early Social-Communication Scales (ESCS). These tasks are described in detail in the following sections.

The parent was informed that breaks could be taken at any time at her discretion, and that there was adequate time for snacks, play, or diaper changes. Most mother/infant

dyads were in the lab for less than 1 ½ hours, but the total time could extend to 2 hours if there were many breaks (especially the longer breaks associated with bottles or breastfeeding). When all of the tasks were complete, the parent and infant were thanked for their time. The research assistant asked to take a picture of the infant for the lab bulletin board and emphasized that this was optional and not for research purposes (all parents agreed). The parent was given a \$50 cash incentive payment and a copy of the signed consent form, and the infant was given a small toy as a token of appreciation.

The research assistant mailed a letter of appreciation to the parent approximately one week after the session. A brief report accompanied the letter and summarized the infant's performance on major indices on the CDI. In the event that an infant scored in the lower percentiles on the CDI (<10%), parents were cautioned not to worry on the basis of a single measure at such a young age. Parents were further encouraged to request additional CDI's in order to monitor their infant's communicative development over time (four parents did so). The photograph of the infant that was taken during the lab visit was also included with the letter as a keepsake for the parent.

7.3. Instruments

The following sections describe the specific instruments and tasks that were employed in this dissertation, as well as procedures for administration, coding, and data-reduction. This dissertation included at least one task in each of the four major categories of assessment: (a) parent report, (b) behavioral tasks, (c) structured tests/observations, and (d) quasi-naturalistic observation.

7.3.a. Parent report

Parent report is generally accepted as a viable and valuable method for obtaining information about child language and communication. Numerous studies have confirmed the ability of parents to provide valid reports of comprehension and production of single words in the first years of life, when assessment is limited to current or emergent behaviors, and when a recognition format is used (e.g., Bates, Bretherton, & Snyder, 1988; Ring & Fenson, 2000; Heilman, Ellis Weismer, Evans, & Hollar, 2005; Marchman & Martinez-Sussman, 2002).

7.3.a.i. CDI: Words & Gestures

The MacArthur-Bates Communicative Development Inventories (CDI's; Fenson et al., 1993) are widely-used parent report forms for measuring early communicative abilities of infants. The CDI: Words and Gestures (CDI: W&G) is a parent report instrument that employs a recognition format and is designed for use with 8- to 16-month-olds. Scores are generated for the dimensions of gesture use, vocabulary comprehension, and vocabulary production. The norms permit a child's scores on the major components of the inventories to be converted to percentiles so that scores can be ranked in relation to other children of the same age and gender.

The CDI: W&G is an 8-page checklist that has two major subscales: 1) Early Words and 2) Actions and Gestures. The Early Words section includes a 396-item vocabulary checklist that is organized into 19 semantic categories. The written instructions for the vocabulary measure ask the parent to mark the first column ("understands") if the child understands but does not yet say a word. For words the child not only understands but also uses, the parent is asked to place a mark in the second column ("understands and says").

The Actions and Gestures index of the CDI: W&G is comprised of 63 items that are further divided into five subsections. The first section gathers information on “first communicative gestures,” which include deictic gestures (giving, pointing, showing, requesting) and gestures that allow infants to make their wishes known (e.g., nodding head or extending arms out to signal a wish to be picked up). For each of the 12 items, the parent is asked to “mark the line that describes your child’s actions right now” by selecting one of three options: “not yet,” “sometimes,” or “often.” The second section measures a child’s tendency to engage in games and routines (e.g., play peek-a-boo, play patty-cake) and the instructions ask, “Does your child do any of the following?” The parent responds with a yes/no response for each of 6 items. The third section pertains to “actions with objects,” and the parent chooses a yes/no response to the question, “Does your child do or try to do any of the following?” Seventeen items are represented on this section of the checklist (e.g., put on a hat, put telephone to ear). Instructions for the fourth section (“pretending to be a parent”) read, “Here are some things that young children sometimes do with stuffed animals or dolls. Please mark the actions that you have seen your child do.” The parent responds with “yes” or “no” to each of 13 items in this section (e.g., cover with a blanket, kiss or hug a doll). The final section (“imitating other adult actions”) asks, “Does your child do or try to do any of the following?” and the parent chooses a yes/no response for each of the 15 items (e.g., put key in door or lock, put on glasses).

Each parent was mailed the CDI: Words & Gestures and asked to complete it after the child’s first birthday and prior to the scheduled laboratory visit. The parent returned the CDI to the experimenter on the day of the laboratory visit. The CDI was subsequently

scanned and the ASCII data output file was transferred to a customized CDI database that generated item-level and summary-level reports for each child.

Data reduction and analysis. The CDI computer database generated summary scores for each child. The major measures of interest were the total number of different gestures produced, the total number of different words produced, and the total number of different words understood. A subset of individual words and gestures was also extracted to allow for comparisons between parent report and other tasks that assessed infants' knowledge or use of the same words and gestures. Extracted words included the ten words represented in the looking-while-listening task (see Table 7.7). Extracted gestures included the ten representational actions with objects that were sampled during the spontaneous labeling task (see Table 7.6), and the four deictic gestures (give, point, show, request) recorded during communication samples and the spontaneous labeling task.

7.3.a.ii. Family history questionnaire

Parents were asked to provide an extensive developmental health history for the child and information about the child's family and home environment. The family history questionnaire (see Appendix C) was created specifically for this purpose. Information about infants' prenatal, perinatal, and postnatal health history was gathered so that children with factors known to interfere with early communicative development (e.g., hearing loss, neurological impairment, pre-term birth) could be excluded from the study. The questionnaire also yielded extensive information about the education, occupation, income, and living situations of the family.

The demographic questionnaire was orally administered by a trained research assistant and required approximately 5-10 minutes to complete. The parent was advised

that everything she said would be kept strictly confidential and that she could choose to skip any questions that she was not comfortable answering. All parents chose to answer every question, although there were some variables that were difficult for parents in both SES groups to remember (e.g., Apgar scores and age at which children achieved early milestones such as rolling over or sitting up). If a parent could not remember a child's Apgar scores, the researcher left it blank but ascertained that the child had been discharged from the hospital within 3 days after birth and that there were no perinatal complications. Similarly, if a parent could not remember the timing of an early developmental milestone (e.g., rolling over), the researcher verified that the child had indeed reached subsequent milestones (e.g., crawling or walking) at developmentally-appropriate ages.

Data reduction and analysis. The research assistant wrote down the responses given by parents during the oral interview. Each response was subsequently assigned a numeric value and the data were entered into a database. The information yielded from the demographic questionnaire informed SES group assignments.

7.3.b. Behavioral tasks

Two behavioral tasks were included to complement the information yielded through other methods of assessment. The spontaneous labeling task was included as a measure of gesture production, and the looking-while-listening paradigm was included as an online measure of vocabulary comprehension. No other known studies have employed these tasks with infants from low-income homes.

7.3.b.i. Spontaneous labeling task

The spontaneous labeling task elicits and measures gesture and vocabulary production, and has been used in a number of research studies with young children (e.g., Bates, Thal, Whitesell, Fenson, & Oakes, 1989; Thal, Bates, Goodman, & Jahn-Samilo, 1997). The task was administered with the infant seated on the parent's lap on the floor. The experimenter had ten objects (*airplane, baby, brush, car, cup, dog, flower, hat, phone, and spoon*) in a small box and she also sat on the floor facing the parent and infant. The experimenter first asked the parent to avoid interacting with the infant during the task so that the infant would focus his or her attention on the objects and the experimenter. Parents were asked to refrain from naming any of the objects or using the objects in the intended manner. Once the infant and parent were comfortably seated on the floor, the experimenter produced a small box containing the stimuli. The objects were taken out of the box and presented to the infant one at a time. The experimenter randomly selected the first object from the box and then enthusiastically stated, "Oh, look at this!" or "Here's something else" as she presented the object. The infant was allowed to examine or play with the object for approximately 20 seconds. If the infant did not spontaneously name or gesture with the object within that time, the experimenter prompted by asking, "What is it?" or "What's this?" to elicit language, and "What do you do?" or "Show me what you do" for gestures. Prompts were given twice to encourage a verbal response and then twice to encourage a gestural response. If the infant did respond by verbally naming the object or producing a recognitory gesture, the experimenter affirmed that this was correct (e.g., "That's right, you do smell the flower!"). If the infant did not identify the object with a word or gesture, then the experimenter ended that trial by providing a neutral statement

(e.g., “Did you like that one?”), taking back the object, and then proceeding to the next object.

The ten objects included in this task were selected because each one is represented on the gesture index of the CDI, and is associated with a relatively early-appearing action. Table 7.6 provides a more detailed description of the stimuli and the associated criteria for correct gestures.

Table 7.6. Description of the stimuli employed in the spontaneous labeling task

Description	Correct gesture
white floppy hat	Put on own or other’s head
3.5" green metal car	Drive purposefully (with or without sounds)
5" blue baby brush	Put to own hair or other’s hair
Red spoon	Put purposefully to own or other’s mouth
4" yellow fabric flower	Bring to own or other’s nose and/or sniff
red plastic cup	Put to mouth and tilt head back
3" blue metal airplane	Move through air (with or without sounds)
baby doll	Hug, pat, kiss, rock
4" tan stuffed puppy	Pat, pet, kiss, walk
black cordless phone	Put to ear or shoulder or mouth

Data reduction and analysis. A verbal trial was considered correct if the child accurately named the object. Close approximations of the target word were considered correct even in the presence of a minor phonological deviation: A verbalization was considered correct with a single omission (e.g., “at” for hat), substitution (e.g., “gog” for dog), or weak syllable deletion (e.g., “bay” for baby). Incorrect trials were those in which the infant did not give a verbal response or provided an incorrect name for an object (e.g., “ba” for phone). Similarly, a gesture trial was considered correct if a recognitory gesture was used to identify the object (e.g., “named” flower by bringing to the nose and sniffing), this was considered a correct gesture trial. If the infant used the

object in an unconventional manner or did not act on the object, this was considered an incorrect gesture trial.

Criteria for correct responses were delineated and agreed upon by the coders. It was mandatory that the infant clearly used an object in a representational manner in order for credit to be given. Accordingly, ambiguous responses were carefully analyzed, and coders adhered to a conservative approach of only giving credit when there was sufficient support for doing so. This was particularly important for objects that involved the mouth (i.e., cup and spoon), since mouthing objects is a behavior that is characteristic of infancy and was frequently witnessed in the infants during the laboratory visits. For this reason, putting the cup to the mouth was not considered a correct gesture if the infant similarly brought other objects to his or her mouth. In order to receive credit for a correct response, the infant had to provide additional evidence of a drinking gesture, such as tilting the head back or making a noise associated with drinking (e.g., slurping or gulping).

A research assistant scored the spontaneous labeling task on-line and the experimenter subsequently second-coded 100% of the trials by viewing the videotape. The two coders had an initial inter-rater reliability of 98.7%. In the event of a discrepancy, the first and second coder reviewed the tape together and made a joint decision as to whether or not the child would receive credit for a correct response.

Each child ultimately received a score of 0-10 correct verbal trials and 0-10 correct gesture trials. The total number of words and total number of gestures produced during the task were calculated for each child and entered into a database. The specific words and gestures each child produced were also recorded so as to allow item-specific

comparisons with other data (i.e., to compare parent report of a specific gesture with that same gesture on the spontaneous labeling task).

The spontaneous labeling task also provided an opportunity to measure deictic gestures that infants produced while interacting with the experimenter and/or parent. Many infants showed an object to the experimenter, pointed to posters on the walls, or gave an object to the parent. These communicative deictic gestures were documented when the experimenter scored the task from videotape and a research assistant also double-coded 15% of the participants' communicative gestures by subsequently watching the videotape. Inter-rater reliability of 90% was obtained for total number of deictic gestures produced by the infants.

7.3.b.ii. Looking-while-listening task

The looking-while-listening task is an on-line procedure that capitalizes on natural infant looking behaviors. Because no overt response is required, the paradigm can be employed even with very young infants. This method focuses on infants' differential looking when presented with two visual displays and an auditory stimulus that pertains to one of the visual displays. Only the auditory stimulus indicates which display is being referred to, so the infant's eye movements can be observed to determine whether what the infant hears moderates the infant's looking behavior. This task is particularly valuable for measuring vocabulary comprehension in infants who may not yet be reliable respondents on more traditional measures of vocabulary comprehension. There are no known studies to date that have utilized this method with infants from low-SES homes.

The looking-while-listening stimuli were ten nouns that were selected because they are very early-appearing words that at least 50% of infants (according to CDI norms)

are reported to know by the thirteenth month. The stimuli were presented in yoked pairs and were matched within pairs as closely as possible on the basis of CDI normative data and visual salience (see Table 7.7). Each word served twice as a target and twice as a distracter, with side of target picture counterbalanced across trials and order of trials quasi-randomized. Twelve “filler” trials were also included to help the infant maintain interest to the task. The filler trials consisted of animal sound effects paired with pictures of animals, and these trials were not coded or analyzed.

Table 7.7. Looking-while-listening word pairs

Pair	Target	CDI norms ^a	
		12 months	13 months
1	Baby	65%	68%
1	Bottle	77%	88%
2	Brush	26%	55%
2	Phone	58%	67%
3	Banana	50%	57%
3	Juice	67%	71%
4	Ball	80%	92%
4	Book	68%	80%
5	Diaper	64%	80%
5	Shoe	63%	78%

^aCDI normative data indicating percent of infants that understand the word

The speech stimuli were recorded in a soundproof recording booth by a female, native English speaker who used child-directed speech. Target words were preceded by a carrier phrase (“Ooh look!”). The carrier phrase was recorded once and was spliced together with each word so as to create ten unique target phrases (e.g., “Ooh look!

Baby!’’). The resulting waveforms were measured, equalized, and edited with Adobe Audition.

The visual stimuli were colorful, photographic images of objects that were superimposed on a solid background. The pictures were collected from a CD-Rom and internet photo databases. The same image was used each time a word was represented.

The looking-while-listening procedure was conducted in a room that had been modified with Styrofoam baffles on the walls in order to reduce the intrusion of external noise. The infant was seated on the parent’s lap approximately 36" away from and facing directly toward two computer monitors. The 12" monitors were set back behind a wall with cutouts so that only the screens were visible to the child. The monitors were set apart from each other with a 9" gap between them. A small red light was mounted in that gap and the experimenter could flash the light and/or sound a beeping noise in order to encourage the child to orient his or her attention between the monitors before a new trial. By centering the child’s attention prior to a trial, it was more likely that children would be looking in the proper direction at trial onset. A video camera was mounted above each monitor and it was adjusted to focus only on the child’s face. The two video cameras were also set back behind a wall with small cutouts, so that only the lenses were visible from the position of the parent and infant. The cameras were connected to a VCR at the control station next to the computer that controlled the experiment.

The parent was asked to sit on a chair centered in front of the two computer monitors with the infant on her lap (see Figure 7.1). Specially-modified, opaque glasses were used so that the parent could not see the pictures and give unintended cues to the infant. The glasses were highly distracting for many infants, so parents were often asked

to remove them so that the infant might better focus on the task. The experimenter then pulled down a curtain so that the parent and child were enclosed in a dark area with light provided only by the monitors. The experimenter sat quietly behind the curtained area at the computer control station and initiated the first trial. The experimenter could see the child on the television monitor at the control station throughout the session.

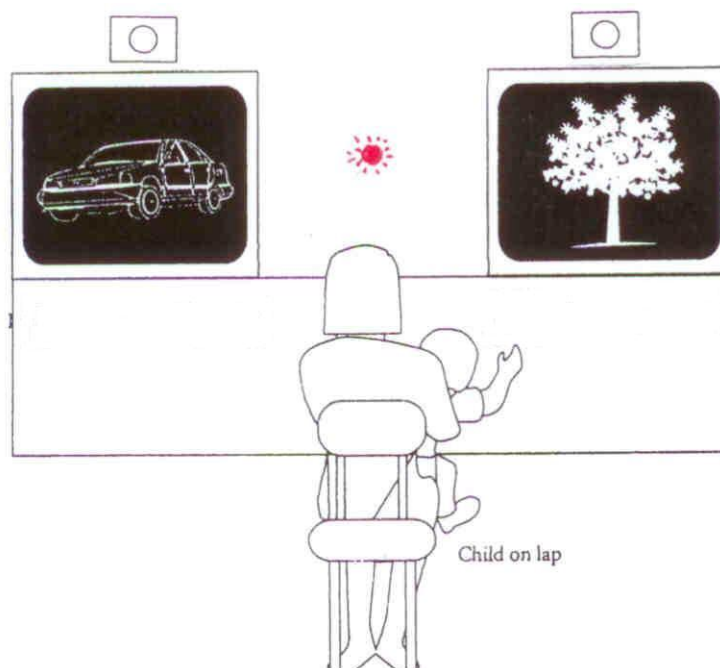


Figure 7.1. Configuration during the looking-while-listening task.

At the onset of a trial, a pair of pictures appeared for 650 ms before the carrier phrase and target word were presented over the speakers. The audio stimuli were played at 75 dB from speakers located slightly behind the infant's head. The pictures remained on the screen for an additional 2000 ms after the offset of the speech stimuli (see Figure 7.2). The monitors were dark for at least one second before the next trial started. The length of each inter-trial interval was determined by the experimenter. If an infant was not looking in the direction of the monitors, the experimenter waited to start the trial and

used the flashing light and sound cues to orient the child's attention between the monitors. Some of the infants required lengthier inter-trial intervals than others, so the length of time to complete the task ranged from five to nine minutes.

