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SENTENCE PROCESSING STRATEGIES OF YOUNG CHILDREN

by

Nameera Akhtar

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy

at

Dalhousie University
Halifax, Nova Scotia
January, 1993

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ISBN 0-315-87443-0

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To my Ummy Jan

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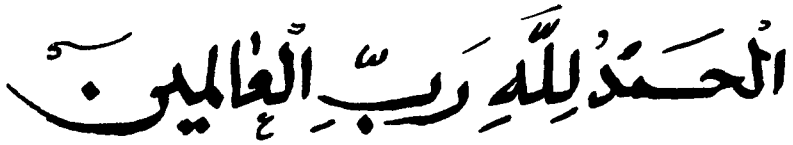
ABSTRACT

Shatz (1978a) has proposed an initial constraint on children's interpretations of speech acts such that they tend to respond with action to speech addressed to them. A number of methodological improvements over the original test of this Action Bias Hypothesis were included in the present study, most notably the use of a robot to present stimulus sentences. Twenty-eight children were videotaped interacting with their mothers and with the robot in a laboratory playroom at 18 and 24 months of age. Subjects' responses to sentences whose lexical content was systematically manipulated indicated that response mode varied with lexical content; that is, as a group, children tended to act when sentences contained action verbs, and tended to produce informing responses when sentences contained copula verbs. This pattern was found at both ages, and argues against an initial bias to act. Rather, young children are sensitive to linguistic and contextual markers of a speaker's communicative intent. Further evidence of their sensitivity to communicative intent was demonstrated in a series of correlational analyses relating maternal speech characteristics to individual differences in children's response strategies. Maternal use of a specific form-function pair - yes/no prescriptives - was a reliable predictor of response style, even when other predictors were held constant statistically. Thus, children do not begin language learning with a bias to associate speech with action, but are sensitive to the functions for which specific forms are used in their communicative environments.

ACKNOWLEDGEMENTS



All praise is due to Allah (God), the Creator and Sustainer of all the worlds.

I would like to express gratitude to my supervisor, Dr. Phil Dunham, for all his efforts over the past few years. His enthusiasm for research was truly infectious. I would also like to thank my committee members - Drs. Chris Moore and Dennis Phillips - for their encouragement and critical feedback. Drs. E. Skarakis-Doyle (University of Western Ontario) and M. Tomasello (Emory University) also provided encouraging and helpful comments which were greatly appreciated. Thanks to Alan Hurshman for first suggesting Robie as an experimental tool.

Two faculty members at Dalhousie deserve special mention. Drs. Ray Klein and Bruce Moore are, in their own ways, examples to me of what it means to be a researcher and an academic. I will remember you both with fondness and respect.

For various forms of much appreciated support, it gives me pleasure to acknowledge a long list of good friends I made at Dalhousie: K.G. Bina, Gisele Boyd, Valerie Corkum, Elizabeth Coscia, April D'Aloisio, Anastasia Droungas, Mary Farmer, Kelly Frame, Rita Ingenmey, Tim and Elke Juckes, Chinglu Li, Lynne MacLeod, Terry McCormick, Chris Moore, Amanda and Rod Pontefract, Heather MacIntosh Schellinck, Isabel Smith, and Norma Wadden.

Finally, I would like to thank my family - in particular, Ummy and Hamza - for their constant support, patience and understanding.

Introduction

Learning a first language is arguably the greatest intellectual accomplishment of the young child. From infancy the child is faced with a barrage of complex utterances and in order to make sense of adults' speech she must perform at least three major tasks. First, she must segment the speech stream into meaningful units. Second, she must extract meaning from the situations in which she hears speech; i.e. determine what the adult is talking about. Finally, she has to develop sound-to-meaning mappings (Gleitman & Wanner, 1988). Each of these tasks poses its own set of specific problems; e.g. the most salient elements in the speech stream may not be the most meaningful (Golinkoff & Hirsh-Pasek, 1990). Yet most normally developing children, over the space of only a few years, become relatively proficient speakers and comprehenders of their native tongues.

In order to account for the speed and apparent ease of first language acquisition theorists have posited various constraints which guide and may simplify the child's task. Although all child language researchers agree that some biological and cognitive preparedness is necessary for language development, there is considerable disagreement as to the nature of the prerequisite skills. The disagreement centers around the domain specificity of the postulated constraints (Bates, Bretherton, & Snyder, 1988). Generative grammarians argue that, due to the nature of the system being acquired and the "poverty of the stimulus", constraints have to be specific to the domain of language (Bickerton, 1984; Chomsky, 1981; Gleitman, Gleitman, Landau, & Wanner, 1988; Lightfoot, 1989). This argument has also been used for the acquisition of individual words. For example, Markman's (1989; 1991) whole-object, taxonomic and mutual exclusivity assumptions are language-specific constraints that were proposed to aid the child's acquisition of lexical items. In a similar vein, Gleitman et al. (1988) assert that clausal representations (as language-

specific as one can get) "are available at the initial stage of language learning" (p. 154). In this view, language is generally viewed as discontinuous with the rest of cognition (Chomsky, 1980).

The opposing view, most eloquently put forth by Bates and her colleagues (e.g., Bates & MacWhinney, 1989; Bates, Thal, & Marchman, 1991) is that language is constructed from innate cognitive and perceptual elements, both phylogenetically and ontogenetically, and that the processes and mechanisms used in language learning are continuous with those of other cognitive domains. Bates et al. (1991) call their version of the constraints approach "general nativism" in contrast to the "specific nativism" of the formalists. One of the arguments advanced by specific nativists is that adult language is modular and separate from the rest of adult cognition (Fodor, 1983). However, Bates et al. argue persuasively from evolutionary theory and developmental evidence that (innate) domain-general mechanisms can produce domain-specific results[1]. Thus, the "human capacity for language could be both innate and species-specific, and yet involve no mechanisms that evolved specifically and uniquely for language itself. Language could be viewed as a new machine constructed entirely out of old parts" (Bates & MacWhinney, 1989, p. 10). Some of these old parts might include devices for memory and fine-motor control as well as an analytic mechanism (Bates et al., 1991). Although other species may share these general-purpose mechanisms to varying degrees, the extent to which they can be used to "enter the problem space of language" (Bates et al., 1991, p. 45) is determined in large part by the nature of the species in question.

Humans and great apes are the only species to evidence significant language ability and the latter, of course, only do so when they have had considerable exposure to humans. It appears that when grammatical competence is used as the definition of language, no primates can approximate the abilities of humans

(Premack, 1986; Seidenberg & Petitto, 1979). However, when communicative competence (i.e. flexible use of communicative symbols in appropriate contexts) is the measure, some captive chimpanzees evidence significant expressive and receptive abilities (e.g., Savage-Rumbaugh, McDonald, Sevcik, Hopkins, & Rubert, 1986). It is important to note that the context in which these chimps acquired language is crucial. Those trained with reinforcement to associate symbols with referents did not generalize use of these symbols to functions other than those with which they had been trained. For example, if taught a word to request an object they did not use that word to comment on the object (Savage-Rumbaugh, 1990). On the other hand, the pygmy chimpanzee Kanzi who was raised in a human-like environment, and who wasn't formally "trained" to learn language, showed more flexible use of the symbols he acquired (Savage-Rumbaugh, 1990). Kanzi's acquisition of communicative symbols has been attributed to his participation in "cultural routines" with his human caregivers (Savage-Rumbaugh, 1990; Tomasello, 1992a, Tomasello, Kruger, & Ratner, in press). These routines consisted of recurring (and therefore predictable) activities engaged in by the chimp and his caregivers. The fact that only the chimps who participated in these activities acquired flexible communicative skills is important, as routines have been shown to play an important role in the child's acquisition of language.

The concept of routines or event structures (Nelson, 1986) is central to the social-pragmatic approach to language acquisition, the main competitor of constraints theories (Tomasello, 1992a). It is now widely recognized that much of children's early language is learned in the context of structured formats (Bruner, 1983) and recurring social-interactional activities such as feeding, bathing, reading picturebooks, etc. (Barrett, 1986; Nelson, 1985; Ninio & Bruner, 1978; Ratner & Bruner, 1978; Snow, Dubber, & de Blauw, 1982; Snow & Goldfield, 1983). The predictability of the routines engaged in by child and adult allows the creation of a

"shared referential context in which the language of the adult makes sense to the prelinguistic child" (Tomasello, 1992a, p. 70). Adults thus scaffold the young child's entry into language by providing recurring formats associated with specific meanings/intents. Infants also contribute to the process by actively engaging in interactions with their caregivers. What Trevarthen (1979; 1980) calls primary intersubjectivity may be a more general constraint with which all humans are endowed at birth.

Simply engaging in interaction, however, is not enough. Becoming a full participant in social/cultural interactions requires the ability to coordinate attention with one's interactant, and the eventual ability to take the other's perspective (Tomasello, 1992a; Tomasello, et al., in press). It is through repeated interactions with adults that the ability to attend jointly to objects develops (Bakeman & Adamson, 1984; Moore & Corkum, 1992). The coordination of attention to an object with another's attention to the same object (joint attention) is analogous to Trevarthen and Hubley's (1978) concept of secondary intersubjectivity, and is crucial to the process of language acquisition. Achieving secondary intersubjectivity is the child's first step in the construction of meaning (Bruner, 1986; Bruner & Haste, 1987; Nelson, 1985); i.e., joint attentional episodes are necessary for the child to begin to make sense of the communicative intentions expressed in adults' speech (Bruner, 1983; Tomasello, 1988). Thus, the adult's use of social routines facilitates the child's emerging ability to participate in joint attentional episodes and thereby provides the child an entry into the meaning of adult utterances.

In this social-pragmatic view of early language, there is no need to posit specific linguistic constraints on the acquisition process because if the child knows the adult's focus or intent, he or she can use this information to guide hypotheses about sound-to-meaning mappings. That is, in routine situations the child has a well-formed "script" of what is going on (e.g., having lunch, taking a bath), and

can use this knowledge in determining what the adult is referring to with a given word or utterance (Tomasello, 1992a; Nelson, 1986). Many of the constraints that have been proposed to account for early word learning can be re-interpreted as strategies or operating principles (Golinkoff, Mervis, & Hirsh-Pasek, 1992) that children have learned from their experience in interaction with adults (Nelson, 1988; 1991; Tomasello, 1992a; 1992b). Consider, for example, Markman's (1991) whole-object assumption which states that when children hear a novel label they will assume it refers to an object as a whole and not to its parts, substance, color, etc. Although Markman calls this assumption an "initial constraint" on word meanings, it may be a strategy children have learned through exposure to consistent naming practices (Echols, 1991). If in ostensive/naming situations an adult typically uses words to refer to objects rather than to their parts, the child may assume that any new label heard in a similar situation refers to the whole object, and not to some attribute or part.

There is, in fact, some evidence indicating that mothers do tend to name whole objects in their speech to young children. Ninio (1980) examined mothers' naming practices with 40 children aged 1;5 to 1;10 and found that 95 % of the labels produced while pointing to pictures referred to whole objects. On the occasions when a part of an object was the referent, the mothers made the part-whole relation clear by mentioning the whole object as well as the part. While a proponent of linguistic constraints might interpret this maternal behavior as an example of parents adjusting their behavior to match their children's biases, it is just as likely the case that the children have acquired a whole-object strategy through exposure to the repeated naming practices of their parents (Golinkoff et al., 1992; Nelson, 1990). Children's general knowledge of ostensive situations - pointing, labelling, and picture books are all salient cues in the "original word game" (Brown, 1956) - plus

the specific pairing of whole objects and labels in maternal speech would be sufficient information from which to generate such a strategy.

A similar argument can be made concerning Clark's (1987) Principle of Contrast (similar but not identical to Markman's (1991) Mutual Exclusivity assumption) which states quite simply that every two forms in a language (words, and morphological markers) will contrast in meaning. As with the whole-object assumption, it is quite possible that this principle is actually a strategy that the child has learned from the behavior of mature language users. Adults generally use different words for different things so it is only reasonable for the child to hypothesize that novel expressions refer to things he or she does not already have words for. Thus, the principle of contrast need not be an innate linguistic constraint but a hypothesis based on the child's input (Tomasello, 1992b).[2] In recent formulations, Clark (1988; 1990) has suggested that use of this hypothesis/strategy presupposes the child's understanding of intentionality in the adult. This suggestion is an implicit endorsement of a cognitive-developmental basis - understanding of intentionality - for the principle of contrast (Nelson, 1990).

The child's understanding of intentionality forms the basis of the social-pragmatic view of language acquisition. Tomasello (1992b, p. 267) states that, in learning a first language, the child must be able to "conceive of the adult as an intentional agent, and indeed to perceive the adult's specific intentions." Participating in episodes of joint attention with an adult, and understanding his or her intentions in producing particular utterances, are presumed to facilitate the child's early acquisition of lexical items (Bruner, 1983; Tomasello, 1992a; 1992b; Tomasello & Todd, 1983; Tomasello & Farrar, 1986). Later, with some lexical knowledge in place the child can bootstrap his/her way to further linguistic accomplishments (Gleitman, 1990; Landau & Gleitman, 1985; Shatz, 1987; Tomasello, 1992b). As indicated previously, the social-pragmatic approach to

language acquisition assumes that the young child possesses considerable knowledge of routine situations (i.e., event knowledge), and that this knowledge, along with the ability to engage in joint attention enables him/her to develop an understanding of adults' intentions. This understanding of intentions (particularly communicative intentions) is seen as a necessary first step in language learning (Tomasello, 1992b).

The focus of this dissertation is an exploration of the early comprehension of communicative intent. As indicated above, there are two general approaches to the child's early linguistic competence: universal constraints versus social-pragmatic learning. The research reported in Chapters 3 and 4 examines a specific "constraint" or bias that has been proposed to account for children's responses to multiword speech (Shatz, 1978a); i.e., that children begin language learning with a bias to respond to speech with action, regardless of the intentions of their social partners. This view is pitted against the more generous claim of the social pragmatists that, from a very early age, children are sensitive to the communicative intentions of their partners. This latter claim requires a great deal more of the young child in the way of social-cognitive abilities. While proponents of the social-pragmatic approach assume that such abilities are in place at the outset of language acquisition, they generally provide little evidence for their assumptions (Shatz, 1992). The material presented in the remainder of this chapter examines these assumptions and indicates that granting toddlers these abilities is not unreasonable. Brief reviews of three interrelated social-cognitive achievements - event knowledge, joint attention, and understanding intent - are presented. The reviews of the development of these abilities are not meant to be exhaustive but simply to illustrate that, by early in the second year, children have sufficient grasp of these skills (especially in familiar contexts) to provide a solid foundation for the acquisition of linguistic knowledge.

Early Event Knowledge

Recent views of cognitive development stress the fact that young children live in a dynamic world of events and propose that their earliest representations are in the form of event schemas based on their everyday experiences (e.g., Mandler, 1983; Nelson, 1985; 1986). Mandler defines an event schema as "a temporally organized representation of a sequence of events or ... a set of expectations about what will occur and when it will occur in a given situation" (1983, p. 456). Mandler also notes that event schemata are hierarchically organized in that each variable in a particular event schema embeds more detailed information; e.g., a restaurant schema may embed an ordering schema and a paying schema (Nelson, 1986). The variables or "slots" in event schemas are actually categories of event information such as actors, actions and props/objects (Lucariello, Kyratzis, & Nelson, 1992; Nelson, 1986). For example, in the peekaboo game many different objects can be hidden and revealed; thus, the infant can abstract a "hidden-object" slot for this particular event structure (Tomasello, 1992b).