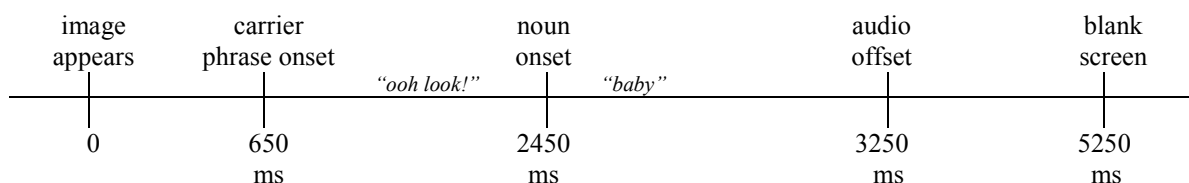


Figure 7.2. Timeline for a looking-while-listening trial.

Data reduction and analysis. When the looking-while-listening procedure was complete, the videotape was converted and compressed with a computer igniter card to create a computer movie file digitized at 29.97 frames per second. The resulting movie file was entered into a customized Macintosh computer scoring program. Trained observers who were blind to trial type and side of target picture coded the task without volume. For each trial, coders analyzed the time course of the infant's gaze patterns frame by frame, noting on each frame whether the infant's eyes were oriented to the left picture, the right picture, in between the two pictures (as when shifting), or away from both pictures (as when off-task). The software then aligned these data with the onset of the target word for each trial and calculated the duration of each look. Two coders independently scored all trials for 15% of the participants and achieved an inter-rater reliability of 97%.

The dependent measure for this task was *accuracy of response*. Because children did not know in advance which picture would be labeled, about half of the time (by

chance) they should have been looking at the target picture at word onset. On distracter-initial trials, the correct response required a shift to the target picture. On target-initial trials the correct response was to continue fixating after word onset. Shifts on all distracter-initial trials and target-initial trials were assessed within the time window from 300 ms (the time required for a child to process the verbal information and mobilize an eye movement) to 1500 ms following target word onset. Accuracy was measured by combining data from both target-initial and distracter-initial trials and calculating the total amount of time that an infant was fixated on the target as a percentage of the total amount of fixation time on either picture. Accuracy was determined for each target word, and a total percent of time looking at the correct targets was calculated for each infant.

7.3.c. Communication samples

Infants were observed during play with a parent and a set of developmentally-appropriate toys. The experimenter placed an assortment of toys on the rug (see Table 7.8 for a list) and asked the parent to play with the infant “like normal” for ten minutes. She also requested that the parent keep the infant on the rug so that the video cameras could capture unobstructed views of the dyad. The experimenter left the room and then remotely operated the video cameras from an adjacent room. When ten minutes had elapsed, the experimenter returned to the room and let the parent know that the task was complete.

Table 7.8. Toys available during the communication sample

Description of toys
Yellow school bus
8-cup stacking cup set
Plastic bowl, spoon, and fork
Plastic peas
Plastic tea kettle with 2 teacups
Plastic hammer and large nails
Plastic screwdriver and large screws
Baby doll in pink clothing
Fabric cradle with pillow and blanket
Clasp purse with mirror, comb, and brush
Farm animals: horse, sheep, chicken, pig, cow, broken cow

Data reduction and analysis. Parent language and gestures and infant language and gestures were later transcribed from the videotape. The transcripts were coded in accordance with CHAT transcription conventions of the CHILDES system (MacWhinney, 2000). Transcription was undertaken by two individuals with at least three years of related experience in a research setting. The transcribers viewed the videotape on a professional quality VHS player and listened to the audio portion with professional-quality headphones. The transcription procedures relied primarily on the extensive guidelines used by Thal and colleagues (Thal, 2002). Four main dimensions of the communication samples were coded: (a) parent language (b) parent gestures (c) infant language, and (d) infant gestures.

Parent language. Every intelligible word that the parent said to the infant was transcribed. A single utterance was defined as any verbalization followed by a silence, change in conversational turn, or change in intonation pattern. Parent utterances were further classified on the basis of the social-construction of the communicative interchange (Gleason, 2001). Each parent utterance was assigned to one of three mutually

exclusive categories (see Table 7.9). *Responsive comments* were those that pertained to an object on which the infant or dyad was focused (e.g., “That’s a neat cow you have!”). This category also included parent utterances that narrated an ongoing child or joint activity. A parent utterance was only categorized as responsive when a parent’s comment was contingent on, and sensitive to, the infant’s focus of attention. *Directive comments* were produced in an attempt to draw the infant’s attention to an object or event (e.g., “Look at this”) or to negotiate what actions would be carried out by the infant (e.g., “Now stack the blue one”). This category also included specific behavioral directives (e.g., “Don’t put that in your mouth”). *The other comments* category contained all of the parent utterances that were not otherwise classified as responsive or directive. This catch-all category included praise (e.g., “You are such a good girl!”), routine social games (e.g., peek-a-boo), and generic statements (e.g., “So much fun stuff!”).

Table 7.9. Mutually exclusive categories of social-construction

Category	Example
Responsive comment	“That’s a big bus that you have”
Directive comment	“Let’s play with the teapot”
Other comment	“So much fun stuff here!”

Parent language was reduced to the total number of words and utterances produced. The number of words and utterances used for a particular category of social-construction was also calculated.

Parent gestures. Gestures were recorded in accordance with the guidelines offered by Namy and colleagues (Namy, Acredolo, & Goodwin, 2000). Five deictic gestures were coded: *give*, *point*, *indicate*, *show*, and *request* (see Table 7.10 for behavioral descriptions).

Table 7.10. Gestures recorded during communication samples

Gesture	Behavioral description
Give	Object is transferred to the infant's hands
Point	Index finger is extended toward an object or event
Indicate	Object is singled out through direct contact (e.g., tapping)
Show	Object is held up in gesture space and oriented toward the infant
Request	One or both hands are extended toward an object, often with grasping

Gestures were assigned to the same categories of social-construction that applied to spoken language (see Table 7.9). For example, a point used to direct the infant's attention to a new object was categorized as a gesture used in a *directive* context. A gesture used to emphasize an object in the infant's focus of attention was categorized as a gesture used in a *responsive* context.

It was further noted whether a gesture occurred in isolation or was paired with spoken language. Finally, when gestures did co-occur with speech, their use to emphasize, disambiguate, or add information that was not available in the verbal utterance was noted (see Table 7.11). These three coding options were derived from the work of Iverson and colleagues (Iverson, Capirci, Longobardi, & Caselli, 1999).

Table 7.11. Possible roles of gesture in gesture+speech combinations

Role of gesture	Example
Emphasize and reinforce speech	"Peas" + point to peas
Disambiguate speech	"Look!" + point to peas
Add information to speech	"Green and yummy!" + point to peas

Parent gestures were reduced to the total number of gestures and total number of different gestures produced. The number of gestures produced for directive, responsive, and other purposes were also calculated. The number of gesture+word combinations were

tabulated. Finally, the number of times that gestures were equivalent to, complementary with, or supplemental to the accompanying speech were calculated.

Infant language. Any words that infants produced were recorded. Very few spontaneous words were recorded given the young age of the infants. The total number of words produced was calculated for each child.

Infant gestures. Communicative deictic gestures were coded in accordance with conventions offered by Thal (2002). Gestures were considered communicative if they occurred in the presence of a vocalization or eye contact or other clear sign that the infant sought the attention of the parent. Four communicative deictic gestures were coded: *giving, pointing, showing, and requesting* (see Table 7.10 for behavioral definitions). Infant behaviors were then reduced to the total number of gestures produced and the number of different gestures produced.

7.3.d. Standardized measures

A standardized observation was also conducted. Standardized measures have well-established reliability and validity. In addition, the clear administration standards allow for meaningful comparisons across children.

7.3.d.i. Early Social-Communication Scales (ESCS)

The Early Social-Communication Scales (ESCS; Mundy, Delgado, & Hogan, 2003) were the fourth and final task administered in the present study. The ESCS are a set of standardized procedures that examine pragmatic aspects of the communicative and social-cognitive behaviors of children. During ESCS administration, the tester presented a variety of objects and tasks to the child in order to elicit social and communicative bids from the child. These tasks were designed specifically to elicit: (a) joint attention

behaviors, defined as nonverbal attempts to share the experience of objects or events with others; (b) behavioral requests, defined as nonverbal behaviors used by the infant to elicit aid in obtaining objects or events; and (c) social interaction behaviors, defined as playful, affectively positive turn-taking interactions with others.

The experimenter and parent sat at opposite sides of a table with the infant on the parent's lap. The table was positioned in the center of the room and a video camera was positioned behind the experimenter in order to capture a full-view face of the infant and a side-profile of the experimenter. Four posters were placed on the walls for the gaze-following task. The left and right targets were placed approximately 60° from the infant's midline on either side. The behind/left and behind/right targets were 150° from the infant's midline. Figure 7.3 provides an illustration of the room during ESCS administration.

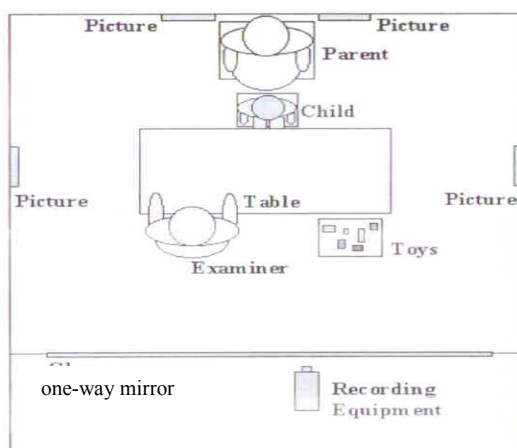


Figure 7.3. Room configuration during ESCS administration.

At the start of the session, the experimenter explained to the parent that she would present the infant with a variety of toys. She asked the parent to interact minimally with

the child during the task and to refrain from helping the child operate any of the toys. To initiate the ESCS, the experimenter looked at the infant, used a hand gesture to indicate the toys at her side, and asked, “What do you want to play with?” If the infant did not respond with a word or gesture, then the experimenter selected a toy, presented it to the child, and followed the administration guidelines for that toy. Nine tasks were presented during the course of the ESCS (see Appendix E). The experimenter followed a recommended order of tasks (see Appendix F), except in instances where a child communicated a preference or dislike for a particular toy or task. When all of the required tasks were complete, the experimenter let the parent know that the session was over.

Data reduction and analysis. Well-trained researchers viewed the recorded ESCS sessions and adhered to the coding conventions for classifying infant behaviors into one of three mutually exclusive major categories:

1. **Joint attention behaviors:** the infant used nonverbal behaviors to share the experience of objects or events with others
2. **Behavioral requests:** the infant used nonverbal behaviors to elicit aid in obtaining objects or events
3. **Social interaction behaviors:** the infant engaged in playful, affectively positive turn-taking interactions

Behaviors were further classified on the basis of whether they were child-initiated bids or responses to bids of the tester (see Table 7.12). Infants received a score for each of the six domains and these constitute the outcome variables of interest.

Table 7.12. Six major categories of infant behavior during the ESCS

Infant behavior	Behavioral definition
Initiating Joint Attention (IJA)	Child uses eye contact, pointing, and showing to initiate shared attention to objects or events
Responding to Joint Attention (RJA)	Child's skill in following the tester's line of regard and pointing gestures
Initiating Behavioral Requests (IBR)	Child's skill in using eye contact, reaching, giving, or pointing to elicit aid in obtaining an object or event
Responding to Behavioral Requests (RBR)	Child's skill in responding to the tester's gestural or verbal commands
Initiating Social Interaction (ISI)	Child's skill at initiating turn-taking sequences and the tendency to tease the tester
Responding to Social Interaction (RSI)	Frequency of eye contact, gestures, and turn-taking in response to interactions initiated by the tester

Inter-rater reliability estimates were obtained for 25% of the ESCS sample. The two coders had an inter-rater reliability of 97% for total behaviors coded within each category. Of the 13 children whose sessions were relied, the lowest agreement rate was 94% and the highest agreement was 99%.

CHAPTER 8

Study 1: Communicative Precursors of Language

8.1. Background information

There are many well-demonstrated and detrimental effects of poverty and low income on children's language and cognition by the preschool years and beyond. Since these income differences are not usually detected during the first 1 ½ years of life, some claim that being raised in a low-income home may be associated with early stability followed by developmental decline. It may be premature to conclude that children from different socioeconomic backgrounds develop similarly within these domains in the first year of life. Much of the existing literature summarizes developmental effects on vocabulary production. However, there is a very limited amount of spoken language available for investigation in the first year of life, which makes this a challenging domain to investigate for purposes of detecting individual or group differences at one year of age. It is therefore not surprising that most studies fail to detect an effect of poverty or low-income on the language of 12-month-old infants.

Even though there may be limited advantages to exploring vocabulary production at 12 months, it is well-documented that children are able to convey and comprehend communicative intent from an early age—well before they are able to produce their first words (see Chapter 4 for a review). Language comprehension and gesture use are thought to be the two dominant communicative devices during the first year of life. In fact, by about nine months, children communicate primarily through gestures, and these constitute the dominant form of expression for the next few months (e.g., Bates et al., 1988; 2001). Normative data available from the CDI suggest there is sufficient variability

in vocabulary comprehension and gesture use by 12 months of age to make these promising variables for investigations of infant communication (Fenson et al., 1993).

In spite of their established importance, very little is known about the emergence of these earliest communicative behaviors in children being raised in low-income environments. This is a particularly relevant question, since the emergence of these skills is tightly linked with the emergence of other skills in both linguistic and nonlinguistic domains.

8.2. The present study

The present study is designed to question whether the trend toward lower language abilities that has been associated with low-income children emerges at two or three years of age. I propose that the different trajectories develop gradually over time and emerge well before the first birthday. Vocabulary comprehension and gesture use of infants from low- and middle-income homes will be analyzed in order to determine whether there are meaningful differences in these robust precursors to language production. I hypothesize that parent report and behavioral tasks alike will reveal subtle differences in early comprehension vocabulary and communicative gesture use, with low-income infants understanding fewer words and producing fewer gestures and fewer different gestures. I hypothesize that neither parent report nor behavioral tasks will detect a difference in the number of words and number of different words that the infants produce.

8.3. Methods

Chapter 7 provides a comprehensive description of participants and the procedures employed in the present study. Information on infant's gesture use was gathered from the CDI, communication samples, and spontaneous naming task. Vocabulary comprehension

was measured via the looking-while-listening task and parent report on the CDI.

Vocabulary production was measured via communication samples, the spontaneous naming task, and the CDI. Complete data were available for all 50 infants on the CDI, spontaneous naming task, and communication samples. Only 34 of the infants contributed data from the looking-while-listening task, because 16 infants (9 L-SES and 7 M-SES) did not attend sufficiently to the stimuli and the data were not interpretable.

8.4. Results

Results are presented first for gestures, and then for vocabulary comprehension and vocabulary production. Descriptive information is provided for each and statistical tests (MANOVA, ANOVA, and independent-samples t-tests) were used to detect any effects of income group and maternal education.

8.4.a. Gestures

Two multivariate analyses of variance (MANOVA) were conducted to examine the effects of socioeconomic status on infant gesture use. One MANOVA investigated the influence of income group and maternal education on the number of different gestures used, and the second examined the influence of these factors on the total number of gestures used for communicative purposes.

8.4.a.i. Number of different gestures

A 2 (income: L-SES, M-SES) X 2 (education: no college degree, college degree) between-subjects MANOVA was performed on two dependent measures of infant gesture diversity (total gesture score on the CDI and the number of different representational gestures produced during the spontaneous labeling task). Using Wilk's criterion (Λ) as the omnibus test statistic, no multivariate effects reached statistical significance.

Furthermore, univariate effects were not significant (ps ranging from .22-.83), indicating that neither the income groups nor education groups differed significantly on any of the measures of gestural diversity (see Table 8.1). The number of different gestures produced by infants during communication samples are also provided for descriptive purposes. However, statistical analyses were not conducted due to floor effects and the fact that only four deictic gestures were measured, thereby limiting the range of variability associated with this variable.

Table 8.1. Number of different gestures produced by infants on three tasks

Demographic group	Number of different gestures		
	CDI ^a	Spontaneous labeling task ^b	Communication sample ^c
SES			
L-SES	28.0 (7.9) 11-46	3.9 (1.8) 0-7	1.2 (1.2) 0-4
M-SES	25.2 (9.9) 12-47	4.7 (1.7) 2-8	1.3 (1.3) 0-4
Maternal Education ^d			
Low	28.4 (7.9) 11-46	4.1 (1.7) 0-6	1.5 (1.4) 0-4
High	25.1 (9.6) 12-47	4.5 (1.9) 2-8	1.0 (1.1) 0-4

^aMaximum of 63 possible Total Gestures ^bMaximum of 10 possible representational gestures

^cMaximum of 4 possible deictic gestures ^dLow =no college degree; High= college degree or higher

8.4.a.ii.Total number of deictic gestures used for communicative purposes

The previous analysis examined the number of *different* gestures (i.e., types) used by the infants. Next, I examined the total number (i.e., tokens) of deictic gestures that infants used to communicate with the parent during the communication sample and experimenter during the spontaneous labeling task (see Table 8.2). A 2 X 2 between-subjects MANOVA was performed on two dependent measures of infant gesture use: total

number of deictic gestures used during the communication sample, and the total number of deictic gestures produced during the spontaneous labeling task. The variables were transformed using a square root transformation to normalize the distributions prior to running statistical analyses. Using Wilk's criterion (Λ) as the omnibus test statistic, the combined dependent variables resulted in a significant main effect for income [$F(2,45) = 4.2, p = .02$, partial $\eta^2 = .16$]. This main effect suggests that the M-SES infants produced significantly more deictic gestures for communicative purposes than did the L-SES infants. The main effect of education and the income*education interaction were not significant.