There are at least two major advantages of the event representation model of early cognition. First, it offers an explanation for the discrepancy often seen between very young children's apparent cognitive and social competence in everyday activities and their failures on experimental tasks that supposedly tap the same abilities (Nelson, 1986). If young children's initial representations are in terms of their recurring event experiences, then they may not be able to operate on the more abstract information presented by most experimental tasks. According to developmental models of event representation (Nelson, 1985; 1986), children's experience with many different "slot fillers" leads to more abstract or decontextualized representations which enable them to perform as well on novel experimental tasks as they do in their familiar environments.

Second, and more important for present purposes, event representations offer a potential bridge between cognitive/Piagetian (e.g., Gopnik & Meltzoff, 1987) and social/Vygotskian (e.g., Bruner, 1983) approaches to early language learning (Lucariello, Kyratzis, & Engel, 1986). Cognitive approaches link various cognitive advances (e.g., object permanence) with specific linguistic achievements, but tend to ignore the role of social interaction in early language learning. Conversely, social-interactional approaches emphasize that the child is a social being from the outset, and that interactions with others are crucial in the language learning process, but they generally do not address the type of cognitive system the child might rely on in this process. A synthesis of these views is possible if it is assumed that the child forms "cognitive representations of social-interactive events" (Lucariello et al., 1986, p. 139). In this view, the child's participation in social routines forms the basis for the development of early event representations which in turn guide future interactions. These event representations provide a "cognitive context" for the language learning child (Nelson, 1986).

Most of the research on the structure and content of event knowledge has been based on the verbal reports of children aged three years and older. However, there is some evidence (reviewed by Fivush, 1987) indicating that even younger children have organized representations of familiar events, and that these representations may be formed fairly rapidly (Bauer & Mandler, 1992; Myers & Mervis, 1989). For example, O'Connell and Gerard (1985) have shown that toddlers are more likely to imitate familiar sequences of actions that form a cohesive event than actions that do not belong together. Evidence that even younger infants can represent events comes from studies of early social games engaged in by infants and caregivers in the infant's first year of life.

Bruner and his colleagues (e.g., Bruner, 1983; Bruner & Sherwood, 1976; Ratner & Bruner, 1978) have examined early games in some detail and have

proposed that a number of features of these games may be important for language development. One such feature is that a given game involves a highly restricted semantic domain and an invariant structure[3] which enables the infant to understand and anticipate the sequence of actions associated with that game. For example, one dyad's version of the peekaboo game always involved four major components - Preparation, Disappearance, Reappearance, and Reestablishment - each of which was composed of two or more constituents. Constituents were always segmented by pauses, making it easier for infants to attend to each constituent separately, and were often but not always verbally marked. A second important feature of games is that whereas the "deep structure" or sequence of components is invariant, the constituents by which these components are realized are free to vary; thus, as in language, different "surface structures" can be associated with the same invariant deep structure. A third aspect of games that may be important for language development is that, within a given game, role structure is reversible. Thus, in the early months of a game, the mother[4] plays the role of agent while her infant is the experiencer of her actions, but over the second half of the first year the infant becomes a more active participant, both initiating games and assuming the role of agent (Bruner, 1983; Hodapp, Goldfield, & Boyatzis, 1984; Snow et al., 1982).

An experiment conducted by Ross and Lollis (1987) provides particularly convincing evidence of this active involvement. Nineteen infants were observed playing with a female experimenter at three-month intervals from 9 to 18 months. On each visit infants played four games with the experimenter and at specified intervals the experimenter was cued to stop playing for 15 seconds. These interruption periods were designed to remove adult scaffolding briefly in order to assess infants' understanding of game structure. The frequency of infants' communicative behaviors during interruption periods was compared to the rates of these same behaviors during corresponding game periods. Results indicated that

"when the adults failed to participate, the infants showed considerable independent understanding of the games" (Ross & Lollis, 1987, p. 245). This understanding, as evidenced by the number and variety of communicative acts performed, certainly increased with age, but even at the younger ages, 40% of the interruption periods resulted in behaviors that made reference to both the adult partner and the game toys. Even at 9 months of age the infants showed "knowledge of the content of the game roles, of the repetitive quality of the games, and of the relation between their roles and those of their partners" (p. 246). As will be shown below, this knowledge of games/routines plays an important role in the development of joint attention and understanding of communicative intent.

Development of Joint Attention

There are a number of reasons for the recent interest in the developmental origins of joint attention (for a review, see Adamson & Bakeman, 1991). Joint attentional episodes may play a role in processes as diverse as emotional regulation (Campos, Campos, & Barrett, 1989), and the growth of "cultural meaning" (Bruner & Haste, 1987; Cole, 1985; Newson, 1979). Understanding attention in others has also been described as a possible precursor to a theory of mind (Baron-Cohen, 1991). Most important for present purposes, however, episodes of joint attention provide "the context in which communicative intentions are thought first to emerge" (Adamson & Bakeman, 1991, p. 6). Bruner (1983) is even more specific on this point: "The problem of how reference develops can ... be restated as the problem of how people manage and direct each other's attention" (p. 68).

Joint visual attention is perhaps the earliest form of joint attention that is relevant to the development of referential communication (Butterworth & Grover, 1988; Schaffer, 1984). It is defined simply as "looking where someone else is looking" (Butterworth, 1991a, p. 223). Note that this definition does not imply that the participants are aware that they are engaging in joint attention, only that they are

both focused (visually) on the same target. There are a number of ways that such an outcome can be achieved.

Butterworth and his colleagues (Butterworth, 1991a; Butterworth & Cochran, 1980; Butterworth & Grover, 1988, 1990; Butterworth & Jarrett, 1991) have proposed three developmental mechanisms (described below) for the infant's achievement of joint visual attention. In their experimental paradigm, the infant sits face-to-face with his or her mother in a room with pairs of identical target toys to the left and right. The mother interacts normally with her infant and is cued at regular intervals to turn and fixate one of the targets. The session is videotaped and measures of the infant's gaze direction and localization accuracy are obtained.

The first mechanism emerges at about six months of age[5] when the infant can reliably turn in the direction indicated by the mother's gaze. At this age, however, infants cannot localize the specific target that the mother is fixating; they look in the appropriate direction (left or right, but never behind their bodies) but then stop at the first object they encounter along their scanning path (Butterworth & Cochran, 1980; Butterworth & Jarrett, 1991). Butterworth (1991a) calls this mechanism "ecological" because achieving joint attention at this age depends as much on the characteristics of the environment as on sensitivity to the mother's cues; i.e. whatever it is in the natural environment that captures the mother's attention is also likely to capture the infant's attention once he/she catches sight of it. Turning in the same direction as the mother enables the infant to end up focused on the same object/event; thus, joint visual attention at six months is restricted to the first object encountered in the infant's visual field and would not seem to require the infant's awareness of the referential object of his/her mother's behavior (Moore & Corkum, 1992).

At around 12 months the infant is able to localize stationary targets accurately, whether first or second along the scanning path. This new ability is taken as

evidence for a "geometric" mechanism whereby the infant can extrapolate from the mother's head and eye orientation to the object of her gaze (Butterworth & Grover, 1990; Butterworth & Jarrett, 1991). At this age the infant intently fixates the mother while she is turning and then very quickly turns in the direction of the target (Butterworth & Jarrett, 1991). These aspects of the infant's response may seem to involve a more intentional analysis of the adult's behavior (but for an alternative explanation, see Moore & Corkum, 1992); however, at this age infants are still unable to search for a target outside of their visual field. Thus, if the mother fixates a spot behind the infant, the infant will either fixate a target in front or will not respond (Butterworth & Cochran, 1980). This is not due to an inability to turn because infants will do so in response to a loud noise behind them; their behavior is instead explained by "a basic inability to attribute the mother's signal to the space outside the immediate visual field" (Butterworth & Jarrett, 1991, p. 62). Some time between 12 and 18 months the infant overcomes this inability through use of a "spatial representational" mechanism. This mechanism allows him/her to search for targets behind him/her, but only if his/her visual field contains no targets (Butterworth & Jarrett, 1991, Experiment 2).