Table 8.2. Total number of deictic gestures produced by infants during two tasks

	Spontaneous labeling task	Communication sample
Group	Total gestures	Total gestures
SES		
L-SES	6.2 (7.5)* 0-28	3.7 (4.6) 0-18
M-SES	11.8 (8.5) 1-36	4.2 (4.6) 0-14
Maternal education		
Low	8.4 (8.7) 0-28	4.5 (4.9) 0-18
High	9.2 (8.2) 0-36	3.4 (4.3) 0-14

* $p < .02$

To probe the statistically significant multivariate effect, univariate 2 X 2 ANOVAs were conducted on each individual dependent variable. There was a significant main effect of income ($F[1,47] = 7.1, p = .01$, partial $\eta^2 = .13$) on the number of deictic gestures produced during the spontaneous labeling task, with more gestures produced by

M-SES ($M=11.8$) than L-SES ($M=6.2$) infants. The education main effect and income*education interaction were not significant. No effects were significant for the total number of deictic gestures produced with parents during the communication sample.

8.4.b. Vocabulary comprehension

Looking-while-listening task. The proportion of time spent looking at the correct target picture was used as the measure of accuracy on the looking-while-listening task. The L-SES infants looked at the target picture on 56% of the trials and the M-SES infants looked at the target picture on 55% of the trials. An independent samples t-test confirmed that the groups did not perform significantly differently from one another. Inspection of the 95% confidence intervals also showed that neither group performed above chance. Accordingly, no additional analyses were conducted on this variable.

CDI. The number of words endorsed by parents on the “understands” column of the CDI vocabulary checklist were calculated by income group and level of maternal education (see Table 8.3). A univariate ANOVA was conducted with income group and maternal education as independent variables and the number of words understood on the CDI as the dependent variable. The main effects of income and education and the income*education interaction were not significant.

Table 8.3. Number of different words understood on the CDI

Group	M (<i>SD</i>)	Range	CDI %
SES			
L-SES	95.8 (69.3)	6-245	50%
M-SES	80.4 (75.3)	8-299	41%
Maternal education ^a			
Low	105.7 (73.1)	21-255	54%
High	73.1 (68.3)	6-299	38%

8.4.c. Vocabulary production

Infant vocabulary production was measured on three tasks: spontaneous labeling task, communication sample, and the CDI (see Table 8.4). Given the extremely low number of words produced by the infants in both income groups on the spontaneous labeling task (L-SES $M=0.2$; M-SES $M=0.2$) and during the communication sample (L-SES $M=0.6$ words; M-SES $M=1.1$), statistical analyses were not conducted for these tasks. A univariate ANOVA was conducted with income group and level of maternal education as independent variables and number of words produced on the CDI as the dependent variable. This test confirmed that there were no main effects of income or education on the number of words produced on the CDI. The income*education interaction was also not significant.

Table 8.4. Number of different words produced by infants on three tasks

Group	Number of different words		
	CDI	Spontaneous labeling task	Communication sample
SES			
L-SES	9.5 (8.4) 0-28	0.2 (0.5) 0-2	0.6 (1.1) 0-5
M-SES	7.8 (10.1) 0-39	0.2 (0.5) 0-2	1.1 (2.1) 0-9
Maternal education ^a			
Low	8.9 (8.4) 1-28	0.2 (0.4) 0-1	0.9 (2.1) 0-9
High	8.4 (9.9) 0-39	0.2 (0.6) 0-2	0.7 (1.1) 0-4

8.5. Discussion

The literature reviewed in the earlier sections of this dissertation suggests that vocabulary comprehension and gesture use in the first year of life are strongly related to vocabulary

production in the second year of life (see Chapter 4 for a review). Given the noted differences that have been detected between low- and middle-income children within language and cognitive domains by the preschool years and beyond (see Chapter 2 for a review), the present study was designed to investigate whether similar effects of a low-income environment would be evidenced in the communicative precursors to vocabulary production. My first hypothesis was that the infants with low socioeconomic status would understand fewer words and would use fewer gestures and fewer different gestures—irrespective of the way in which these were measured. This hypothesis reflects the assumption that the differences that are observed in vocabulary production by the end of the second year of life emerge much earlier in development and manifest in more subtle communicative differences that are less amenable to direct investigation. The data did not support my hypothesis with respect to vocabulary comprehension. Furthermore, maternal education and income did not have an effect on the number of different gestures produced by children, although they did have an effect on the total number of deictic gestures used by the infants for communicative purposes. My second hypothesis was that income and maternal education would have no effect on vocabulary production, and this hypothesis was supported. The implications of these results are discussed in greater detail below.

Gestures

Gesture use was examined in three different ways, and all three sources of data converge on the finding that income and level of maternal education had no effect on the number of different gestures used by the infants. The infants were remarkably similar in the number of different representational gestures they demonstrated during the spontaneous labeling task, the number of different deictic gestures used during the communication sample, and

the total number of gestures endorsed by parents on the CDI. This suggests that the infants had the same gestures at their disposal that they could recruit for communicative purposes. However, the frequency with which the infants used these deictic gestures for communicative purposes was affected by income. Specifically, lower income was associated with infants using fewer gestures to initiate communication with the experimenter during the spontaneous labeling task. Therefore, although the infants may have had the same gestural resources, the infants from lower socioeconomic strata recruited these resources less often to achieve some communicative function.

Vocabulary comprehension

Vocabulary comprehension was measured via parent report on the CDI, and the results suggest that maternal education and income group did not have a significant effect on the number of words that the infants understood. In fact, the nonsignificant trend was toward higher scores for the infants whose mothers had a lower level of education—which is directly counter to my hypothesis. Other studies have reported higher parent reported vocabulary scores for 8-12 month-old infants whose mothers have low levels of income or education, leading some to question the accuracy of parent report (see Chapter 10 for a review and an empirical investigation of this issue). This issue notwithstanding, the data suggest that there was no effect of income or education on the number of words that the infants understood.

The findings based on parent report on the CDI were replicated with a behavioral task used to assess vocabulary comprehension. When maternal education and income group were used as predictors of vocabulary comprehension, there was no effect of these on infant accuracy during the looking-while-listening task. Instead, the infants looked

equally often at the target picture (L-SES=56%, M-SES=55%). The groups did not perform significantly differently from one another, but they also did not respond at better than chance levels. Because there were only two images for infants to look at during a given trial, infants, by chance, could have looked at the correct target 50% of the time. Inspection of the confidence intervals demonstrated that infant looking behaviors did not differ significantly from chance (L-SES, 56% accuracy with a 95% confidence interval of 48-60%; M-SES, 55% accuracy with a 95% confidence interval of 50-60%). Indeed, the literature demonstrates that 12 months may simply be too early to employ this paradigm. For example, one study that employed this paradigm with multiple age groups reported that “for the youngest (12-15 months)...there was little evidence of word recognition” (Zangl, Klarman, Thal, & Bates, 2005, p. 205). The notion is echoed by other veteran researchers (A. Fernald, personal communication, March 17, 2006; M. Friend, personal communication, May 1, 2006; Hultgren, Friend, Kashima, & Schaible, 2006). The looking-while-listening task was selected because it capitalizes on natural looking behaviors and requires no overt response from the infant. This paradigm has generated many studies that have allowed for a more complete understanding of the words and situations that infants and toddlers comprehend, often at ages when children are still not producing an abundance of spoken words (e.g., Fernald & Hurtado, 2006; Fernald, Perfors, & Marchman, 2006). However, my data suggest that the infants were simply too young or did not understand enough of the words and therefore did not produce useable data.

Vocabulary production

I hypothesized that there would be no effects of income or maternal education on the number of different words produced by the infants, due to floor effects and the enormous variability that characterizes this early developmental period. Vocabulary production was measured by parent report and during communication samples and the spontaneous labeling task. Scores obtained by parent report on the CDI were analyzed, and no effects of income or education were detected. Although the groups appeared to be remarkably similar to one another, the extremely low number of words produced by infants on the behavioral tasks made statistical analysis inappropriate. These findings support my second hypothesis and the prevailing view that there are no effects of income on vocabulary production until later in the second year of life (see Chapter 2 for a review).

Conclusion

In conclusion, I found no effect of income or maternal education on the number of different gestures used by infants or the number of different words that infants understood. These results run counter to my original hypothesis and suggest the possibility that there truly are no differences in these early communicative skills. I did, however, find that the infants from low-income homes used deictic gestures significantly less often to communicate. This finding suggests that the low-income infants may have the same number of gestures at their disposal, but recruit them significantly less often to communicate with adults. I will return to explore this finding in Chapter 12.

CHAPTER 9

Study 2: Social-cognitive Foundations for Language

9.1. Background information

A solid literature suggests that very early social-cognitive skills may serve as a foundation for the future development of language and cognition (see Chapter 5 for a review). Accordingly, the cognitive and social developments in the first year of life may both allow for and stimulate the continued development of language for communicative purposes. The ability to jointly attend to people, objects, or events and to understand the communicative intents of others is thought by some to be the “foundational social-cognitive skill underlying children’s comprehension of the symbolic dimensions of linguistic communication” (Tomasello, 2003, p. 31). In spite of the demonstrated importance of early joint attention behaviors, very little is known about any effects of income on the emergence or development of these behaviors in infants from different socioeconomic strata. This is a particularly relevant question, since the emergence of these skills is tightly linked with the emergence of other skills in both linguistic and nonlinguistic domains.

9.2. The present study

The present study explores the relation between socioeconomic status and infants’ joint attention and related social-cognitive behaviors measured during a standardized observation. I challenge the assumption that the poorer performance on language and cognitive measures that has been associated with low-income children “appears” at two or three years of age. Instead, the literature with middle-class children indicates that the trajectories develop gradually over time and emerge from a core set of foundational

behaviors that are established during the first year of life (e.g., Bates et al., 1988; Carpenter et al., 1998). I hypothesize that the group of infants from low-income homes will obtain lower scores on each of the measures of social-communication.

9.3. Methods

Chapter 7 provides a comprehensive description of participants and the procedures employed in the present study. All 50 infants participated in and completed the Early Social-Communication Scales (ESCS), and their behaviors were classified into one of three mutually exclusive major categories:

1. **Joint attention behaviors:** the infant used nonverbal behaviors to share the experience of objects or events with others
2. **Behavioral requests:** the infant used nonverbal behaviors to elicit aid in obtaining objects or events
3. **Social interaction behaviors:** the infant engaged in playful, affectively positive turn-taking interactions

Behaviors were further classified on the basis of whether they were child-initiated bids or responses to bids of the tester (see Table 9.1). Infants received a score for each of the six domains and these constitute the outcome variables of interest.

Table 9.1. Six major categories of infant behavior during the ESCS

Infant behavior	Behavioral definition
Initiating Joint Attention (IJA)	Child uses eye contact, pointing, and showing to initiate shared attention to objects or events
Responding to Joint Attention (RJA)	Child's skill in following the tester's line of regard and pointing gestures
Initiating Behavioral Requests (IBR)	Child's skill in using eye contact, reaching, giving, or pointing to elicit aid in obtaining an object or event
Responding to Behavioral Requests (RBR)	Child's skill in responding to the tester's gestural or verbal commands
Initiating Social Interaction (ISI)	Child's skill at initiating turn-taking sequences and the tendency to tease the tester
Responding to Social Interaction (RSI)	Frequency of eye contact, gestures, and turn-taking in response to interactions initiated by the tester

9.4. Results

Mean scores for each of the six subscales are presented by SES group and by level of maternal education (see Table 9.2). Three multivariate analyses of variance (MANOVA) were conducted to examine the influence of SES and maternal education on the development of early social-communicative skills. Each MANOVA addressed one of the three categories of behavior elicited during the ESCS observation.

Table 9.2 ESCS subscores by SES and maternal education

	SES		Maternal education ^a	
	L-SES	M-SES	Low Ed	High Ed
IJA	19.2 (9.5) 7-51	20.39 (8.2) 8-34	20.3 (9.6) 7-51	19.2 (8.3) 8-34
RJA	45.6 (32.3) 0-100	40.4 (31.5) 0-100	50.7 (33.0) 0-100	36.3 (29.4) 0-100
IBR	26.5 (12.9) 7-52	28.0 (9.9) 8-42	29.4 (12.2) 7-52	25.2 (10.6) 8-42
RBR	47.22 (22.6) 6-100	48.0 (26.4) 0-86	49.5 (23.1) 0-100	48.9 (25.4) 6-86
ISI	1.6 (2.3) 0-11	1.0 (1.2) 0-5	1.5 (2.4) 0-11	1.2 (1.1) 0-5
RSI	17.0 (6.4) 6-31	18.2 (6.3) 8-29	17.7 (6.2) 6-31	17.4 (6.5) 6-29

^a Low education=no college degree; High= college degree or higher

9.4.a. Joint Attention

A 2 (income: L-SES, M-SES) X 2 (education: no college degree, college degree)

between-subjects MANOVA was performed on two dependent variables: number of instances in which an infant initiated joint attention, and number of instances in which an infant responded to the experimenter's bid for joint attention. These variables were transformed using square root and arcsine transformations, respectively, to normalize distributions prior to running statistical analyses. Using Wilk's criterion (Λ) as the omnibus test statistic, no multivariate effects approached or reached statistical significance. Furthermore, no univariate effects were significant for either dependent variable (ps ranging from .25-.68).

9.4.b. Behavioral Requests

A 2 X 2 between-subjects MANOVA was performed on two dependent variables: number of instances in which an infant made behavioral requests, and number of instances in which an infant responded to experimenter behavioral requests. These

variables were transformed using square root and arcsine transformations, respectively, to normalize distributions prior to running statistical analyses. Using Wilk's criterion (Λ) as the omnibus test statistic, no multivariate effects reached significance. Univariate effects were not significant for either dependent variable (ps ranging from .07-.96).

9.4.c. Social Interaction

A 2 X 2 between-subjects MANOVA was performed on two dependent variables: number of instances in which an infant initiated social interaction, and number of instances in which an infant responded to experimenter bids for social interaction. Each variable was transformed using a square root transformation to normalize distributions prior to running statistical analyses. Using Wilk's criterion (Λ) as the omnibus test statistic, no multivariate effects reached statistical significance. Furthermore, no univariate effects were significant for either dependent variable (ps ranging from .11-.67).

9.4.d. Cross-study comparison

The ESCS, being a relatively new instrument, does not have published norms. However, the authors do have preliminary data from 12-month-old infants that afford the opportunity for cross-study comparisons (P. Mundy, personal communication, March 22, 2006). Independent-samples t -tests were conducted to determine how the combined sample in the current study compared to another group of typically-developing infants of the same age. Results indicated that the infants in the current study did not differ from the comparison sample on the subscales of Initiating Joint Attention, Responding to Joint Attention, and Initiating Behavioral Requests. However, the infants in the current study did score significantly lower on the Responding to Behavioral Requests subscale and

significantly higher on the Responding to Social Interaction subscale. (Comparative data were not available for the category of Initiating Social Interaction.)

Table 9.3. ESCS cross-study comparison

	Present study N=50	Mundy, in press N=63
	M (<i>SD</i>)	M (<i>SD</i>)
IJA	19.7 (8.9)	19.2 (10.7)
RJA	43.2 (31.7)	51.7 (23.1)
IBR	27.2 (11.5)	29.6 (12.9)
RBR	47.6 (24.1)*	66.3 (26.7)
RSI	17.5 (6.3)*	8.0 (5.2)

9.5. Discussion

The literature reviewed for middle-class infants in the earlier sections of this dissertation suggests that there are solid links between early social-cognitive skills (particularly joint attention) and later language outcomes. I undertook the present study in order to determine whether a standardized observation would reveal similar income differences in some of the early social-cognitive behaviors that may serve as a foundation for later language. In light of the literature that suggests lower language skills for low-income infants by as early as 24 months, I hypothesized that the infants from low-income homes would obtain lower scores on a task designed to measure earlier-emerging and related social-cognitive behaviors. My hypothesis was not supported by the data. The low- and middle-income infants performed equivalently to one another on each of the six ESCS subscales, suggesting equal tendencies to initiate and respond to joint attention, social interactions, and behavioral requests. The task that I selected to measure early social-cognitive behaviors clearly did not detect any effects of income or maternal

education. There are two logical explanations for this. The first is that the ESCS did not adequately tap into the intricate social-cognitive differences that do exist, and the second is that the ESCS provided a realistic reflection of the equivalent skills across income groups. I consider each possibility in turn below.

It is possible that the ESCS did not detect social-cognitive differences that actually existed between the two income groups. The ESCS was selected for this study because it measures the social-cognitive variables of interest and is designed for use with infants as young as eight months of age. However, the ESCS provides only a brief snapshot of infant behavior in a highly constrained context. Because the ESCS is a standardized observation, all of the infants had equal opportunities for interaction with the tester. Accordingly, the null results for any group differences indicate that the infants, when presented with equal opportunities for interaction, did not behave differently from one another. The literature suggests, though, that the opportunities for these types of social and communicative interactions may be less likely in the everyday environments of infants being raised in low-income homes (see Chapter 3 for a review). It is therefore possible that the low-income infants possessed the same social-cognitive *abilities*, but they may have significantly fewer *opportunities* to employ them in their daily lives due to reduced interactions with their primary caregivers. The current data do not allow me to speak to this issue, but the possibility warrants further investigation. Testing this possibility could be achieved through naturalistic observations of infants during daily activities with a primary caregiver, ideally across multiple visits at multiple ages. This information, if gathered in conjunction with standardized observation like the ESCS,

could provide valuable new information about the early social-communicative behaviors of infants from low- and middle-income homes.