To summarize, according to Butterworth and his colleagues, infants first can match an adult's gaze direction (at around six months of age), then develop the ability to localize targets in the immediate visual field (at around 12 months), and finally (by 18 months) are able to search behind them in response to an adult's cues. It must be noted, however, that the developmental course just described is based on research examining infants' responses to adults' head turns accompanied by corresponding changes in gaze direction (i.e. congruent changes in head and eye orientation). Studies which have manipulated the cues of head and eye orientation show that congruent changes in head and eye orientation are more effective in eliciting infant responses than changes in eye orientation alone (Butterworth &

Jarrett, 1991, Experiment 2; Corkum & Moore, 1992; Lempers, 1979). It may not be until 18 months or later that infants will reliably follow changes in eye orientation alone (Corkum & Moore, 1992). Of course, congruent changes in head and eye orientation are probably those most frequently encountered by infants in their naturalistic interactions with adults; this fact plus the movement associated with a head turn (Lempers, 1979) may make the congruent head and eye change a more salient cue in joint visual attention tasks.

Another very salient cue used by adults to direct infants' attention is the manual point. Comprehension of manual pointing seems to follow a developmental pattern similar to that of comprehension of deictic gaze in that it is not until 12 months of age that infants are able to localize targets to which adults point (Butterworth & Grover, 1990; Lempers, 1979). Younger infants will fixate the pointing finger as often as they fixate the designated target (Butterworth, 1991a; Morissette, Ricard, & Gouin-Decarie, 1992). While adding pointing to a mother's change in gaze direction serves to increase six- and nine-month-olds' attention (i.e. the probability of a response is greater than when no point accompanies the gaze change), it does not increase their accuracy in target localization (Butterworth & Grover, 1990). Older infants' localization accuracy, however, is greatly enhanced by the addition of a pointing gesture, especially when motion is added to the target (Butterworth, 1991b).

Butterworth (1991b) argues that the emerging abilities to comprehend deictic gaze and manual pointing both rely on the geometric mechanism described above. This conclusion is supported by Lempers' (1979) significant positive correlation between understanding pointing (without a gaze shift) and understanding gaze shifts (without pointing) in 36 infants ranging in age from 9 to 14 months.[6] Further support for the hypothesis that these two abilities reflect a common underlying mechanism comes from Morissette et al.'s (1992) recent longitudinal

study of 24 infants observed at three-month intervals from six to 18 months. These researchers found a significant positive correlation between the onset of the ability to use gaze direction and the onset of the ability to use points to locate targets. Furthermore, neither of these abilities showed a clear developmental priority; they both emerged between 12 and 15 months of age. Although Morissette et al. interpret these developmental achievements as evidence for a common referential system, some caution is needed in interpreting early abilities to locate targets.

Various claims about the infant's understanding have been made on the basis of the infant's production of joint attention behaviors. Most often it is claimed that when an infant matches an adults' head turn, he/she has turned to see what the adult is looking at or what the adult is interested in (e.g., Baron-Cohen, 1991; Bretherton, 1991). Moore and Corkum (1992) call this the "commonsense" view of joint visual attention. They claim that this view implies that "not only does the infant understand the psychological relation between adult and object, but also understands the similarity between adult and self with respect to the possibility for such psychological orientations towards objects in the world" (Moore & Corkum, 1992). These authors posit a simpler mechanism for explaining behaviors such as gaze matching which does not require the infant's understanding of his/her own nor others' mental states; basically they describe a process whereby the caregiver initially shapes the child's looking response, and the child eventually learns that turning in the same direction as the mother will lead to an interesting sight. On their view then, early joint visual attention involves a simple coordination of secondary schemes: the scheme of responding to the mother's behavior and the scheme of turning in the direction of a target.

The proposed mechanism is a plausible one, although one might argue about the age at which such a mechanism would be replaced by a more sophisticated understanding of the infant's own and others' mental states, and exactly what

behaviors might serve as indicators of this developmental change. In any case, the specific mechanism involved in the infant's achievement of joint attention may not be critical.For present purposes, the important point is that the infant ends up focused on the same target as the adult, regardless of the mechanism by which this is achieved. The fact that "the perceptual systems of different observers 'meet' while encountering the same objects and events in the world" (Butterworth & Jarrett, 1991, p. 55) allows the infant to simultaneously perceive what the adult is perceiving[7]; i.e., to participate in joint attention. Even the earliest ecological mechanism has as its outcome a state where both mother and child are focused on the same object.

The research reviewed thus far has concentrated on only the infant's contribution to achieving joint attention but the establishment and maintenance of joint attention always involves the activities of at least two partners (Tomasello, 1988). The experimental studies described above were designed with the laudable objective of highlighting the infant's role in joint attentional episodes. Consequently, they provide no information on the adult's role in this same process and how this role might interact with the child's development (Schaffer, 1984). In naturalistic interactions it becomes quite clear that the young infant does not bear the full burden of determining the adult's focus. For much of the first year, the majority of joint attentional episodes are initiated by the mother either following into the infant's focus or actively leading the infant to attend to what she is attending to (Schaffer, 1984; Tomasello, 1988; Trevarthen, 1980). At some point between six and nine months, however, the infant becomes a more active "negotiator" in the organization of joint attention (Adamson & Bakeman, 1991; Bruner, 1983; Findji, Pecheux, & Ruel, 1992; Green, Gustafson, & West, 1980; Ross & Lollis, 1987; Stern, 1985), and is increasingly able to coordinate his/her attention to an object with attention to a person (Adamson & Bakeman, 1991; Bakeman & Adamson,

1984; Schaffer, 1984; Trevarthen & Hubley, 1978). Certainly by early in the second year, he/she is capable of actively searching for adult cues such as deictic gaze for the purpose of word-to-world mappings (Baldwin, 1991; 1992).

The bulk of research on the development of joint attention has concentrated on a specific type of joint attention: joint visual attention. The emphasis in the literature on joint perceptual (especially visual) attention - as opposed to joint conceptual attention (Tomasello, 1992a) - is probably related to the relative ease of operationalizing perceptual attention. This emphasis also fits well with child language researchers' tendency to focus on the acquisition of names for objects or "things you can bump into" (MacNamara, 1982). The trend is changing, however, with more research now being conducted on the acquisition of relational words, especially verbs (e.g., Behrend, 1990a; Tomasello, 1992b; in press; Tomasello & Kruger, 1992). These recent studies indicate that verbs are not typically learned in the ostensive contexts that have generally been linked with early object label acquisition (Tomasello, 1992b; in press; Tomasello & Kruger, 1992). Verbs are modelled most often by mothers before or after the child's performance of an action, rather than during it (Tomasello & Kruger, 1992). To learn these words, the child needs to know to what the adult is referring, but ostensive gestures will not help as the referent action has either already been completed or has yet to be performed when the word is uttered. Joint attention in these cases is not joint visual attention, but joint conceptual attention (Tomasello, 1992a).

Tomasello and Kruger (1992) outline a number of interesting possibilities for the types of cues children might use for joint conceptual attention in nonostensive contexts. In the "completed action" context, the child has just observed an action and has to link his/her memory of this action with the novel word used by the adult. Although it is not entirely clear how this is accomplished, the fact that some result of the action might be perceptually available at the time the new word is introduced

(especially for change of state verbs; Tomasello, 1992b) could aid the child in making the link; i.e., the perceptual change could serve as a cue for the action referent. The learning situation is reversed in the "impending action" context where the verb is modeled before the action is performed. Here, the child has at least two ways of linking the word with the referent action. One relies on auditory memory in that the child must hold the novel word in memory while observing the action being performed; recent research indicates that two-year-olds are able to do this (Tomasello, in press; Tomasello & Barton, 1992). The second option relies on the child's previous experience with the referent action in established routines, and has the advantage of somewhat lessening the short-term memory load. If, through repeated interactions, the child has become familiar with the referent action independent of language, then nonverbal contextual cues can evoke an "anticipation or image of the action about to be performed" (Tomasello & Kruger, 1992, p. 314). The child can link this image with the adult model of the new word. The connection between the child's mental image and the adult model is then reinforced when the referent action is subsequently performed.

These solutions to the problem of verb learning in nonostensive contexts all presuppose the young child's ability to represent mentally relevant aspects of the learning situation. Recent studies indicate that this presupposition is not unreasonable. By the end of the first year, children are able to represent recurring events (Bauer & Mandler, 1992; Nelson, 1986) and various other aspects of their natural environments (e.g., Meltzoff & Gopnik, 1989)[8]. Tomasello and Kruger (1992) argue that mental representations actually facilitate language acquisition as they reduce the perceptual attentional demands on the child; the child does not have to attend (perceptually) simultaneously to both the adult and the referent. Simultaneously experiencing the same representation as another is what is meant by

joint conceptual attention. Note that this definition does not require any conscious awareness of one's own or another's mental contents.

Early matching of mental representations (i.e., joint conceptual attention) is very likely to occur in the context of predictable event structures (Tomasello & Kruger, 1992). Bruner has suggested that early routines/games "provide an opportunity for distributing attention over an ordered sequence of events" (1983, p. 47). For example, an infant who is exposed to the same routine at mealtime every day will be able to anticipate his caregiver's upcoming actions on the basis of nonverbal contextual cues such as being placed in a high chair. If the caregiver precedes a particular action with a verbal description, the infant will be able to associate an image of the subsequent action with the word(s) used to describe it. In this context, the infant does not have to be aware that he and his caregiver are conceptually focused on the same action referent in order for language learning to proceed. As indicated in the review of joint visual attention, the fact that the infant and caregiver are simultaneously focused on the same object/action is sufficient. Thus, early on the infant is not required to read the adult's mind or intentions in order to establish joint conceptual focus; his/her burden is relieved by the predictability of the event structures he/she participates in. These event structures or routines may in fact provide the context in which infants first evidence an understanding of others' intentions (Bruner, 1983).

Early Understanding of Intent

Philosophers and researchers agree on the importance of intentions in adult (e.g., Searle, 1969; 1983) as well as child language (Bruner, 1983; Greenfield, 1980; Halliday, 1975; McShane, 1980). Whereas research with adults has examined their interpretations of speech acts (e.g., Clark, 1979), developmental studies have tended to concentrate on the child's expression of his or her communicative intentions (Coggins, Olswang, & Guthrie, 1987). For example,

Halliday (1975) has shown that instrumental functions generally emerge prior to informative functions. Considerably less attention has been paid to how the child comes to understand the communicative intentions of others (MacNamara, 1989).

Towards the end of the first year, usually around 9 months, infants begin to produce a variety of goal-directed behaviors that parents and developmental researchers interpret as intentional (e.g., Bates, 1979; Frye, 1991). Soon thereafter they begin to use vocal and gestural symbols to communicate intentionally (e.g., Bretherton, 1991; Bretherton & Bates, 1979). Bates (1979) defines intentional communication as "signaling behavior in which the sender is aware, a priori, of the effect that the signal will have on his listener and ... [the persistence] in that behavior until the effect is obtained or failure is clearly indicated" (p. 36). She also states that various behaviors such as gaze alternation and the use of different signals to achieve the same goal can be used to index the infant's communicative intentions. Based on this operational definition, it is clear that by the end of the first year infants are able to communicate intentionally.

Whereas most researchers agree on the intentional nature of the infant's behavior at this age, there is considerable disagreement as to when children begin to understand the intentions of others. The fact that researchers use different behaviors as evidence of understanding intent may offer an explanation for the great discrepancy in the literature regarding the age at which children can demonstrate this understanding. For example, developmentalists such as Dunn (1988; 1991), Stern (1985), and Reddy (1991) claim that teasing behaviors seen towards the end of the first year are evidence that the infant understands others' intentions and expectations. Astington and Gopnik (1991), on the other hand, define understanding intention as understanding that it is "a mediating factor between desire and action" (p. 50) and their studies show that this understanding appears around 4-5 years. As these authors themselves point out, however, the concept of

intention is very complex and even in adults "different aspects might be understood at different times" (p. 40). If this is true of adults, it is certainly plausible that infants and children may understand certain aspects of intentionality before others; i.e., the concept of intention is one that develops with maturation (e.g., symbolic thinking) and social experience (Barresi & Moore, 1992). Similarly, there are different types of intentional relations, and one would expect that simple action intentions may be easier for the young child to comprehend than, for example, embedded epistemic relations.

Astington (1991) has proposed that, prior to 4 years, the child's concept of intention is in fact tied to actions (rather than to mental states) and their associated outcomes . This position fits well with research showing that the child's understanding of intention emerges from an earlier notion of agency (Poulin-Dubois & Shultz, 1988; Shultz, 1991). Thus, the young infant's "understanding of intent" may actually be better termed an understanding of adults' actions. By 12 months, however, the child's perception of adults is not simply in terms of their "self-propelled movements" (Premack & Dasser, 1991). In addition to understanding adults as agents, they also understand them as perceivers; i.e., prelinguistic one-year-olds' strategic use of gaze indicates that they understand that "an agent's behavior depends on what he is attending to" (Gomez, 1991, p. 202). As indicated above, an understanding of adults' actions and adult focus is likely to emerge in recurring games or routines and may form the basis for a more mature understanding of intent, particularly communicative intent.

Before examining some of the evidence for young children's comprehension of communicative intent, it is necessary to provide a definition of this construct. As indicated above, it is important to bear in mind that there are different levels of understanding intent and that the concept of intention becomes increasingly complex with development. For the purposes of this dissertation, understanding

communicative intent is defined as the knowledge that different communicative acts require different responses. Early in development, this knowledge need not be conscious but is reflected in children's differential responding to the speech acts of others. Thus, a child who responds verbally or gesturally to requests for information and acts in response to directives can be said to be sensitive to the illocutionary force or communicative intent of these speech acts (or can at least discriminate between them) even if he /she is not aware of these distinctions. One might expect that younger children would have a more limited response repertoire and, therefore, a more limited understanding of intent as indexed by this measure. Consequently, the development of speech act comprehension would involve the construction of a larger reponse repertoire, increasing sensitivity to various cues to communicative intent, and the appropriate mapping of responses to specific speech acts. As with other cognitive skills, the processes involved in understanding communicative intent would also become more explicit (or accessible to consciousness) with development. The studies reviewed below and in the following chapter indicate that, by two years, children's responses in various communicative situations demonstrate considerable sensitivity to the communicative intents of those with whom they interact.

Data suggesting that children in the second year of life understand one specific intent - the intent to refer to or label an object or action - comes from lexical training studies (e.g., Tomasello & Farrar, 1986; Tomasello & Kruger, 1992). Although associative learning certainly plays a role in early vocabulary acquisition, two lines of evidence suggest that the child subjects in these studies are doing more than simply forming associative links between adult models and immediate perceptual experiences. First, as indicated in the review of joint attention, learning action words typically occurs in contexts in which the action referent is not perceptually available (Tomasello & Barton, 1992; Tomasello & Kruger, 1992). Second,

Baldwin's (1991) work has shown that when an 18-month-old child hears a novel label he/she will not link it to the object on which he/she is currently focused, but will actively search for cues to adult focus. Dunham, Dunham, and Curwin (1992) have recently replicated this result with 18-months-olds in a very different learning context. The children's behavior - which leads to correct label-to-object mappings even when the child is focused on the wrong object at the time the novel word is modeled- indicates that the child knows that the adult meant to refer to something and that it is his/her task to determine what that something is. Thus, data from lexical training studies show that in the first half of the second year children can understand an adult's intent to label. Recent research by Ninio (1992) suggests that by 18 months children may demonstrate sensitivity to a variety of other communicative intents as well.