A second possible explanation for equivalent infant performance is that the ESCS scores accurately reflected equivalent skills of the low- and middle-income infants. Twelve months may simply be too early to detect any meaningful group differences. If this is the case, then it affirms the need for additional investigation into the age range of 12-24 months. Since differences in language and cognition are typically first witnessed by 24 months or older, it is necessary to look at increasingly younger ages in order to achieve a better understanding of exactly when differences can first be detected, and which domains may be most susceptible to early effects of income. The explanation that differences did not exist runs counter to my original hypothesis but is a valid possibility that is supported by the data and will be discussed in greater detail in Chapter 12.

Although my hypothesis that the low-income infants would achieve lower scores on the six ESCS subscales was not supported, the data certainly provide important descriptive information about very early development. My data also afforded the opportunity for a cross-study comparison. The infants in the present study performed similarly on three of the subscales (Initiating Joint Attention, Responding to Joint Attention, and Initiating Behavioral Requests) when compared to a group of same-aged infants that participated in a separate research study (see Table 9.3). The infants in the current study scored significantly lower than the comparison group on the Responding to Behavioral Requests subscale and significantly higher on the Responding to Social Interaction subscale. Because there are no associated norms for the ESCS, it is impossible to determine whether one sample or the other obtained scores that are more consistent

with expectations. Differences in the testing situation may have played a role in the observed differences between studies. The ESCS was the final task administered in the current study, so the infants had spent at least an hour with the tester prior to the initiation of the ESCS. Familiarity with the environment and the tester may have contributed to their readiness to interact and respond to social initiations. It is also possible that I, as the ESCS tester, was not as authoritative in my delivery of Behavioral Requests, thereby reducing the likelihood that infants would respond. Indeed, a more assertive delivery of behavioral requests was the only suggestion that was made by a highly-trained researcher who provided feedback for training purposes. In short, though, the inconsistent directionality of differences (i.e., the present sample is higher on one measure and lower on another) minimizes the likelihood that income or education effects were the source of the noted differences between my sample and the comparison sample.

The present study is the only known study that has employed the ESCS with infants from low-income homes. The data will accordingly be made available to the authors of the ESCS so that they may, should they wish, include data from these children at the lower end of the socioeconomic distribution when they compile the norms.

CHAPTER 10

Study 3: Parent Report on the CDI: Does Low-Income Imply Low Accuracy?

10.1 Background information

Parent report is generally accepted as a viable and valuable method for obtaining information about child language. Numerous studies have confirmed the ability of parents to provide accurate reports of comprehension and production of single words during the first 2 ½ years when assessment is limited to current or emergent behaviors and when a recognition format is used (e.g., Bates, Bretherton, & Snyder, 1988; Ring & Fenson, 2000; Dale, 1991; Heilman, Ellis Weismer, Evans, & Hollar, 2005; Marchman & Martinez-Sussman, 2002; Rescorla, 1989; Camaioni, Caselli, Lonobardi, & Volterra, 1991; Dale, Bates, Reznick, & Morissett, 1989; Rescorla & Alley, 2001). However, participants in such studies have generally tended to come from middle-class homes, and it would be premature to generalize findings to populations that differ significantly from these samples. The present study was designed to determine whether socioeconomic status (SES) has a significant impact on parents' ability to provide accurate information about their infants' early communicative skills. Specifically, can parents with low income and/or education be relied upon to provide meaningful information about infant communication?

The MacArthur-Bates Communicative Development Inventories (CDI's; Fenson et al., 1993) are a widely-used parent report forms for measuring communication in young children. The CDI's employ a recognition format for gathering information on vocabulary and other indices of early language. Results from research with the CDI's that

included parents with low-income and/or low education have been inconsistent and, at times, seemingly conflicting. Given the important role that parent report has played in early screening for language delays and because there are so many clinical and research applications that rely on information provided by parents on checklists, the question of whether this subgroup provides valid information about child language is an issue of critical importance.

10.1.a. Potential over-report of vocabulary by low-SES parents

In the original CDI norming study, Fenson and colleagues (1993) used maternal education as a marker for SES. They reported an unexpected inverse relationship between maternal education and reports of vocabulary comprehension for 8-12 month-old children but not for 13-16 month-old children. Specifically, mothers with only a high school education reported higher scores for their children's comprehension vocabulary in the first year of life than did mothers with more extensive schooling. The authors cast some doubt on the validity of these higher comprehension vocabulary scores when they caution that "certain applications carry higher risk of inaccuracy than others" (p. 22). A similar pattern was reported by a team of researchers who found that lower parent education and income were associated with higher comprehension and production vocabulary on the CDI for 10-13 month-old children (Feldman, Dollaghan, Campbell, Kurs-Lasky, Janosky, & Paradise, 2000). Feldman and colleagues concluded that parents with low education and income "may be susceptible to differential reporting biases [that lead them to] overestimate their child's abilities in comparisons with parents with more education and income" (p. 319). Although this is a plausible interpretation, there is no direct evidence for this claim. Parent report was the only measure obtained in the Fenson et al. (1993)

and Feldman et al. (2000) studies, so it is impossible to make comparisons between parent report and other measures of child language, a necessary step to determine whether SES might have impacted parent accuracy on the language checklist. An alternative and equally plausible possibility is that parent report accurately reflected the variability that existed in these particular groups of children. This is certainly possible given that some studies have reported average to above-average scores for low-income children at these very early ages (e.g., Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997).

10.1.b. Potential under-report of vocabulary by low-SES parents

Arriaga and colleagues (Arriaga, Fenson, Cronan, & Pethick, 1998) compared CDI scores of children from very low-income homes to scores of more privileged children and found that low-income children in the 16-30 month range performed “strikingly lower” (p. 219) than the middle-to-upper-class children on the major feature of vocabulary production.

The authors acknowledge that the lower scores might accurately reflect lower vocabulary of 16-30 month-old children from low-SES homes. This is a reasonable possibility, given the well-documented negative effects of poverty on language development with increased age (e.g., Fish & Pinkerman, 2003; Hart & Risley, 1995). However, Arriaga and colleagues also propose a “parental misjudgment hypothesis” and suggest that “lower income parents might underestimate their children’s verbal abilities, perhaps because they are less verbally interactive with them” (p. 220). The authors reiterate the caution that the CDI norms may not be directly applicable to children from low-education/low-income families. Ultimately, though, without additional information with which to compare parent report, it is impossible to determine how accurately the parents in this study responded on the language checklist.

Roberts and colleagues (Roberts, Burchinal, & Durham, 1999) conducted a longitudinal study in which low-income African-American children were assessed via a short-form version of the CDI at 18, 24, and 30 months of age. A battery of tests was also administered at each age including the Sequenced Inventory of Communication Development-Revised (SICD-R; Hedrick, Prather, & Tobin, 1984). CDI scores at 18, 24, and 30 months were compared with the expressive communication age (ECA) on the SICD-R at 12, 24, and 36 months. Using SICD-R scores as a standard of comparison, 25% of parents were found to under-report productive vocabulary on the CDI at 18 months, 40% did so at 24 months, and 39% did at 30 months. The authors draw the conclusion that low-income parents have a tendency to under-report vocabulary at 18, 24, and 30 months of age, and because of this potential for a systematic bias, CDI percentile scores should be “used cautiously” with African-American children from low-income homes (Roberts, Burchinal, & Durham, 1999; p. 101).

There are a number of limitations to the Roberts et al. study that are important for its interpretation. First, the study relied on comparisons between CDI productive vocabulary scores and scores on the expressive subscale of the SICD-R. This expressive scale contains only three questions (of approximately 100 questions on the entire subscale) that pertain to productive vocabulary. Children are asked, “What’s that?” when shown pictures of three very early-appearing words (baby, shoe, and ball). The remaining questions and tasks on the expressive subscale of the SICD-R are quite varied, include examination of non-speech sounds and imitation of motor acts, and are designed to tap into phonologic, pragmatic, syntactic, and semantic aspects of language. Approximately 25% of the total questions on the SICD-R (depending on a child’s base or ceiling on the

test) are obtained by parent report. It is problematic to use a measure that relies heavily on parent report and then compare this to parent report on the CDI and make the claim that parents are under-reporting on one or the other. Furthermore, since a separate group of middle-class children were not included for comparison in the study, it is impossible to determine whether this degree of “under-reporting” is unique to low-income parents or whether the same standards of comparison would result in similar under-report on the CDI by middle-class parents. The CDI and SICD-R were not obtained at the same ages and so SICD-R scores were in some cases compared to CDI scores obtained six months earlier or later.

In light of the methodological issues in the Roberts et al. (1999) study, the conclusion that “some parents may be under-reporting their children’s early vocabulary,” (p. 92) warrants closer examination. It should be noted that mean CDI scores for the predominately low-income sample hovered closely around the CDI median at 18 months (53rd percentile) and at 24 months (45th percentile). It was only at the older age of 30 months that the low-income group scored considerably below the CDI’s 50th percentile (scoring at the 27th percentile). The premise is that parents were under-reporting the children’s vocabulary at 18 and 24 months, yet the children still scored squarely near the CDI median at these ages. If parents reported “more accurately” (i.e., did not under-report), then the implication is that these low-income children should have scored significantly above the CDI median (based on norms from a primarily middle-class sample) for productive vocabulary at 18 and 24 months.

Excepting the Roberts et al. study described above, only one other known study has compared CDI scores from low-income parents with other measures of child

vocabulary. Pan and colleagues (Pan, Rowe, Spier, & Tamis-LeMonda, 2004) gathered parent report on a short-form version of the CDI from 105 low-income parents. CDI scores were compared with concurrent spontaneous speech measures and standardized language assessments, and modest but significant correlations between each of the measures at 24 months were reported. The authors report that the total number of words produced on the CDI correlated modestly ($r = .49$) with the number of words produced during a 10-minute interaction with a parent. While this correlation is statistically significant, it is certainly lower than the strong and significant correlation ($r = .83$) reported between the same measures in a middle- to upper-middle class group of Caucasian 20-month-old children (Bates, Bretherton, & Snyder, 1988).

Vocabulary production scores on the CDI in the Pan et al. study were also found to be significantly correlated ($r = .54$) with a subset of language-related items on the Bayley Scales of Infant Development (Bayley, 1993) and with the Peabody Picture Vocabulary Test (PPVT; $r = .50$), a measure of single-word vocabulary comprehension. Approximately half of the low-income respondents in the study were Caucasian mothers from rural neighborhoods, and the other half were minority mothers from urban neighborhoods. Significantly lower CDI scores were associated with the minority children, and Pan and colleagues suggest cautious interpretation of CDI scores contributed by low-income African-American and Hispanic urban mothers. They go on to speculate that this subgroup may under-report vocabulary production, while at the same time acknowledging the alternative interpretation that low-income Caucasian mothers may over-report vocabulary production. It should be noted that 41% of the urban children lived in bilingual households, creating a potentially serious confound, considering the

unique profiles associated with early bilingualism. In addition, a parent whose infant is exposed to multiple languages is faced with a more challenging task when asked to report on words known in only *one* of those languages. Furthermore, if the parent respondent primarily employed a language other than English in daily living, then this could also have impacted the parent's ability to respond accurately on an English version of the CDI. Ultimately, Pan and colleagues reiterate the same reservations expressed by many other researchers about the ability of low-income parents to provide meaningful information on a parent report checklist measuring early communication. However, the methodological confounds discussed here and the lack of behavioral evidence to support claims of under-report suggest that further investigation is required before drawing conclusions about the accuracy of low-income minority parents.

10.1.c. Parent report of gestures

In addition to the obvious import of spoken words, gestures also play a fundamental communicative role for infants and toddlers (e.g., Bates, Thal, Whitesell, Fenson, & Oakes, 1989; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Iverson, Capirci, & Casselli, 1994). In fact, gesture production may be a reliable early predictor of persistent language delay (Thal & Tobias, 1992). Given the established importance of early gestures, indices measuring communicative and symbolic gestures are also included on the CDI: Words & Gestures. However, little is known about the relation between parent report of gestures and children's use of gestures. This is an important practical question, since parent report provides a cost- and time-efficient method for assessing communicative development in young children. Given the importance of early gestures

and the established utility of parent report, the relation between parent report and children's use of gestures warrants closer examination.

Rodrigue and colleagues (Rodrigue, Sizemore, & Thal, 2004) designed a study to determine whether parent report on the CDI would capture the same gesture trends witnessed in toddlers in a laboratory setting. Parents completed the CDI at 16 months, and children were observed at the same age during 20 minutes of play with a parent and experimenter. Children's gestures were transcribed and coded from a videotape and then compared to parent report of the same gestures. Results indicated that the total gestures reported by parents on the CDI and number of different gestures produced by children during communication samples were moderately and significantly correlated ($r=.47$, $p<.01$), indicating a substantial relationship. The results suggest that parent report on the gesture index of the CDI can provide a meaningful measure of gesture production at this age. However, this study examined an age when spoken language often begins to eclipse gesture use, and it is important to examine parent report of gesture at even younger ages. Furthermore, the participants represented a very limited range of socioeconomic and ethnic backgrounds, and similar investigations with low-income participants are warranted.

10.2. The present study

The data available at present suggest that the relation between SES and parent report is anything but straightforward or well understood. Effects of SES on vocabulary scores obtained by parent report seem to vary--depending upon the ages of children and whether comprehension or production vocabulary is measured. Furthermore, the lack of any direct comparisons between infant performance on behavioral tasks and parent report seriously

limits most current claims for under-report or over-report altogether. In addition, there are no published studies that evaluate the relation between parent report on the gesture index of the CDI with other measures of infants' use of gestures.

The question driving this research is a basic one—do low-income parents tell us something meaningful, real, and accurate when they complete checklists pertaining to infant communication? More specifically, do these parents provide an accurate representation of the words their infants understand and the gestures their infants use? Determining the answer to our question requires a direct examination of parent report and infant performance, ideally on behavioral measures of *those same items*. Researchers (Ring & Fenson, 2000) have reported a strong correlation between parent judgment on the CDI and child performance on tasks designed to measure knowledge of those same words for a population of primarily middle-class participants. The present study employed a similar method with low-income and middle-income parents by obtaining parent report on a vocabulary checklist and then assessing infant performance on tasks designed to measure comprehension of those same words. In addition, scores on the gesture index of the CDI were compared with children's use of gestures in an elicited context.

The infants in the present study were twelve-month-olds, and earlier work with 8-12 month-old infants (Fenson et al., 1993) and 10-13 month-old infants (Feldman et al., 2000) suggests that parents may over-report vocabulary comprehension at this age. However, given the lack of behavioral evidence to support the claims of over-report, I hypothesize that low-income parents will prove to be reliable reporters of gestures and comprehension vocabulary.

10.3. Methods

Chapter 7 provides a comprehensive description of participants and the procedures employed in the present study. All 50 mothers completed the CDI: Words & Gestures, and all of the infants participated in the spontaneous labeling task. Only 34 of the infants contributed data from the looking-while-listening task, because 16 infants (9 L-SES and 7 M-SES) did not attend sufficiently to the stimuli and the data were not interpretable.

10.4. Results

Results are organized around three sets of findings. Parent report of comprehension vocabulary and gestures on the CDI: Words & Gestures inventory are presented first. Next, data are presented for infant performance on the behavioral tasks measuring vocabulary comprehension and gesture production. Third, data that relate parent report to infant performance are presented, and these data speak directly to the question of accuracy of parent report.

10.4.a. Parent report of vocabulary comprehension and gesture use

CDI scores for vocabulary comprehension and gesture use are presented in Table 10.1. A 2 (income: low, mid) X 2 (education: low, high) between-subjects MANOVA was performed with the number of different words understood and number of gestures on the CDI serving as dependent variables. Using Wilk's criterion (Λ) as the omnibus test statistic, the combined dependent variables did not result in significant main effects of income or education. The income*education interaction was also not significant, so no post-hoc analyses were conducted.

Regression analyses were also conducted with SES and level of maternal education entered as predictors. The combination of SES and level of maternal education

accounted for a nonsignificant 6% of the variance in vocabulary comprehension scores and a nonsignificant 4% of the variance in gesture scores.

Table 10.1. CDI comprehension vocabulary and gesture scores

Demographic	Comprehension Range	CDI percentile	M (<i>SD</i>)	Gestures Range	CDI percentile	
	M (<i>SD</i>)					
SES						
L-SES	95.8 (69.3)	6-245	50%	28.0 (7.9)	11-46	58%
M-SES	80.4 (75.3)	8-299	41%	25.2 (9.9)	12-47	46%
Maternal education ^a						
Low	105.7 (73.1)	21-255	54%	28.4 (7.9)	11-46	59%
High	73.1 (68.3)	6-299	38%	25.1 (9.6)	12-47	46%

^a Low education=no college degree; High= college degree or more.

10.4.b. Behavioral task: vocabulary comprehension

The proportion of time spent looking at the target picture was used as the measure of accuracy on the looking-while-listening task. The L-SES infants looked at the target picture on 56% of trials and the M-SES infants looked at the target picture on 55% of trials. These groups did not perform significantly different from one another, and inspection of the 95% confidence intervals shows that they also did not perform better than chance. These results are discussed in greater detail in Chapter 8.

10.4.c. Behavioral task: gesture use

The total number of representational gestures that infants produced when presented with the ten objects during the spontaneous labeling task are reported in Table 10.2 below. A univariate 2 (income: low, mid) X 2 (education: low, high) between-subjects ANOVA was performed with the number of representational gestures serving as the dependent variable. There were no significant main effects of income or education. The

income*education interaction was also not significant, so no post-hoc analyses were conducted.

Table 10.2. Number of representational gestures produced by infants on the spontaneous labeling task

Demographic group	M ^a (<i>SD</i>)	Range
SES		
L-SES	3.9 (<i>1.8</i>)	0-7
M-SES	4.7 (<i>1.7</i>)	2-8
Maternal Education		
Low	4.1 (<i>1.7</i>)	0-6
High	4.5 (<i>1.9</i>)	2-8

^aMaximum of 10 possible

10.4.d. Accuracy of parent report: vocabulary comprehension

Infant performance on the looking-while-listening task was included as a behavioral measure with which to compare parent report of vocabulary comprehension. Because the infants performed at-chance, it is not appropriate to use these scores to validate parent report.