Ninio coded the single-word utterances of 24 18-month-olds for communicative intent and then characterized the expression of each intent in terms of formal "realization rules". For example, the child's use of the word "more" to express the intent "Speaker proposes a repetition of previous action" was characterized as a rule whereby intent was realized by " a constant expression regardless of specifics of intent" (p. 94). In this example, "more" codes a request for the continuation of an action, regardless of what the specific action was. Conversely, the rule corresponding to the use of the word "tickle" for the same intent (i.e. a request to repeat the preceding action) was "realize intent by a variable expression covarying with a variable component of the message" (p. 95); thus, "tickle" in this case codes the specific action to be repeated. A pooled data base consisting of the single-word utterances of 48 mothers in speech to their children - deemed to represent the communicative environment of the child subjects - was subjected to the same analysis. Results indicated that an average of 95 % of children's realization rules (and 97% of their utterances) followed maternal models. Furthermore, the more

frequently a particular rule was modeled in the input, the higher the probability that it was adopted by the children. Thus, it appears that, at 18 months, "the meaning children attribute to one-word utterances is in terms of the intentional communicative acts speakers perform in uttering these utterances" (Ninio, 1985, p. 527).

Summary

The preceding reviews indicate that, by the middle of the second year, children have made major advances in their abilities to attend jointly to an object or activity, and to analyze (at a basic level) the intentions of their social partners. Neither of these skills requires the infant's conscious understanding of her own or others' mental states. Indeed, these abilities may themselves set the stage for the late-emerging ability to reflect on mental contents (Barresi & Moore, 1992). In general, infants display their most advanced understanding in the context of well-rehearsed routines or games. The process by which games facilitate social understanding involves the construction of event representations which act as "cognitive context" (Nelson, 1986) and allow the child to spread attention across a sequence of actions (Bruner, 1983). The cognitive context thus allows the child to predict reliably her social partner's actions. Precisely how children go from predicting actions to understanding intentions is by no means clear, but it appears from Ninio's (1992) work that by 18 months they are paying attention to the communicative intents associated with single-word utterances in their input.

It should be noted that the conclusion that 18-month-olds are "paying attention to intent" is based on a rather indirect measure of comprehension. Because Ninio's subjects used single words for the same intents (or in the same communicative situations) as their mothers, it is assumed that they originally processed the input speech in terms of underlying intent. However, there may be other explanations for the relationship between maternal and child use of the same rules for the realization

of intent. For example, adults could have shaped and reinforced any vocalizations that approximated an acceptable verbal realization of a specific intent (Ninio, 1992). Children's immediate responses to utterances varying in intent would provide a better (or at least more direct) measure of comprehension of communicative intent. Studies examining one- to two-year-olds' responses to multiword utterances are reviewed in the following chapter.

Chapter 2: Early sentence processing strategies

It is generally believed, by both parents and researchers, that children in the early stages of language acquisition are able to understand far more than they can say. This general observation that comprehension precedes production has been demonstrated at the level of single words (e.g., Benedict, 1979; Goldin-Meadow, Seligman, & Gelman, 1976; Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987) as well as more complex constructions (e.g., Sachs & Truswell, 1978; Shipley, Smith, & Gleitman, 1969). Parents' beliefs in their children's competence, however, are not based on research findings but on the simple observation that a child who is at the single-word stage in language production is nevertheless able to respond appropriately to many syntactically complex parental requests. For example, if a mother hands her child a block and says "Why don't you put this in your toybox?", the child may comply by placing the block in the toybox. It is this type of appropriate responding that parents interpret as evidence of relatively advanced comprehension skills.

It is now known, however, that appropriate responding is not always a reliable indicator of comprehension (Bloom, 1974; Gleitman, Shipley, & Smith, 1978). More formal observations by child language researchers have led to other, more parsimonious, interpretations of apparently competent performance. These researchers have demonstrated that a child in the early stages of language learning does not possess knowledge of grammatical relations, but rather relies on any of a number of comprehension strategies or shortcuts for understanding . A comprehension strategy has been defined as "a short-cut, heuristic, or algorithm for arriving at sentence meaning without full marshaling of the information in the sentence and one's linguistic knowledge" (Chapman, 1978, p.310). As children approaching the language learning task have few if any linguistic resources, their

early comprehension strategies tend to involve knowledge of events combined with use of contextual cues (Chapman & Kohn, 1978; Huttenlocher, 1974; Strohner & Nelson, 1974).

Studies of the development of comprehension strategies indicate that children first tend to rely on pragmatic and semantic strategies, and only later begin to use grammatical cues such as word order (Bever, 1970; Lahey, 1974; Strohner & Nelson, 1974; Wetstone & Friedlander, 1973). Thus, a child may first use the pragmatic strategy " Do what is usually done in this situation" in responding to parental requests, and later, when she has acquired sufficient nominals, may be able to "Locate the object mentioned" (Chapman, 1978). Finally, when vocabulary development is well underway, she may begin to rely on word-order strategies; e.g., the SVO (Subject-Verb-Object) strategy whereby the first mentioned participant in a sentence is interpreted as the agent of the specified action (Bridges, 1980).[9]

This chapter reviews observational and experimental studies that have examined one- and two-year-olds' responses to multiword utterances. An advantage of naturalistic studies is that they allow children to display their most mature understanding in interactions with familiar people (usually mothers) in familiar surroundings (Dunn, 1988). Data from naturalistic interactions coupled with more structured observations also allow one to develop hypotheses about the specific cues children are using in responding to speech. For example, Huttenlocher (1974) found that saying "Yes!" in a stern voice to a 10-month-old had the same impact as "No!" in that it caused the child to stop what she was doing. This response can be interpreted as indicating that the child was processing the intonation or prosody of the utterance. Systematically varying a linguistic cue such as prosody in an experimental design (e.g., Lahey, 1974) and determining its effects on children's

responses, however, provides stronger evidence for the role of that cue in comprehension.

Although, in general, experiments allow one to make stronger claims about the relationship between various cues to sentence meaning and children's response strategies, they can introduce other problems. For example, some experimental tasks in the comprehension literature require the child to act out sentences. The child's failure on such tasks may be due to a failure to comply, or to a failure to comprehend the task requirements, and may not index the child's linguistic comprehension at all (Golinkoff et al., 1987). One solution to this problem involves examining children's free responses to controlled sentences (e.g., Shipley et al., 1969; Smith, 1970); however, it is when evidence from naturalistic and experimental studies converges that one feels most confidence in a given factor's influence on children's responses.

The material presented in this chapter is organized in three main sections which review the young child's responses to multiword speech. Together, these reviews provide converging evidence for the influence of event knowledge, contextual and linguistic cues, and speech input in the young child's use of comprehension strategies. The first section presents an overview of observational and experimental studies of the development of comprehension strategies in children learning English as a first language. These studies reveal that lexical comprehension, contextual cues, and knowledge of everyday events, play important roles in the child's use of strategies in responding to speech. The second section consists of a brief review of cross-linguistic experiments on the development of sentence processing. These experiments highlight the role of input in the development of comprehension strategies in that specific form-function relations in the input language are shown to influence children's strategy use. The final section reviews studies examining children's responses to different utterance types. The majority of these studies

indicate that two-year-old children are able to discriminate different sentence forms (e.g., questions vs. declaratives), and even different functions associated with a given form.