10.4.e. Accuracy of parent report: gestures

There were 10 items represented in the spontaneous labeling task and the same 10 items are sampled on the gesture indices of the CDI. Accordingly, parent responses for the subset of 10 items were compared with the gestures used by infants during the task. Parent report scores for those 10 representational gestures and the total number of representational gestures produced by infants in the spontaneous labeling task were not significantly correlated ($r=.17$, ns) in L-SES or M-SES ($r=.38$, ns; see Figure 10.1).

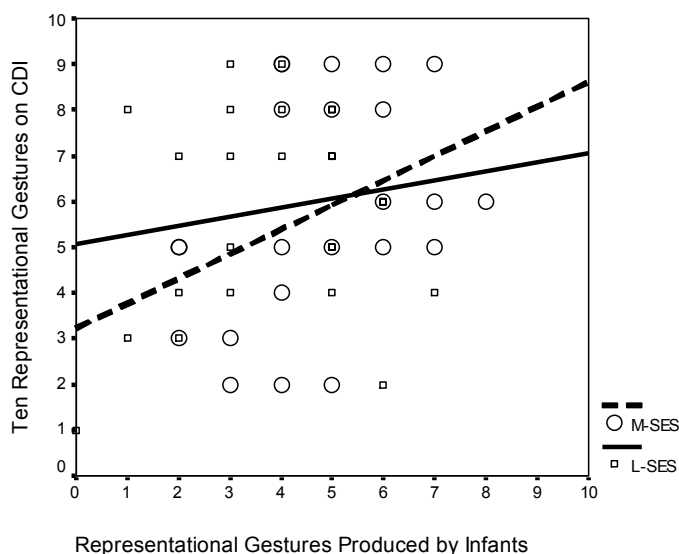


Figure 10.1. Representational gestures by infants and by parent report.

I then explored the one-to-one relation between parent report of a specific representational gesture and infants' use (or nonuse) of that same gesture during the behavioral task. First, there were instances in which parent report and infant performance on the behavioral task were in agreement (e.g., parent responded "yes" to "puts telephone to ear" on CDI and the infant demonstrated this gesture with the phone during the spontaneous labeling task). This agreement category also included instances in which parents reported their infant did not use a gesture and the infant did not produce that gesture during the task. Second, there were instances in which parents "over-reported" by saying their child produced a gesture that the infant did not produce in the laboratory setting. Third were instances in which a parent reported that their infant did not produce a gesture but the infant *did* produce the gesture during the behavioral task (i.e., parents "under-reported"). The proportions of each of these response patterns are summarized in Table 10.3 by SES group. A z-test of proportion scores confirmed that there was not a

significant difference in the likelihood of L-SES and M-SES parents to over-report their infants' use of the 10 representational gestures. The two groups of parents were also equally likely to under-report infant gesture use, with L-SES under-reporting in 11% of trials and M-SES under-reporting in 13% of trials.

Table 10.3. Mother-infant dyad response patterns for representational gestures

Group	Dyad in "Agreement"	Parent "Over-Report"	Parent "Under-Report"
L-SES	.60	.29	.11
M-SES	.64	.23	.13

10.5. Discussion

Several studies of low-income families (e.g., Arriaga et al., 1998; Feldman et al., 2000; Fenson et al., 1993) have detected higher parent-based vocabulary scores in the first year of life and/or lower vocabulary scores in the second and third years—leading many to wonder whether low-income parents accurately report on their young children's vocabulary when language checklists are used. However, since these studies did not include measures of child performance, conclusions about how accurate or inaccurate parents might have been in their assessments of their child's vocabulary knowledge were speculative. The lack of any direct comparisons between child performance on behavioral tasks and parent report seriously limits most current claims for inaccurate reporting by parents with low-SES and provided the impetus for the current research.

Vocabulary comprehension

The present study included behavioral measures to provide assessments of infants' vocabulary comprehension and gesture use that were independent of parent report. Unfortunately, the behavioral task that was selected to measure vocabulary

comprehension did not yield interpretable data. The infants performed at chance, thereby eliminating the possibility of using this measure as a validation of parent report. (The issues surrounding the utility of the looking-while-listening paradigm are discussed in greater detail in Chapter 8.) Our data suggest that the infants as a group truly did not know the words included on the looking-while-listening task *or* that they did not understand how to “play the looking game.” The infants looked indiscriminately at the pictures and their looking behavior was not affected by the verbal component of the task. Furthermore, there was no difference in the amount of time that the low-income (M=56%) and middle-income (M=55%) infants looked at the correct target pictures.

Innovative techniques should be explored in order to discover new ways of tapping into and measuring vocabulary comprehension in infants. For example, researchers could include a training component for the looking-while-listening task to determine whether infants can readily learn how to “play the looking game” if they are given response-specific feedback on initial trials. Interactive social games could also provide an avenue for assessing vocabulary comprehension, perhaps by using a familiar structure (e.g., peek-a-boo game) as a framework for assessing vocabulary comprehension. Natural observations of infant behavior during play with objects may also provide meaningful information about representational use of gestures. Other on-line techniques that indirectly measure neural processes and brain activity, including event-related potential (ERP) studies, may also yield valuable new information. For now, though, my data do not allow me to directly speak to the issue of how accurate the parents with low-income and low-education were in their reports of vocabulary comprehension on the CDI.

It is, however, of interest that the vocabulary comprehension scores reported by parents on the CDI were not significantly different in the two income groups. This result is counter to the results of other researchers (e.g., Fenson et al., 1993; Feldman et al., 2000) who have found higher vocabulary scores at this age to be associated with low levels of income and maternal education. I found no effect of income or education on the parent-derived vocabulary comprehension scores, although there was a trend in the direction reported by earlier studies (e.g., mothers without a college degree reported 105 words for their infants and mothers with a college degree reported 73 words for their infants). Ultimately, my results indicated no effect of income or education on the comprehension vocabulary scores of the 12-month-old infants.

Gestures

There are no known published reports that evaluate accuracy of parent report for gestures. I found that the two groups of infants were equivalent on scores derived from the parent-completed checklist *and* the behavioral task measuring gesture use. Hence, not only did the parents of the two groups (on average) rate their infants equivalently, the two groups of infants also responded equivalently on the behavioral task. Through item-level analyses, it was possible to determine the extent of parent and infant agreement on measures of gesture use. Parents in the two income groups were equally accurate reporters of their infants' gestures, evidenced by agreement between parent report and infant performance on 60% of trials in the low-income group, and 64% of trials in the middle-income group. Parents in the two income groups were equally likely to overestimate representational gestures. There was also no effect of income on mothers' tendency to under-report gestures. The similarities across income groups speak clearly to

the question of whether low-income parents of 12-month-old infants can report reliably on the gestures they know and use.

Conclusions

In spite of prior speculation that parents of children in this age range might tend to over-report *vocabulary*, the published reservations about using parent report with low-income parents have not been restricted only to the vocabulary indices. Since no research had been conducted to explore parent report of gestures, it was not possible to differentiate between the vocabulary and gesture indices. However, I found no evidence of over-report of gesture use by the parents with low income and/or education. This finding lends credence to the gesture scores obtained by parent report in Study 1. The equivalent findings for accuracy of parent report in low-income and middle-income samples are also quite encouraging for clinical and research purposes. Gestures serve a critical communicative role in the first year of life, and they have even been shown to play a valuable role in predicting later vocabulary production. It is therefore valuable to learn that parents may provide meaningful reports of the representational gestures their infant's use, since parent report plays an increasingly large role in research and assessments of infant communication.

The findings of numerous studies suggest caution in using the CDI's and other forms of parent report with low-income samples for two main reasons. The first is that children from low income/low education families are under-represented in the normative CDI sample (Fenson et al, 1993). This concern is of relevance only when users are interested in deriving percentile scores from the raw scores. The use of raw scores per se is unaffected by the upward skew in the normative data set. A second, more serious

concern pertains to parent accuracy. Because higher vocabulary scores have been obtained in low-income samples for children in the 8 to 13 month age range (Fenson et al., 1993, Feldman et al., 2000), some believe that parents in this bracket are prone to over-reporting, as there is little basis for expecting especially high scores for children being raised in low-income homes. In contrast, for children around 2 years of age, several studies have reported lower to dramatically lower CDI scores in low-income samples. Because these findings are generally in line with expectations about the increasingly negative developmental effects of poverty, the lower scores have generally been accepted as valid indices of children's skills (as opposed to being attributed to parent under-reporting). The present findings conflict with the profile of low-income children and parents depicted by these studies. We found equivalent performance by low- and middle-income infants and equally accurate reports of gestures by their parents.

There are a host of factors (e.g., shyness, anxiety, fatigue) that may affect young children's performance on behavioral tasks with an unfamiliar experimenter. Children may also be presented with a specific exemplar in a task that does not fit with their conception of a word. Accordingly, caution is required when drawing conclusions about how "accurate" parents are in their reports when children's behavioral data provides the data for comparison. In each of these instances, though, the expectation would be that children's performance would provide an under-representative estimate of vocabulary size.

The parents in the present sample may also have differed meaningfully from parents who did not elect to participate in the research, perhaps reflecting a greater orientation toward learning more about their children's early development. Furthermore,

the parents that participated in my study had the time to participate and transportation or some means of getting to the research laboratory. The characteristics of the parents who were interested and able to participate may weight the low-income sample toward characteristics associated with a middle-class orientation

These results should engender cautious optimism about the ability of low-income parents to complete a parent report form accurately, although the findings are not necessarily generalizeable beyond the gesture index of the CDI or to low-income parents in general. The lack of interpretable data from the looking-while-listening task at 12 months prevented any validation of the CDI for vocabulary comprehension. I therefore propose the need for a follow-up study with these infants when they are 24 months of age. The looking-while-listening paradigm is well-suited for measuring vocabulary comprehension by two years (e.g., Zangl et al., 2005), but there are no known studies that have employed this task with infants from low-income homes. A study of this nature would be particularly useful for assessing the predictive validity of CDI scores at 12 months for language outcomes at 24 months. Further investigations are urgently needed because the role of parent report is expanding, but skepticism still exists about the accuracy of information obtained from parents with low levels of income or education.

CHAPTER 11

Study 4: Words and Gestures Used by Low- and Middle-Income Mothers

11.1. Background information

Research that explores the relation between parent characteristics and child language development is motivated by the notion that children learn language in a highly interactive social context (Vygotsky, 1962). Various properties of maternal speech constitute the variables most frequently used to measure the social context in which infants first learn to communicate. Certain aspects of maternal speech, especially social-pragmatic, didactic, and affective characteristics, are shown to be strongly related to the communicative skills of young children (e.g., Wallace, Lodder, & Roberts, 1998).

Although there is a large body of research that examines the verbal behaviors of mothers, very little is known about the accompanying *nonverbal* communicative behaviors of mothers during interactions with their infants. Speech and gestures are often combined by a speaker in order to convey a single coherent message to a listener (e.g., McNeill, 1998; Goldin-Meadow, 1998; 2000), so an understanding of how mothers use the gestural modality to communicate with their infants may provide additional insight into the social and communicative context in which infants learn language. The present study examines social-pragmatic properties of low- and middle-income mothers' verbal and nonverbal communication with their infants, and further asks whether these differ across socioeconomic strata.

11.1.a. Maternal speech

The total number of words and the number of different words used by mothers are the two properties of maternal speech that are most frequently reported in the developmental

literature. It is now well-established that these quantitative and qualitative input characteristics are positively and strongly associated with aspects of child language (e.g., Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Hart & Risley, 1995; Hoff, 2003). For example, Iverson and colleagues found that the total number of words produced by Italian mothers during a 45-minute interaction at 16 and 20 months was positively correlated with the number of different words, and the total number of words and gestures produced by their children at the same ages (Iverson, Capirci, Longobardi, & Caselli, 1999). The number of different words that parents use while talking with their preschool-aged children has also been found to predict their children's vocabularies in second (Weizman & Snow, 2001) and third (Hart & Risley, 1995) grades.

Stark differences have been witnessed in the number of words and the number of different words used by mothers with differing levels of socioeconomic status. A solid literature has established that low-income parents talk less to their young children (e.g., Hart & Risley, 1995; DeTemple & Snow, 1996; Hoff-Ginsberg, 1991) and use less diverse vocabulary (e.g., Rowe & Pan, 2004), and that these may result in slower vocabulary growth over time (e.g., Pan, Rowe, Singer, & Snow, 2005; Huttenlocher et al., 1991). There are similar associations with maternal education, with more highly educated mothers employing a larger repertoire of words during child interactions. One study found that this relation even held true in a purely low-income group, with the more highly-educated mothers using more diverse vocabulary during interactions with their toddlers than the less-educated mothers (Rowe & Pan, 2004). Hoff (2003) observed that differences in the amount of growth of 2-year-old's productive vocabulary could be fully accounted for by differences in their mother's speech, suggesting that the quantity and

quality of maternal speech is uniquely important above and beyond any contribution of income and education.

Mothers' interactional styles have also been shown to have a bearing on child outcomes. For example, Gleason (2001) described caregivers as using language primarily for verbally responsive or verbally directive purposes. A *verbally responsive interaction* occurs when a parent attends to a child's focus of attention and lets this dictate what she says next. A *verbally directive interaction* occurs when a parent attempts to control or direct a child's attention. Importantly, the extent to which mothers generate responsive comments that are contingent on the infant's focus of attention has been shown to be associated with infants' ability to perceive the relationship between words and their referents (e.g., Rollins, 2003; Carpenter et al., 1998; Vibbert & Bornstein, 1989; Smith, Adamson, & Bakeman, 1988; Tomasello & Akhtar, 1995).

One study found that the amount of verbally responsive language produced by mothers when their children were nine months old was positively correlated ($r=.63$, $p<.05$) with children's use of gestures at the same age and with the number of words produced on the CDI at 13, 14, and 15 months (Carpenter, Nagell, & Tomasello, 1998). A predictive relationship has even been established, with the total number of words used by parents in a verbally responsive manner at early ages relating to later aspects of child language. For example, Rollins (2003) used correlation and regression analyses to understand the relation between maternal input at 9 months and child language variables at 12 months. She found that only the number of words produced in verbally responsive contexts was predictive of the number of words understood by infants at 12 months ($r=.89$, $p=.003$). Specifically, mothers who used more words to talk about objects in the

child's focus of attention at 9 months had children who understood more words on the CDI at 12 months. Furthermore, infants who were exposed to more verbally responsive utterances at 9 months had more advanced morphosyntactic skills at 30 months ($r=.53$, $p=.01$) as measured by the Index of Productive Syntax (IPSyn; Scarborough, 1990).

Previous research suggests that mothers with low socioeconomic status tend to be more directive in their talk to their children (e.g., Hart & Risley, 1999; Hoff-Ginsberg, 1991). One study found that maternal educational attainment, as a proxy for socioeconomic status, was negatively associated ($r= -.53$, $p<.01$) with mothers' use of directives (Rowe & Pan, 2004). One interpretation of this result is that parents from different socioeconomic strata may have different goals during communicative interactions with their children, with some parents primarily concerned with directing their children's behavior, and others seeking to elicit talk from their children (Hoff-Ginsberg, 1991).

11.1.b. Maternal gestures

Although an abundant literature describes aspects of maternal speech, very little is known about how mothers employ gestures while interacting with their infants, or the function that these gestures might serve in helping children learn language. Because there is such a close connection between gesture and speech, "gestures offer themselves as a second channel of observation of the psychological activities that take place during speech production" (McNeill, 1985, p. 350). Indeed, it has been established that parents modify their gestures toward children in the same ways that they modify verbal speech (Iverson et al. 1999; O'Neill, Bard, Linnell, & Fluck, 2005). As is the case with child-directed speech (i.e., "motherese"), mothers tend to use child-directed gestures (i.e., "gesturese");

O'Neill et al., 2005) that are concrete, conceptually simple, and tied to the immediate physical and temporal context. In addition, gestures used during interactions with young children tend to be redundant with and reinforcing of the message conveyed in speech and they appear to be used with the goal of underscoring, highlighting, and attracting attention to particular words and/or objects (O'Neill, 2005). There is also evidence that "gesturese" is not a trait unique to American parents, since it has been evidenced in mothers from at least three cultures and in two languages: English (O'Neill et al., 2005), American (Shatz, 1982), and Italian (Iverson et al., 1999).

It is reasonable to suspect that children's earliest vocabulary development could be influenced by the gestural behaviors of their mothers, since deictic gestures can serve to single out a property or referent and make the relation between a referent and the accompanying speech more salient. This would seemingly reduce the many ambiguities that a child is confronted with when learning to associate a particular word with its referent (see Quine, 1960). There is some evidence that suggests a positive relation between mothers' gesture production and the number of gestures, number of words, and number of different words produced by children (Iverson et al., 1999). Iverson and colleagues observed a small sample of upper-middle-class Italian mothers as they interacted with their children at 16 and 20 months of age. They found that the total number of gestures produced by mothers was strongly and significantly correlated ($r=.51$, $p<.05$) with infants' use of gestures at 16 months. Maternal pointing gestures at 20 months were also highly and significantly correlated ($r=.60$, $p<.05$) with children's use of gestures at the same age. Vibbert & Bornstein (1989) also illustrated the importance of combining speech and gesture. They report that mothers who frequently encouraged their

toddlers to attend to objects by pointing them out and elaborating on their properties had toddlers with higher comprehension scores on the Reynell Developmental Language Scales (Reynell, 1981).

Given the limited data that speak to gesture use in parents, it is not surprising that even less is known about low-income mothers' use of gestures in communicative contexts with their young children. Two studies offer some insight into this issue. A recent investigation conducted with families receiving services through Early Head Start found a positive and significant effect of the total number of maternal pointing gestures on growth in child vocabulary production from 14 to 28 and 36 months (Pan et al., 2005). Rowe (2000) provides more extensive and detailed information on pointing gestures by low-income mothers during brief play interactions with their 14-month-old infants. The total number of points produced by mothers was moderately and significantly correlated ($r=.33$, $p<.05$) with the number of words understood on the CDI. Rowe is the only known researcher who has noted whether low-income mothers used gestures in directive or responsive contexts. She found that the significant relationship between mothers' pointing and children's comprehension vocabulary was limited to the number of pointing gestures used by mothers in a directive context--and *not* in the context of joint attention. Rowe notes that "this pattern was somewhat surprising given research showing a link between maternal talk during joint attentional episodes and child vocabulary development" (p. 18).

Although both of the studies reported here with low-income mother and infant dyads do offer valuable insight into the nonverbal communicative behaviors of mothers from low-income homes, there are no standards with which these maternal behaviors can

currently be compared. Neither of the studies included comparison groups representing different socioeconomic strata. It is therefore not possible to determine how maternal gesture use might have varied as a function of household income, maternal education, or some combination thereof.

11.2 The present study

Study 1 examined aspects of infants' use of words and gestures. However, socioeconomic status has also been associated with quantitative and social-pragmatic differences in child-directed language used by *mothers*. I posit that these differences will be evidenced in the present study and that there will be similar differences in child-directed gestures.

The specific research hypotheses are that:

1. L-SES mothers will use fewer words, a smaller repertoire of words, and fewer deictic gestures than M-SES mothers during play-based interactions with their infants.
2. L-SES mothers will predominantly use words and gestures in directive contexts and M-SES mothers will predominantly use words and gestures in responsive contexts.
3. The number of responsive utterances produced by mothers will be related to the number of gestures produced by infants during the play-based communication sample in Study 1.

There are no known studies that have contrasted the gestures employed by mothers from low- and middle-income homes during interactions with their infants. The present study will help to fill this gap by providing descriptive information about the communicative gestures produced by mothers with varying levels of income and education. This study

may also add to our understanding of the relation between maternal input and the number of communicative gestures used by infants at 12 months of age.

11.3 Methods

Chapter 7 provides a comprehensive description of participants and the procedures employed in the present study. All 50 of the parent/infant dyads participated in 10-minutes of play during the communication sample. Maternal communicative behaviors were reduced to the total number of words, total number of deictic gestures, and the number of different words and number of different deictic gestures. The percent of times that words and gestures occurred in directive, responsive, or other communicative contexts was also calculated.

11.4 Results

Results are presented first for quantitative aspects of maternal communication and then for social-pragmatic aspects. Descriptive information and analyses designed to detect group differences are presented within each section.

11.4.a. Quantitative aspects of maternal communication

Two multivariate analyses of variance (MANOVA) were conducted to examine the effect of socioeconomic status on maternal speech and gesture use during the communication samples. The first MANOVA investigated the influence of income group and maternal education on the total number of communicative behaviors (total words and total gestures), and the second examined the influence of these factors on the variety of communicative behaviors (number of different words and number of different gestures).

11.4.a.i. Number of words and gestures

A 2 (income: L-SES, M-SES) X 2 (maternal education: low, high) between-subjects MANOVA was performed, with total number of maternal words and total number of maternal gestures serving as dependent variables. Using Wilk's criterion (Λ) as the omnibus test statistic, the combined dependent variables resulted in a significant main effect for education [$F(2,45) = 4.26, p = .02$, partial $\eta^2 = .16$], and a significant main effect for income [$F(2,45) = 4.53, p = .016$, partial $\eta^2 = .17$]. The income*education interaction was not significant (see Table 11.1).

Table 11.1 Words and gestures produced by parents during the communication sample

Group	Total gestures		Different gestures		Total words		Different words	
	M (SD)	Range	M (SD)	Range	M (SD)	Range	M (SD)	Range
SES								
L-SES (n=27)	20.1 (8.3)	7-35	3.6 (.8)	2-5	435* (152)	100-693	112* (26)	54-159
M-SES (n=23)	20.0 (10.2)	4-46	3.7 (1.2)	1-5	555 (202)	236- 1184	134 (40)	80-231
Maternal education ^a								
Low (n=24)	22.8* (7.8)	9-35	3.8 (.8)	2-5	486 (159)	196-753	120 (31)	83-190
High (n=26)	17.5 (9.7)	4-46	3.4 (1.1)	1-5	494 (209)	100- 1184	125 (38)	54-231

^a Low education=no college degree; High= college degree or higher. * $p < .05$

To probe the statistically significant multivariate effects, univariate 2 X 2 ANOVAs were conducted on each dependent variable. For total number of words, there was a significant main effect of income [$F(1,46) = 8.14, p = .01$, partial $\eta^2 = .15$], with more words produced by M-SES ($M = 555$) than L-SES ($M = 435$) mothers (see Figure 11.1). The education main effect and the income*education interaction were not significant.

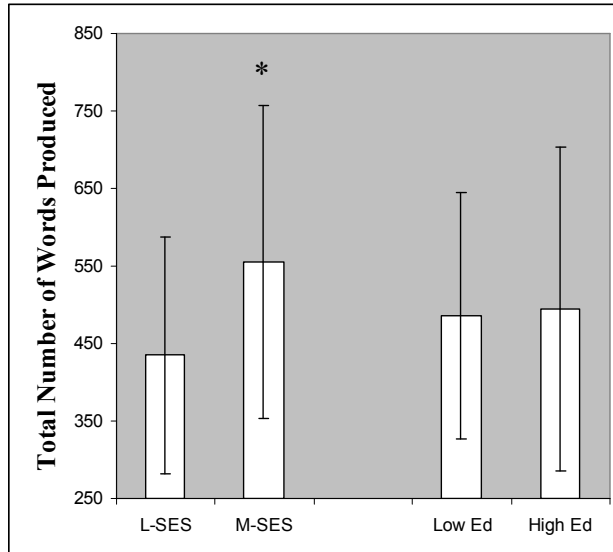


Figure 11.1. Number of words produced by parents during communication samples.

For total number of gestures, there was a significant main effect of education [$F(1,46) = 7.61, p = .01$, partial $\eta^2 = .14$], with mothers with low education producing more gestures ($M = 22.8$) than mothers with a college degree ($M = 17.5$; See Figure 11.2). The income main effect and income*education interaction were not significant.

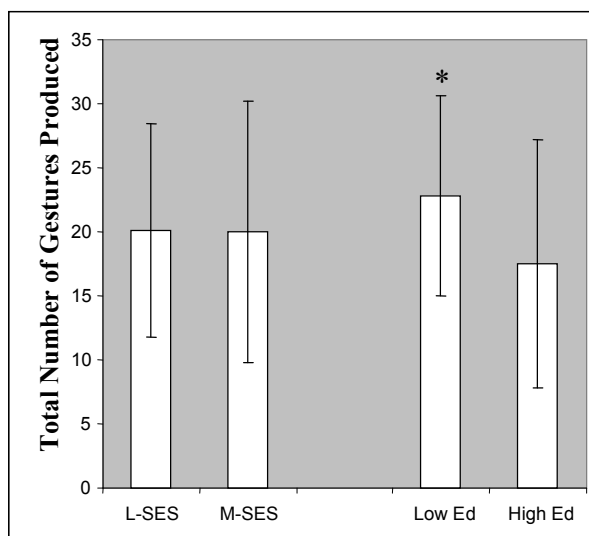


Figure 11.2. Number of gestures produced by parents during communication samples.

11.4.a.ii. Number of different words and gestures

A 2 (income) X 2 (education) between-subjects MANOVA was performed with the number of different words and number of different gestures serving as dependent variables. Using Wilk's criterion (Λ) as the omnibus test statistic, the combined dependent variables resulted in a significant main effect for income [$F(2,45) = 3.49$, $p = .04$, partial $\eta^2 = .13$]. The main effect for education and the income*education interaction were not significant.

To probe the statistically significant multivariate effect, univariate 2 X 2 ANOVAs were conducted on each individual dependent variable. For number of different maternal words, there was a significant main effect of income [$F(1,46) = 6.03$, $p = .02$, partial $\eta^2 = .12$], with a greater variety of words produced by M-SES ($M = 134$) than L-SES ($M = 112$) mothers (see Table 11.1). The education main effect and income*education interaction were not significant. No effects were significant for the number of different gestures produced by parents.

11.4.b. Social-pragmatic aspects of maternal communication

Social-pragmatic aspects of maternal words and gestures were considered next (see Table 11.2). A percentage was reported (instead of absolute number) in order to control for the observed differences in the number of words produced between the groups. A univariate 2 (income) X 2 (maternal education) ANOVA was conducted with the percent of *words* produced in a directive context as the dependent variable. A main effect of education was found [$F(1,46) = 5.25$, $p = .03$, partial $\eta^2 = .10$], with mothers with less education using a greater percentage of words in directive contexts. The main effect of income and the

income*education interaction were not significant. It is also of interest to note the patterns that existed within the income groups. Although mothers in both income groups used some of their words for directive purposes, M-SES mothers had a balance in the percentage of directive (M=42%) and responsive (M=42%) words. In contrast, the L-SES mothers produced disproportionately more directive (M=53%) than responsive (M=29%) words (see Figure 11.3.a).

Table 11.2. Percent of total words and gestures employed in each context

	% Gestures per context ^a			% Words per context		
	RSP	DIR	OTH	RSP	DIR	OTH
SES						
L-SES	15	84	1	29	53	18
M-SES	33	66	1	42	42	17
Maternal Education						
Low	16	83	1	27	55*	18
High	30	70	1	41*	42	18

^a RSP= responsive, DIR= directive, OTH= other. *p<.02

A univariate 2 X 2 ANOVA was also conducted with the percent of *gestures* used in a directive context as the dependent variable. The main effects of education and income were not significant, but a significant income*education interaction was detected [$F(1,46)=5.01$, $p=.03$, partial $\eta^2=.10$]. Inspection of the interactions revealed an effect of income on mothers with high education [$F(1,46)=7.31$, $p=.00$ partial $\eta^2=.23$], but not on mothers with low education. Although the M-SES mothers were balanced in the percentage of directive and responsive words, M-SES and L-SES both produced a disproportionately greater percentage of gestures used in a directive context (see Figure 11.3.b).

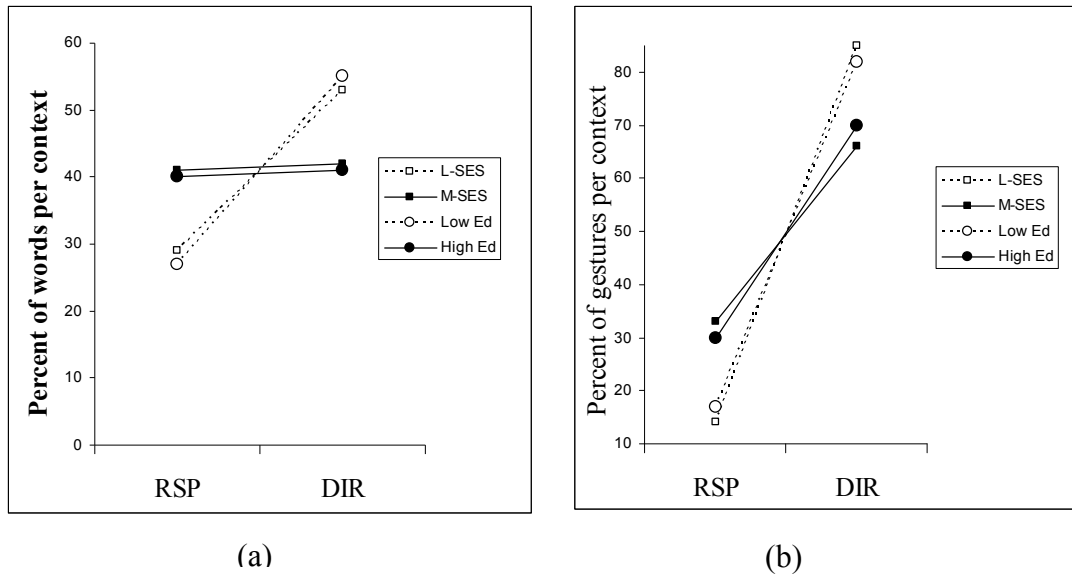


Figure 11.3. Percent of (a) words and (b) gestures used in directive and responsive contexts.

In order to determine whether there were any effects of income and education on the percent of words produced in a responsive context, a 2 X 2 univariate ANOVA was conducted. With the percent of *words* produced in a responsive context as the dependent variable, a significant main effect of education was detected [$F(1,46)=6.67$, $p=.01$, partial $\eta^2=.13$]. The main effect for income and the income*education interaction were not significant. A final univariate 2 X 2 ANOVA was conducted with the percent of *gestures* produced in a responsive context as the dependent variable. There were no main effects for income or education, but an income*education interaction was significant [$F(1,46)=4.70$, $p=.04$, partial $\eta^2=.09$]. Inspection of the interactions revealed an effect of income on mothers with high education [$F(1,46)=6.5$, $p=.02$ partial $\eta^2=.21$], but not on mothers with low education. The pattern for the interaction (L-SES+high education < M-SES+low education < L-SES+low education < M-SES+high education) suggests that

L-SES mothers with a college degree used the smallest percent of gestures in a responsive context and M-SES mothers with a college degree used the largest percent of gestures in a responsive context.

11.4.c. Maternal words and gestures as predictors of infant gestures

A multiple regression analysis was conducted to examine the association between parent word and gesture use and child word and gesture use during the communication samples. The analysis was run with the number of directive parent gestures, number of directive parent utterances, number of responsive parent gestures, and number of responsive parent utterances as predictors of infant gesture use. The full model did not account for a significant proportion of the variance in child gesture use ($\tilde{R}^2 = .086$). However, the number of responsive parent utterances emerged as a significant predictor of child gesture use ($\beta = .088$, $t_{48} = 2.42$, $p = .02$). This regression coefficient indicates that with each additional responsive parent utterance, there was an increase of .088 infant gestures.

11.4.d. Relations between gesture and accompanying speech

The relation between gesture and speech was examined in two ways. First, the *structure*, or form, of all communicative acts was measured (see Table 11.3). L-SES and M-SES mothers structured their communication in similar ways, with verbal utterances in isolation being most prevalent in both income groups. L-SES mothers paired gestures with 17% of their verbal utterances, and M-SES mothers paired gestures with 15% of their verbal utterances. Only 1% of gestures occurred in isolation in either group.

Independent-samples t-tests confirmed that there was not a significant difference in the percent of communicative acts structured in each way by L-SES and M-SES mothers.

The *informational relation* between gestures and speech (when the two co-occurred) was

also explored. When gestures were paired with language, they functioned to reinforce, disambiguate, or add information to the message conveyed in speech. Independent-samples t-tests confirmed that L-SES and M-SES mothers were equally likely to use their gestures to reinforce, disambiguate, and add to the verbal message.

Table 11.3. Relationships between gesture and speech

	% of time in L-SES	% of time in M-SES
Structure		
Gesture alone	1	1
Speech alone	82	84
Gesture+speech	17	15
Informational relation		
Reinforce	47	43
Disambiguate	37	42
Add	16	15

In order to further examine the relation between mothers' use of words and gestures, the Pearson product-moment correlation between total number of words and total number of gestures was computed. The overall linear correlation between words and gestures was moderate and significant ($r=.49$, $p=.01$). When Spearman's rho was calculated separately for the two SES groups, it became obvious that the strength of the relationship in the L-SES group ($r=.78$, $p=.01$) was driving this strong and significant correlation. The number of words and the number of gestures produced in the M-SES group were weakly and not significantly correlated with one another ($r=.25$, ns; see Figure 11.4).

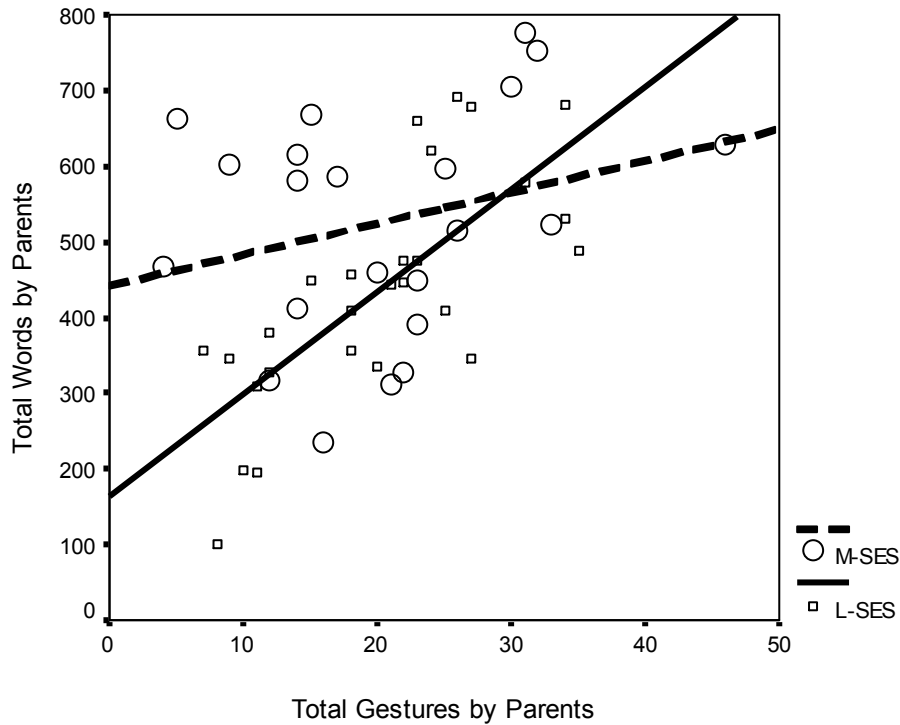


Figure 11.4. Relation between total number of words and gestures produced by parents.