The development of comprehension strategies: Studies of children learning English

While studies of speech act comprehension in preschool and school-aged children abound (e.g., Carrell, 1981; Garvey, 1975; Robinson & Whittaker, 1985; Spekman & Roth, 1985; Tyack & Ingram, 1977), there is considerably less research examining one- to two-year-olds' comprehension of different communicative acts. As suggested in the previous chapter, however, the existing research indicates that, from the earliest stages of language development, young children "actively seek to reconstruct for themselves the intentions of their mothers in communicating with them " (Bridges, Sinha, & Walkerdine, 1981, p. 116). At first these reconstructions rely heavily on the immediate context of adults' utterances. Reliance on context in comprehending utterances, however, is not limited to young children. Even adults base their understanding of speech acts on various aspects of the context in which these acts are performed (Clark, 1979; Searle, 1969). In some sense, there may be no such thing as a completely "decontextualized" utterance as the process of comprehension depends upon some form of context at every stage of development (Bridges et al., 1981). In this regard it is important to note that there are many different types of context - e.g., physical, linguistic, social/cultural, cognitive - that are used in the comprehension of language (Nelson, 1985). What develops is the child's ability to use flexibly different types of context in different communicative situations. Thus, the developmental process in comprehension can be viewed as the "gradual freeing of the child from dependence upon immediate [physical] context" (Bridges et al., 1981, p. 120, insertion and emphasis mine).

Some of the earliest contextual cues used by children are nonlinguistic; e.g., the mother's direction of gaze. When the mother looks at an object, particularly if she also points to it and/or shakes it, the infant will look at the object too (Chapman, 1978). If the adult has accompanied her behavior with the word "Look", the infant will appear to have understood and complied with her command. Thus, in the stage of "prelinguistic comprehension", the appearance of comprehension may be due more to the adult's judicious use of timing, gesture, and speech to capture the child's attention than to the infant's ability to comprehend intent (Bridges et al., 1981; Chapman, 1978; Paul, 1990).

Although adults continue to scaffold the child's understanding, developing object permanence in sensorimotor stages V and VI allows the child to evidence true comprehension of lexical items (Chapman, 1978; 1981; Miller, Chapman, Branston, & Reichle, 1980). Thus, the child is able to search successfully for absent objects in response to locative requests, particularly if the objects are kept in familiar locations (Huttenlocher, 1974). That comprehension at this stage is based on lexical and not syntactic understanding is demonstrated in the child's responses to requests for action. For example, if asked to make one toy act on another, the child will often perform the action himself. This "child-as-agent" strategy (Sinclair & Bronckart, 1972) is evidence that the child understands some of the lexical content of the utterance (the action word, and perhaps one of the object names), but does not process its syntactic relations.[10] At this age (12 to 18 months), children do not generally appear to use word order or other syntactic cues to sentence meaning. Rather, they rely on a combination of lexical and world knowledge in responding to speech (Chapman, 1978). Thus, appropriate responding to a request such as "Open the book" is not due to processing of the action-object relationship, but can be explained by the child's understanding the word "book" and knowing what is usually done with books (Paul, 1990).

Data from experimental studies also support the role of event knowledge in early comprehension (e.g., Bever, 1970; Chapman & Miller, 1975; Chapman & Kohn, 1978; Kramer, 1977; Strohner & Nelson, 1974). These studies provide evidence of a "probable event strategy" whereby the more probable relation between two nouns (in the child's experience) is preferred. A child using this strategy, when asked to enact the sentence "Baby carries mother", will make the mother figure carry the baby, as it is generally mothers who carry babies and not the reverse (Chapman & Kohn, 1978; Paul, 1990). Similarly, when given an anomalous command such as "Throw the chair", the child is likely to sit down on the chair (Kramer, 1977). Thus, the child uses his/her lexical understanding in combination with his/her knowledge of everyday events in responding to speech acts.

Even with increased word and world knowledge, however, situational cues continue to play an important role in the child's comprehension strategies in the second year (Bridges, 1980; Chapman, 1981; Chapman & Kohn, 1978; Paul, 1990). For example, Bridges (1980) and Chapman (Chapman & Miller, 1975; Chapman & Kohn, 1978) have demonstrated that some preschoolers show a positional bias in enactment tasks such that they tend to choose the toy nearest to hand as the agent of the action, regardless of the form of the test sentence. Other contextual cues that influence children's responses include gestural accompaniments to speech (Allen, 1991). Utterances accompanied by gestures are more likely to elicit responses from one- year-olds (Allen & Shatz, 1983; Schnur & Shatz, 1984). Gestures also influence the response mode chosen by the child, with more nonverbal (e.g., looking, action) than verbal responses produced after gestured utterances (Allen & Shatz, 1983). Thus, various cues present in the physical and communicative context influence one- and two-year-olds' responses to linguistic stimuli.

There is some disagreement as to whether toddlers can use syntactic information in responding to sentences (e.g., Chapman, 1978; Strohner & Nelson, 1974; Wetstone & Friedlander, 1973). Recent studies indicate, however, that two-year-olds may exhibit some sensitivity to word order (Golinkoff et al., 1987; Roberts, 1983). Some of the discrepancies in the literature may reflect the fact that the ability to attend to and process word order is just emerging in the third year (Roberts, 1983) and may be "vulnerable to disruption" (Paul, 1990, p. 67). Performance may also vary with specific task requirements (Hirsh-Pasek & Golinkoff, 1991). Thus, young children may be able to use word order in the preferential looking paradigm (Golinkoff et al., 1987; Hirsh-Pasek & Golinkoff, 1991), but may not be able to do so in tasks in which event probability and other more salient or well-established cues compete for attention (Paul, 1990). Evidence that two-year-olds learning English can and do rely on word order in enactment tasks is shown in the cross-linguistic studies of sentence processing presented below.

Cross-linguistic studies of sentence processing

Most cross-linguistic research on the development of comprehension strategies has been conducted within the framework of Bates and MacWhinney's (1982; 1987; 1989; MacWhinney, 1987) Competition Model of language acquisition. According to this model, natural languages are viewed as "a class of solutions to the problem of mapping nonlinear meanings onto a highly constrained linear medium whose only devices are word order, lexical marking, and suprasegmentals" (Bates & MacWhinney, 1989, p. 8). These devices compete with one another as "cues" to sentence meaning, and different languages vary in the degree to which they rely on specific devices as cues to meaning. In English, for example, word order is a highly reliable cue for sentence interpretation in that the first noun is generally the subject of the verb; i.e., most simple sentences follow the SVO order. On the other hand, in highly inflected languages such as Serbo-Croatian, morphological markers

are more reliable cues to meaning than word order (Slobin & Bever, 1982). The following brief review of cross-linguistic studies indicates that children are sensitive, from a very early age, to the differential validity of cues in their native tongues.

Bates and her colleagues presented 40 English-speaking and 40 Italian-speaking children ranging in age from 2;6 to 5;6 with a sentence enactment task (Bates, MacWhinney, Caselli, Devescovi, Natale, & Venza, 1984). The sentences varied systematically in word order, animacy, and contrastive stress. The main findings were that, even at the earliest age tested, English-learning children used word order as the most important cue to sentence interpretation, whereas the children learning Italian relied on animacy in interpreting the test sentences. These are just the results one would predict on the basis of "cue validity" in the adult language: word order is the most reliable cue to sentence meaning in English, but semantic cues such as animacy are more valid in Italian which utilizes highly variable word orders.

Kail (1986) extended these results by including a comparison group of children learning French. The French language can be seen as intermediate between English and Italian in that it has a canonical SVO word order but it permits the use of SOV and VSO orders as well. Kail's results showed that the French-speaking children acquired the word-order strategy later than English-speaking children, offering further evidence for the young child's sensitivity to cue validity in his/her native language.