11.5 Discussion

I undertook this study in order to test three hypotheses. The first pertained to quantitative aspects of maternal communication. I hypothesized that the L-SES mothers would produce fewer words and gestures, and fewer different words than the M-SES mothers. The first hypothesis was partially supported by the data: The M-SES mothers did produce more words and a greater variety of words. This finding is consistent with the literature reviewed in the Introduction which shows that low-income mothers have been found to talk less to their children and use fewer different words. The fact that the level of maternal education did not also have an effect on the number of words or number of different words produced is somewhat surprising, given the literature that indicates maternal education may serve as the best predictor of interaction style. It is possible that

the distinction used here (college degree vs. no college degree) may not have been sufficiently fine-grained to detect any meaningful effects of education on mothers' speech to their infants. Perhaps a more refined classification of education level would have yielded different results. Because only two mothers in the current sample had earned less than a high school diploma, it was not possible to examine differences that may have existed at the extreme lower end of the education continuum.

The first hypothesis also predicted that the L-SES mothers would produce fewer gestures than the M-SES mothers. This prediction was not supported by the data. The identical group means ($M=20$) indicate that the L-SES and M-SES mothers used gestures equally often while interacting with their infants. These findings are of some interest, because they suggest that there may not be a global difference in the sheer frequency with which low- and middle-income mothers communicate or direct thoughts or ideas to their children. Instead, the well-established income differences associated with maternal communicative behaviors may be unique to the spoken modality. Although the hypothesized effects of income on gesture frequency were not detected, there was a demonstrated effect of maternal education on the number of total gestures produced by mothers. Mothers without a college degree produced significantly *more* gestures while interacting with their infants than did the mothers with a college degree. This unexpected result will be explored further below, after consideration of education- and income-related social-pragmatic aspects of maternal gesture use.

The second hypothesis was that the L-SES mothers would use a greater percent of their words and gestures in directive contexts, and that the M-SES mothers would use a greater percent of words and gestures in responsive contexts. These hypotheses were not

supported by the data. Income group alone did not relate to the context in which words or gestures were used. However, maternal education did have a significant effect on the percent of words used in directive and responsive contexts. Mothers with a high level of education produced a greater percentage of words in responsive contexts when compared to mothers with a low level of education. Conversely, mothers with a low level of education produced a greater percentage of their words in directive contexts when compared to the college-educated mothers. Although there was no main effect of income on the context in which gestures were used, there was a significant income*education interaction. The results for *words* are in a direction that is consistent with the literature and the original hypothesis. Specifically, the more advantaged mothers (in terms of education) used a greater percentage of their words in responsive contexts, while less educated mothers used a greater percentage of their words in directive contexts. There was a slightly different relation between SES and directive and responsive *gestures*. Mothers in both incomes groups produced a disproportionately greater percentage of their gestures in a directive context, likely reflecting a directive function that is somewhat inherent to deictic gestures. There was also an interaction between education and income, such that L-SES mothers with a college degree used the smallest percent of gestures in a responsive context, and M-SES mothers with a college degree used the largest percent of gestures in a responsive context.

Returning to an earlier point, the finding that mothers with *less* education produced significantly more deictic gestures than the more educated mothers is counter to my original hypothesis and seems counterintuitive at first pass. However, the greater number of gestures used by less educated mothers may not reflect a greater tendency to

interact with their infants. Instead, the increase in the number of gestures seems to reflect the fact that gestures in both income groups were predominantly used in *directive* contexts (e.g., 84% in L-SES and 66% in M-SES). Essentially, the mothers with less education were significantly more directive and this was evidenced in their tendency to use gestures more frequently than did the mothers with more education.

My third hypothesis was that the number of responsive utterances produced by mothers during the communication sample would emerge as a significant predictor of the number of gestures employed by infants during the same task. This hypothesis was supported by the data, which indicated that each responsive parent utterance was associated with an increase of .088 infant gestures. This result parallels earlier work of Carpenter and colleagues (1998), who found that the amount of verbally responsive language produced by middle-class mothers when their infants were nine months old was positively correlated with infants' use of gestures at the same age. The current results provide support for a similar relation between maternal input and infants' use of gestures at a later age and within an ethnically-diverse group of infants from low- and middle-SES homes.

In addition to the hypothesis-driven objectives of this study, a secondary goal was to provide basic descriptive information about the verbal and nonverbal interactions of low- and middle-income mothers with their infants. L-SES and M-SES mothers both used gestures in the manner most commonly associated with child-directed gestures. Child-directed gestures are most commonly used by parents to reinforce and disambiguate verbal speech, possibly reflecting a mother's effort to accommodate the unique needs of a young learner. These functions are quite different from what is typical

of adult interactions, where gestures complement or supplement information conveyed in speech (e.g., McNeill, 1992). In the present study, gestures were used to reinforce and disambiguate accompanying speech in 84% of instances by L-SES mothers and in 85% of instances by M-SES mothers. This suggests that parents in both income groups were attuned to the unique needs of their infants, and modified their gestures in order to accommodate the communicative needs of their children.

Mothers paired gestures with their words in 15% (in L-SES) and 17% (in M-SES) of total utterances. Not only were the two groups quite similar to one another with regard to the tendency to combine words and gestures, but these numbers are strikingly similar to the percentages reported by other research groups. For example, Iverson and colleagues (Iverson et al., 1999) and Shatz (1982) both report that the mothers in their study paired gestures with 15% of their utterances. The results presented here suggest that some aspects of the low-income and middle-income mothers' communicative behaviors were not only similar to one another, but also to mothers who have participated in similar research studies.

There are two caveats that should be considered in interpretations of these data. First, the conclusions about maternal communication are based on mothers' behaviors during a brief, 10-minute play session in a laboratory setting. Mothers and infants were observed at a time when there was little for the mother to do, other than communicate and play with her child. It may be the case that more pronounced differences between the groups would exist if the mothers were observed in their everyday environments, and there may also be greater ecological validity associated with samples conducted in the home environment and over a longer time. Future work should therefore seek to expand

the length of observations and the environments in which mother-infant interactions are observed.

Second, there are many additional aspects of maternal behaviors that merit investigation. This work focused solely on certain social-pragmatic aspects of communication. Affective, didactic, and pragmatic elements of maternal speech have been shown to relate to the development of cognitive skills (e.g., Wallace, et al., 1998). Future studies should build on the current results by including more comprehensive assessments and measuring multiple aspects of maternal speech and gesture. Furthermore, research suggests that directive language may only be negatively associated with children's language development when used to focus the infant on an entirely new entity outside of the infant's current focus of attention (e.g., Dunham et al., 1993). My coding scheme did not delineate between maternal directives used within and outside of the infant's current focus of attention, so further refinement is recommended for future investigations of a similar nature.

In summary, the present study yielded results that are generally consistent with the literature that explores effects of socioeconomic status on maternal speech. Less advantaged mothers (defined by income or education) used more words, more different words, and used a greater percentage of their words in a directive context. However, an inverse relation was found between socioeconomic status and the number of gestures used by mother during interactions with their infants. Mothers with a lower level of education used significantly more gestures, perhaps reflecting a stronger trend of maternal directiveness that was evinced by more pointing and directing of infant attention. Importantly, I demonstrated that an increase in responsive parent utterances

during the communication sample was associated with an increase in the number of gestures used by infants during the same task. My results add new and valuable information to what is known about the ways in which mothers with varying levels of income and education use gestures to communicate with their infants and about the interplay between maternal words and gestures.

CHAPTER 12

General Discussion and Conclusions

12.1 General discussion

I undertook this dissertation with the primary goal of learning more about the very early social-cognitive and communicative development of infants being raised in low-income homes. This objective was accomplished through a set of four studies. Studies 1 and 2 assessed the communicative and social-cognitive skills of the infants as measured by parent report, behavioral tasks, and standardized observations. Study 3 explored the relation between parent report and behavioral tasks measuring the same behaviors, in order to determine whether the data obtained by parent report were meaningful. Study 4 was designed to measure quantitative and social-pragmatic properties of words and gestures used by mothers, and to examine the relation between these variables and infants' use of gestures. Each of the four studies was solidly grounded in a theoretical foundation, and logically built upon and extended prior research. Although many of my original hypotheses were not supported, some interesting implications of the work are considered here.

The motivation and rationale behind these studies are aligned with a constructivist theoretical perspective, which proposes that the foundations for language are established well before the first birthday. By this theoretical account, the first year of life constitutes a critical developmental period in which the earliest social-cognitive and communicative functions emerge, and the basic foundation for language learning is constructed. Using this model as a framework, I sought to test the “communicative foundations” of

vocabulary comprehension, joint attention, and gesture use in 12-month-olds from low- and middle-income homes.

The results from Study 1 and Study 2 suggest that typically-developing infants, irrespective of socioeconomic status, may first undertake the task of “building language” with the same set of social-cognitive and communicative “tools” in their “cognitive toolboxes.” This conclusion is supported by the fact that there was no effect of income on the number of words that infants understood, the number of different gestures they used, or the social-communicative behaviors they displayed during a standardized observation. However, there may be meaningful socioeconomic differences in the *frequency* with which these communicative tools are accessed and used. Indeed, an appropriate analogy may be that all infants begin to build their language on a similar schedule and with the same tools and materials at their disposal, but the foundation may stabilize more quickly for some infants than for others. Envision, for example, that each communicative gesture that an infant produces is akin to one more nail being hammered into the communicative foundation. In this scenario, the infants who use significantly fewer gestures will also take significantly longer to build a ground floor of the foundation that is solid enough and sturdy enough to support future development.

If the analogy above is accurate, then the assessments that were employed in this dissertation were not particularly well-suited to detect potential differences in the *frequency* with which infants used their communicative tools. Some of the measures were designed to note the presence or absence of certain knowledge or behaviors (e.g., parent report on the CDI, and the measure of representational gestures on the spontaneous labeling task). The CDI revealed no difference in the number of words that infants

understood or the number of different gestures that the infants used, and the spontaneous labeling task revealed no effects of income or maternal education on the number of “gestural names” produced. Another aspect of the spontaneous labeling task did lend itself to frequency counts of communicative gestures. The infants used deictic gestures to communicate with the tester while the task was being conducted. The tester adhered to a testing protocol that dictated how she interacted with the infants, so I accordingly learned more about how the infants interacted given similar input. In this instance the middle-income infants were found to use significantly more gestures ($M=11.8$) than the low-income infants ($M=6.2$) to communicate with the experimenter. The equivalent number of representational gestures produced by the infants diminishes the likelihood that the low-income infants were simply more reluctant to interact with the tester.

The communication sample also afforded the opportunity to observe mother-infant interactions and to measure the total number of gestures used by infants in a play-based interaction with a familiar caregiver. Interestingly, in this context there was no difference in the number of communicative gestures used by the low- and middle-income infants. One potential explanation for this is that the infants were so intrigued with the new toys and the freedom to move around that they only focused minimally on the parent. There is some support for this possibility, because the middle-income infants directed almost three times as many communicative deictic gestures toward the experimenter during the spontaneous labeling task than toward the parent during the communication sample. The low-income infants used almost twice as many gestures with the experimenter than with the mother within a similar period of time. This issue warrants further investigation, and we could certainly learn a great deal more through data that are

derived from extended and frequent observations of infants in playing with familiar toys in their natural environments with a primary caregiver.

Although the current data only speak to the frequency with which the infants employed communicative gestures, the same analogy presented above may very well extend to vocabulary comprehension. Recall that there were significant differences in the number of words and number of different words that mothers directed toward their infants, with low-income mothers using fewer of each (see Study 4). Extending the earlier logic, it may be reasonable to suspect that the infants from low-income homes thereby have fewer opportunities to recruit their comprehension skills, or “tools for understanding.” Accordingly, the rate of growth in vocabulary comprehension could be slower for the infants from low-income homes who have fewer opportunities to put their tools to work. The present data cannot speak to this issue. However, future work should build on these preliminary data by conducting frequent assessments of vocabulary comprehension and by exploring the relation between the amount of maternal speech and the rate of growth in early comprehension vocabulary. Indeed, the existing literature (e.g., Wallace et al., 1998) and the results from Study 4 suggest that it may be equally important to consider the social-pragmatic context in which mothers’ words and gestures are employed. For example, maternal responsiveness (in words and gestures) may have a differential impact on infant communication at different ages, and a longitudinal study would have the potential to tease apart these nuances.

Study 3 provides validation of the CDI gesture scores that were obtained in Study 1 and provides support for the use of parent report with mothers with low levels of income and/or education in future research studies. The data suggest that parent report of gestures

may be valid when contributed by mothers with low levels of income and education. Unfortunately, it was not possible to validate parent report of vocabulary comprehension, because the infants did not perform above chance on the looking-while-listening task. However, the finding that socioeconomic status had no bearing on the extent to which parents over- or under-reported infant gesture use is an important result that has positive implications for the utility of the CDI and related instruments. Prior to this investigation, no known published studies had examined accuracy of parent report of gesture use. Accordingly, my work provides important new evidence for the utility of parent report—even with parents who have low levels of income and/or education. Future studies should expand upon this initial work by conducting longitudinal studies that administer the CDI at multiple ages and combining this with behavioral tasks that can serve to validate parent report.

Future studies should continue to explore the relation between maternal input and infant development. The vast majority of research into maternal input has been restricted to verbal aspects of maternal communication. The small literature that speaks to nonverbal aspects of maternal communication has found the total number of gestures produced by middle-class mothers to be strongly and significantly correlated with infants' use of gestures (e.g., Iverson et al., 1999; Vibbert & Bornstein, 1989). However, only two known studies (Rowe, 2000; Pan et al., 2005) explore the relation between the communicative gestures used by low-income mothers and developmental outcomes of their infants. Furthermore, mine is the only known study to directly compare the gestures of middle-income and low-income mothers and examine the extent to which these were used to direct or respond to the infants' focus of attention. There may well be some

predictive validity associated with these aspects of maternal input at 12 months, and a follow-up study with the same infants at 24 months could speak to this issue.

It would be irresponsible to ignore the possibility that I failed to detect many differences in the early communicative and social-cognitive skills of infants because these differences, in fact, did not exist. It may be the case that 12 months is simply too early to detect any meaningful group differences. If this true, then it affirms the need for additional investigation into the age range of 12-24 months. Since differences in language and cognition are often witnessed as early as 24 months, it is necessary to look at increasingly younger ages in order to achieve a better understanding of exactly when differences can first be detected, and which domains may be most susceptible to early effects of income.

It must also be noted that there are any number of potential issues surrounding the current sample that may have played a role in the findings. Infants were considered low-income if they were in the “very low-income range” by HUD standards and/or their families received government assistance (e.g., WIC or Medi-Cal). Only 20% of the sample was at the extreme lower end and in poverty proper, and poorer outcomes have been associated with children who are raised in poverty. In fact, the association between income and development appears to be non-linear, with the biggest negative impacts evidenced at the lowest levels of income (e.g., Duncan & Magnuson, 2002). In addition, only two of the low-income mothers had less than a high-school education, which reduced the utility of maternal education as a meaningful predictor. Studies that have included mothers without a high school diploma have found strong and significant relationships between maternal education and measures of early speech and language

(eg., Dollaghan et al., 1999). In addition, minorities were represented equally in the two income groups in order to reduce potential confounds of ethnicity and income. However, one potential consequence of this strategy is that the present low-income sample may not resemble low-income samples in other research studies that have largely consisted of minority children (e.g., Roberts et al., 1999). Finally, a significant percentage of the low-income infants had both biological parents in the home. My sample may therefore differ significantly from other studies that have a large representation of single mothers (e.g., Jackson, 2003).

It should also be noted that the data in this dissertation were obtained from a convenience sample, and not a randomly selected group of participants. It is impossible to determine how the parents who had the interest, as well as the transportation and other resources that allowed them to participate, may differ from parents who did not respond to posted fliers that advertised the study. Finally, future work should consider using continuous measures of income and maternal education, instead of categorical representations of these (e.g., low vs. high). By relying on the categorical variables of income and education, I may have unnecessarily constrained the families to one group or another, thereby masking variability by conducting group-level analyses. The demographic information in the present study was gathered in such a way that regression-type approaches were not possible, so it is impossible to speak to the possibility with the current set of data.

There may be an unintended implication in my work that the skills and behaviors witnessed in middle-class populations reflect an ideal standard to which other groups should be compared. I do not believe that the behaviors of middle-class families provide

a “gold standard.” However, I do acknowledge that the middle-class standards are what currently drive the expectations for success in school and other academic environments. I accordingly consider it important to obtain a better understanding of how the experiences and outcomes associated with infants from low-income homes may differ from the experiences and outcomes associated with infants from higher levels of the socioeconomic stratum.

12.2. General conclusions

In summary, this dissertation takes us one step closer to understanding the nature of early communicative development of infants from low- and middle-income homes. The main findings include that: a) 12-month-old infants from low- and middle-income homes had the same repertoire of gestures at their disposal, but infants from low-income homes used gestures less often for communicative purposes; b) there was no effect of income on joint attention or related social-cognitive skills; c) lower levels of income and education did not reduce the accuracy of parent report on the gesture index of the CDI; d) mothers with higher levels of income used more words to communicate with their infants, but mothers with lower levels of education used more gestures to communicate with their infants, primarily for directive purposes; and e) the number of responsive utterances produced by mothers during the communication sample emerged as a significant predictor of the number of gestures employed by infants during the same task. The implications of these findings were discussed and future directions have been suggested.

My work, in addition to providing important descriptive data, provides a logical starting point for a continuing research agenda. I recognize the limitations of the current study and hope that this initial investigation will stimulate further investigation of the

important issues identified herein. This research could also inform the broader theoretical issue of how and when the environment may come to significantly impact children's social-cognitive and communicative development. Continued research into these issues is warranted by the potential benefit of learning about the ideal nature and timing of early enrichment programs for infants with low-income backgrounds.

Demographic Characteristics of Mothers

Demographic Characteristics of L-SES Mothers

Participant #	Children	Age at birth	College degree	Currently employed	Current or last occupation	Hollingshead Index	Welfare	In poverty
03	3	22	No	No	Food service	20	No	Yes
04	4	32	Yes	No	Secretary	60	No	No
05	1	25	Yes	No	Admin. assistant	65	No	No
08	1	24	No	Full-time	Peddler	20	Yes	Yes
09	2	25	Yes	No	Store clerk	40	Yes	Yes
12	1	24	Yes	Full-time	Preschool teacher	60	No	No
13	1	20	No	Part-time	Vet. assistant	30	No	Yes
17	2	39	Yes	Part-time	Midwife	30	No	No
18	6	26	No	No	Preschool teacher	60	No	Yes
19	3	27	No	Part-time	Food service	20	No	Yes
21	2	29	No	Full-time	Admin. assistant	65	No	No
22	2	28	No	No	Medical assistant	50	No	No
23	1	25	Yes	Part-time	Accounting	50	No	No
24	1	23	No	No	Dance teacher	60	No	No
26	2	22	No	Part-time	Food service	20	Yes	No
31	2	19	No	Full-time	In-home childcare	20	Yes	No
36	2	26	No	Full-time	Office assistant	40	No	No
39	1	26	No	No	Customer service	60	No	No
40	2	32	No	No	Receptionist	40	No	Yes
42	1	24	No	Part-time	Retail sales	50	No	Yes
43	1	31	No	Part-time	Retail sales	50	No	No
44	2	21	No	No	Retail sales	50	Yes	Yes
47	4	34	No	Full-time	Title researcher	60	No	No
48	1	28	No	Full-time	Telemarketing	30	No	Yes
49	1	22	No	Part-time	Data entry	50	No	No
51	1	20	No	Full-time	Enlisted military	30	No	No
52	2	24	No	No	Enlisted military	30	No	No

Demographic Characteristics of M-SES Mothers

Participant #	Children	Age at birth	College degree	Currently employed	Current or last occupation	Hollingshead Index
01	1	33	Yes	Part-time	Speech pathologist	80
02	3	33	No	Part-time	Admin. assistant	65
06	1	36	Yes	Part-time	Advertising agent	60
07	2	35	Yes	No	Elementary teacher	70
10	2	31	Yes	No	Business project coordinator	60
11	2	30	Yes	Full-time	Attorney	90
14	1	32	Yes	No	Education counselor	70
15	1	31	Yes	No	Journalism	70
16	2	34	Yes	Part-time	Elementary teacher	70
20	1	31	No	No	Labor relations worker	80
25	2	34	Yes	No	Secretary	60
27	1	37	Yes	Part-time	Computer programmer	70
28	1	26	Yes	No	Accountant	80
29	1	28	Yes	No	Computer systems analyst	80
30	1	32	Yes	Full-time	Occupational therapist	60
32	2	38	Yes	Part-time	Bookkeeper	50
34	2	35	Yes	Part-time	Project manager	70
37	2	34	Yes	Part-time	Computer systems analyst	80
38	2	33	Yes	Part-time	Small business owner	60
41	1	28	Yes	Full-time	High school teacher	80
45	1	35	No	Part-time	Medical clerk	50
46	1	31	Yes	Full-time	Project coordinator	60
50	1	35	Yes	Full-time	College professor	90

Demographic Characteristics of L-SES Fathers

Participant #	Children	Age at birth	College degree	Currently employed	Current or last occupation	Hollingshead Index	Welfare	In poverty
04	4	40	Yes	Full-time	Customer service	60	No	No
05	1	29	No	Full-time	Casino dealer	40	No	No
08	1	25	Yes	Full-time	Mechanic	40	Yes	Yes
12	1	25	No	Full-time	Enlisted military	30	No	No
13	1	30	No	Full-time	Cook	20	No	Yes
17	2	39	Yes	Full-time	Ticket agent	40	No	No
18	6	28	No	Full-time	Paralegal	60	No	Yes
19	3	28	No	Full-time	Construction	20	No	Yes
21	2	34	No	Full-time	Enlisted military	30	No	No
22	2	27	No	Full-time	Construction	20	No	No
23	1	26	No	Full-time	Construction	20	No	No
24	1	21	No	Full-time	Enlisted military	30	No	No
26	2	24	No	Full-time	Janitor	10	Yes	No
31	2	22	No	Full-time	Asst. manager food service	30	Yes	No
36	2	33	No	Full-time	Self-employed	40	No	No
40	2	32	No	Part-time	Writer	70	No	Yes
42	1	21	No	Full-time	Customer service	60	No	Yes
43	1	28	No	Full-time	Computer technician	60	No	No
47	4	33	No	No	Freight handler	20	No	No
49	1	21	No	Full-time	Shipping	60	No	No
52	2	24	No	Full-time	Meter reader	30	No	No

Demographic Characteristics of Fathers

APPENDIX B

Demographic Characteristics of M-SES Fathers

Participant #	Children	Age at birth	College Degree	Currently employed	Current or last occupation	Hollingshead Index
01	1	34	Yes	Full-time	Attorney	90
02	3	33	Yes	Full-time	Police officer	40
06	1	33	No	Full-time	Advertising sales	60
07	2	39	Yes	Full-time	Store manager	70
10	2	35	No	Full-time	Business manager	70
11	2	31	Yes	Full-time	Chemist	90
14	1	31	Yes	Full-time	Elementary teacher	70
15	1	35	Yes	Full-time	Computer programmer	70
16	2	34	Yes	Full-time	Government official	60
20	1	37	Yes	Full-time	Labor-relations worker	80
25	2	34	Yes	Full-time	Executive	70
27	1	40	Yes	Full-time	Technical recruiter	80
28	1	28	Yes	Full-time	Engineer	90
29	1	32	No	Full-time	Technical trainer	70
30	1	41	Yes	Full-time	Computer engineer	90
32	2	43	Yes	Full-time	High-school teacher	80
34	2	40	Yes	Full-time	High-school teacher	80
37	2	32	Yes	Full-time	Computer systems analyst	80
38	2	38	Yes	Full-time	Software engineer	70
41	1	29	No	Full-time	Painter	30
45	1	38	No	Full-time	Small business owner	60
46	1	44	No	Full-time	Project manager	70
50	1	37	Yes	Full-time	Doctoral student	80

APPENDIX C

Family History Questionnaire

Date: _____

“During this interview we will talk mainly about what has been happening in your life since (BABY) was born. Everything you tell me will be kept strictly confidential. If you choose not to answer a particular question, just let me know and we will go on to the next one.”

Child's Name: _____

Respondent/Relationship to Child: _____

Home Address: _____

Home Phone: _____

Email Address: _____

1. Child's DOB: _____

2. Child's Gender: M F

3. Child's Ethnicity: Caucasian African-American Asian Hispanic Other

4. Are any languages other than English spoken to this child? YES NO

If yes, beginning at what age: _____ How frequent: _____

What language? _____

Please provide us with information on any other children:

Name	DOB	Gender

5. Mother's Name: _____ Age: _____

6. Father's Name: _____ Age: _____

7. Education of Mother:

- a) Partial High School
- b) High School Graduate
- c) Partial College (more than one year)
- d) College Graduate
- e) Graduate School or Professional Training

8. Education of Father:

- a) Partial High School
- b) High School Graduate
- c) Partial College (more than one year)
- d) College Graduate
- e) Graduate School or Professional Training

9. Is the child's mother currently employed?

a) NO

b) YES

_____ Full-time

Occupation: _____

_____ Part-time

10. Is the child's father currently employed?

a) NO

b) YES

_____ Full-time

Occupation: _____

_____ Part-time

11. Approximate gross annual household income:

a) 0- \$7,000

b) \$8,000-\$12,000

c) \$13,000-\$15,000

d) \$16,000-\$19,000

e) \$20,000-\$22,000

f) \$23,000-\$25,000

g) \$26,000 - \$29,000

h) \$30,000 - \$36,000

i) \$37,000 - \$50,000

j) \$51,000 - \$75,000

k) 76,000+

12. We are interested in whether or not the families in our program are receiving any financial assistance from government programs. At the present time are you receiving money or other help from:

a) Supplemental Security Income? YES NO

c) Public Assistance or Welfare? YES NO

d) Unemployment Compensation? YES NO

e) WIC? YES NO

13. What is the total number of people who live in the child's home: _____

14. With whom does the child live:

a) Both biological parents

b) One biological parent

c) Foster parents

d) Adoptive parents

e) Shared/joint custody

f) Other, please explain: _____

15. Who is the child's primary caregiver:

a) Parent

b) Other relative

c) Daycare

d) Babysitter/nanny

e) Other, please explain: _____

16. How are your child's medical expenses covered?

- | | | |
|---------------------------------|-----|----|
| a) You or your family? | YES | NO |
| b) Private health insurance? | YES | NO |
| c) Prepaid medical program/HMO? | YES | NO |
| d) Medicaid? | YES | NO |
| e) Any other source? | YES | NO |

If yes, please explain: _____

Prenatal and Birth History

17. How many weeks did the pregnancy last: _____

18. Baby's birth weight: _____ lbs. _____ ozs.

19. Were there any other unusual circumstances at the delivery of this child: YES NO

If yes, please explain: _____

If yes, Apgar scores: @ 1 min. _____ @ 5 min. _____

If yes, how old was your baby when discharged from the hospital: _____ days

Life Events - Early Childhood

20. Has your child done any of the following? If so, at what age:

a)	Rolled over:	YES	NO	
b)	Sat alone:	YES	NO	
c)	Crawled:	YES	NO	
e)	Said a word:	YES	NO	
f)	Walked alone:	YES	NO	

21. Does your child have any hearing problems that you are aware of: YES NO

If yes, please explain: _____

22. Has he/she had any ear infections: YES NO

If yes, how many: _____

Approximately how long was each episode (in days): _____

Was any medication required? YES NO

If yes, which ones: _____

Have tubes been inserted in his/her eardrum(s): YES NO

When: _____

23. Has your child had any surgeries or illnesses that have required hospitalizations? YES NO

If yes, please explain: _____

Family History

If any family members have had any of the following problems please list which member(s) and explain the problem(s). *Please fill this out with your child being the reference point, for example, the maternal grandmother would be the child's mother's mother; paternal uncle would be the child's father's brother.*

Examples to include: mother, father, brothers, sisters, maternal grandmother/grandfather, paternal grandmother/grandfather, maternal aunts/uncles, paternal aunts/uncles, others.

		Nature of Problem	Relation
YES	NO	Speech or language problems:	
YES	NO	Learning disabilities/problems:	
YES	NO	Neurological problems:	
YES	NO	Chronic illness or medical problems:	
YES	NO	Psychiatric problems:	

APPENDIX D

Sample Communication Sample Transcript

@Situation: ES030cs1c1.cha communication sample 1

ES030

@New Episode

Page 1 of 27

@Start: 00:00:15

@Finish: 00:10:15

@Time: 00:10:00

*CHI: [= give] &voc .

%ges: d/give . [+ SP]

%cmb: G+S

%com: chi suddenly picks up tea kettle, vocs, and gives to par

%tim: 01:22

Child gesture:
deictic give

*PAR: oh the kettle .

%mor: oh the kettle . [+ RSP]

%cmb: S

%com: par acknowledges give

%tim: 01:23

Parent language & post-code:
responsive

*PAR: for Mommy make coffee [= show] ?

%mor: for Mommy make coffee ? [+ RSP]

%ges: d/show . [+ RSP]

%cmb: G+S

%rel: add

%com: par shows chi teapot as she asks this

%tim: 01:29

Combination:
gesture + speech

*PAR: there's a cow # cow [= indicate] moo@o .

%mor: there's a cow cow moo@o . [+ DIR]

%ges: d/indicate . [+ DIR]

%cmb: G+S

%rel: reinf

%com: chi playing with peas; par taps cow and repeats cow for emphasis

%tim: 04:27

Parent gesture & post-code:
directive

*PAR: Audrey's got a chicken .

%mor: Audrey's got a chicken . [+ RSP]

%cmb: S

%com: par starting to line up stacking cups; talking about what chi has

%tim: 04:32

Informational relation
between language & gesture:
reinforce

*CHI: [= give] &voc .

%ges: d/give . [+ SP]

%cmb: G

%com: chi vocalizes and hands chicken to par

%tim: 04:35

APPENDIX E

Description of ESCS Tasks

1. Object Spectacle Task: The tester presents the child with a wind-up toy and remains silent but attentive while the toy is active out of the child's reach. If the child initiates a bid for attention (e.g., by alternating eye contact with the toy and tester), the tester provides a response (e.g., "I see it!"). If the child makes a bid for the toy (e.g., reaches), the tester responds by moving the toy within reach of the child. If the child does not request the object, then the tester places it within the child's reach when the toy is no longer moving and allows the child approximately 10 seconds to play with the object. Each of six object spectacles is presented three times in this manner and interspersed throughout the session.
2. Turn-Taking Task: The tester places an object (car or ball) in the child's reach and then returns her hands to her own side of the table and opens them wide in anticipation of the child rolling the object back to her. The tester remains in this posture for about 10 seconds. If the child does not initiate a turn-taking game then the tester does so and pairs the roll with playful sounds (e.g., "vroom"). If the child rolls the object back to the tester, then the game continues for up to 12 infant turns. The same procedure is repeated later in the session with the second object.
3. Social Interaction Task: The tester removes all objects from the table and tells the child, "Let's play a game!" The tester then sings a few bars of a popular childhood song (e.g., "Itsy-Bitsy Spider") and after approximately 10 seconds of singing, runs her fingers across the table and touches or tickles the child. The object is to engage in a song and physical interaction that the child enjoys. The tester then returns her hands to her side of the table and pauses while looking at the child for a few seconds. The child may then bid for the tester to repeat the game by making eye contact, wiggling fingers on the table, etc. If the child does not make a bid, then after 5 seconds the tester repeats the touch or tickle. There are three tickles per set and two sets per ESCS session.
4. Gaze-Following Task: The tester first brings the child's attention to the tester's face by touching her own nose and saying, "Look!" The tester then extends her arm in a short-arm point toward one of four posters on the wall and calls out the child's name three times in succession with increasing volume. The tester attempts to direct the child's attention to posters in the following order: Left of child, Left/behind of child, Right of child, Right/behind of child. The point and tester's eye contact with the poster are maintained for at least 6 seconds. The tester may then make a statement that pertains to the poster if the child did look (e.g., "You saw my puppy!") or did not look at the poster (e.g., "Did you see

the flower?”). Two sets of four pointing trials are presented at different times.

5. Response to Invitation Task: The tester presents one of three objects (hat, glasses, or comb) to the child. If the child uses the object in a conventional manner, such as putting the hat on his own head, then the tester leans across the table and asks, “(Name), can I play?” The tester repeats the question up to three times. If the child does not use the object in a conventional manner on themselves, then the tester prompts this and then asks, “(Name), can I play?” This sequence is repeated for all three of the objects.
6. Book Presentation Task: The tester presents a large, picture board book on the table and opens it to a pre-determined page. The tester says, “What do you see?” and allows the child 20 seconds to look at the page. The tester then says the child’s name and points to pictures in the book without touching or tapping the pictures. Children may visually follow the tester’s point or may point themselves to pictures. If children point to pictures, the tester responds neutrally (“I see that”). The procedure is repeated two more times for a total of 3 pages per session.
7. Plastic Jar Task: The tester shows the child a clear plastic jar with a sealed lid and two mechanical toys inside. The tester gives the jar to the child and waits for the child to bid for help or for up to 10 seconds. The tester then retrieves the jar, opens it, dumps out one of the toys, and winds it up. This then turns into an Object Spectacle trial which is repeated once more for the second object in the jar. The Plastic Jar Task is conducted once per session.
8. Follows Commands: When it is time for a child to return a toy to the tester, the tester asks the child to, “Give it to me” in a clear “command” tone of voice (rather than a polite or playful tone). The tester allows 3 seconds before repeating the request. The experimenter makes a second verbal request and, if necessary, pairs a third and fourth request with a palm-up gesture. If the child does not respond after the fourth request, the experimenter gently retrieves the toy. The tester initiates this sequence at least 8 times during the session.

APPENDIX F

Recommended Order of ESCS Tasks

Order	Object	Associated Task
1	Ball	Turn-Taking Task #1
2	Mechanical wind-up toy	Object Spectacle #1
3	Glasses	Invitation Task #1
4	Hand puppet	Object Spectacle #2
5	Song-tickle Game	Social Interaction Task #1
6	Poster “look” trials	Gaze Following #1
7	Whistle	Object Spectacle #3
8	Book	Book Presentation Task
9	Mechanical wind-up toy	Object Spectacle #4
10	Car	Turn-Taking Task #2
11	Hat	Invitation Task #2
12	Mechanical wind-up toy	Object Spectacle #5
13	Jack-in-the-box	Object Spectacle #6
14	Comb	Invitation Task #3
15	Plastic jar with wind-up toys	Plastic Jar Task
16	Song-tickle game	Social Interaction Task #2
17	Poster “look” trials	Gaze Following #2

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