The acquisition of cues within a single language - Hungarian - also provides support for the Competition Model. MacWhinney, Pleh, and Bates (1985, Experiment 1) asked Hungarian children to enact simple sentences varying in four cues: case marking, animacy, word order, and stress. Their results indicated that the relative order of acquisition of these cues depended on their relative validity (i.e. availability and reliability) in the adult language. Thus, it appears that children as

young as 2;6 are paying attention to specific form-function relations in the input they receive from adult speakers. In interpreting sentences, children exposed to English rely on word order (Bates et al., 1984), while those learning Italian (Bates et al., 1984) and Hungarian (MacWhinney et al., 1985) use animacy and case marking respectively. That two-year-olds can also process combinations of word-order and inflectional cues is shown in studies by Hakuta (1982) and Slobin and Bever (1982).

Hakuta (1982) presented two- to six-year-old Japanese children with simple active and passive sentences to enact. Results indicated that these children employed a strategy whereby a morphological marker -specifically, the postposed particle "ga" - and word order were combined. Their responses to the test sentences indicated the use of a "the first noun marked by -ga is the agent" strategy (Hakuta, 1982, p. 68). Thus, children are equally "prepared" to learn inflectional and word-order languages (Slobin & Bever, 1982; Weist, 1983). Their relative reliance on one or the other of these strategies (or a combination) is determined by the characteristics of the specific language to which they are exposed.

The research reviewed thus far demonstrates that two-year-old children are able to make use of linguistic and contextual cues, as well as world knowledge, in responding to multiword speech. Results of the cross-linguistic studies indicate that, by two-and-a-half, children have learned which semantic and syntactic devices most reliably convey meaning in their native tongues. It has not been demonstrated, however, whether use of these and other cues/devices enables children to respond differentially to the communicative acts of others. An overview of studies examining one- to two-year-olds' responses to different sentence types (e.g., yes/no questions vs. wh-questions), and different pragmatic functions (e.g., requests for action vs. requests for information) is presented in the following section.

Differential responding to speech acts

As indicated previously, there is relatively little research directly examining one- and two-year-olds' comprehension of different speech acts. The preceding sections of this chapter have shown that young children use the same cues as adults in interpreting simple utterances - that is, linguistic and contextual cues, as well as their background knowledge - although they may do so less flexibly than adults. It is therefore reasonable to suggest that they can use these cues in responding to the speech acts of others.

Most of the research on toddlers' responses to multiword speech has examined their responses to maternal questions. There are at least three reasons for this emphasis on responses to questions. First, questions are very frequent in adults' speech to children (Ervin-Tripp, 1970; Snow, 1972). Second, questions are associated with a variety of pragmatic functions; e.g., a yes/no question can be used to request action or to request information (Keenan, 1974; Shatz & McCloskey, 1984). Third, from the earliest stages, children are more responsive to questions than to other sentence types (Bloom, Rocissano, & Hood, 1976; Hoff-Ginsberg, 1990).

The specific form of their responses also indicates that one- and two-year-olds can discriminate questions from non-questions (Bloom et al., 1976; Ervin-Tripp, 1970; Olsen-Fulero & Conforti, 1983; Shatz, 1978b; Shatz & McCloskey, 1984). For example, two-year-olds respond with more verbal, on-topic utterances to questions than to declaratives (Bloom et al., 1976). Shatz (1978b) has shown that they also discriminate between imperatives and question-directives. In a naturalistic study of three children's responses to maternal directives, she found that action reponses to question-directives were often accompanied by nods and/or a verbal "yes". These gestures and verbalizations never accompanied responses to imperatives. This qualitative difference in responses serves as evidence that the

children were sensitive to the difference between imperatives and question-directives.

On what basis do these young children make distinctions between different sentence forms? One obvious candidate for the distinction between questions and non-questions is intonation contour. Ferrier (1985) reviews several studies indicating that early attention to speech contours underlies the young child's increased responsiveness to questions. Specifically, rising contours are used and comprehended by one-year-olds as turn-allocations or requests for some sort of response. There are also individual differences in the specific responses associated with rising intonation: two of Ferrier's (1985) 12-month-old subjects used rise only to request action, and one responded to all uses of rise as if they were requests for information. It is interesting to note that individual differences in strategies used for comprehending rising contours were associated with maternal use of rise to perform specific speech acts. Recent research has shown that information about communicative intent is present in the prosodic characteristics of speech directed to preverbal infants (Fernald, 1989; Stern, Speiker, & MacKain, 1982). These findings lend further support to Ferrier's (1985) conclusion that 12-month-olds use intonation in responding to the speech acts of adults.

Intonation differences may also form part of the explanation of one-year-olds' early discrimination of two question forms: wh-questions and yes/no questions (Shatz & McCloskey, 1984). Ryan (1978) examined maternal speech to 12-month-olds and found that all questions without rising intonation were wh-questions. However, as a given wh-question was as likely to be uttered with or without a rise (Ryan, 1978), there must be some other factor(s) that young children attend to in discriminating wh- and yes/no questions. Shatz and McCloskey (1984) suggest that attention to intonation differences and lexical information (particularly at the beginning of the question) help children to distinguish between wh- and yes/no

questions. Evidence for this distinction is the fact that two-year-olds very rarely repond "yes" or "no" to a wh-question, but do so regularly in response to yes/no questions (Crosby, 1976; Horgan, 1978; Rodgon, 1979). The fact that two-year-olds can discriminate between these two question types does not, however, imply that they comprehend their form, content, and pragmatic force in the same way that adults do (Shatz & McCloskey, 1984). Detailed inspection of their response patterns indicates that, at this age, children tend to use specific strategies in responding to each of these question types (Allen & Shatz, 1983; Horgan, 1978; Steffensen, 1978).

Horgan (1978) and Steffensen (1978) both report that their one- and two-year-old subjects regularly responded "yes" or "no" to yes/no questions, but their responses were "lacking in semantic content" (Steffensen, 1978, p. 224); that is, they were not always appropriate as they often conflicted with other aspects of the child's behavior. For example, one child used one or the other of these particles exclusively for extended periods, and would often say "no" to a request at the same time as he was reaching to take what was offered. Another child used the strategy of imitating the final word of each yes/no question. These results indicate: 1) that one-year-olds are sensitive to the form and "answerhood conditions" of yes/no questions (Shatz & McCloskey, 1984), but have not yet mastered the semantics of yes/no particles (Steffensen, 1978); and 2) that there are individual differences in the strategies young children employ in answering yes/no questions (Steffensen, 1978).

There is also some evidence of individual differences in strategies for responding to wh-questions. Allen and Shatz (1983) presented five children aged 1;4 to 1;6 with common what-questions, and found that systematic response strategies were influenced by the children's participation in specific linguistic routines with their mothers. Specifically, the children interpreted what-questions to

be the wh-questions they were most used to hearing in interactions with their mothers. For example, the child who played the "Where's your _____ ?" game at home interpreted many of the what-questions as locative requests. On the basis of this result, Allen and Shatz (1983, p. 333) conclude that routines "provide a framework of lexical and pragmatic expectations according to which responses to some questions are formulated".

The preceding studies indicate that young children can distinguish different sentence forms (e.g., questions vs. non-questions, wh-questions vs. yes/no questions). They appear to make these distinctions on the basis of cues such as intonation and lexical content. Participation in linguistic routines also influences their responses to different sentence types. What is even more interesting for present purposes, however, is whether two-year-olds can discriminate between different functions (i.e., communicative intents) associated with the same form. As indicated previously, questions can be used for a variety of communicative functions. For example, they can be used to request action, or to request information. Even as requests for information they can be used to request specific or general information. Most of the studies reviewed below indicate that two-year-olds are capable of discriminating different speech acts associated with the same form.

Anecdotal evidence that young children appreciate the function or intent of speech directed to them comes from Brown (1977). Brown describes two distinct ways in which his subject Adam responded to his mother's why-questions. When these questions were used to request information, Adam responded with "because", but when they were used to request action, he appropriately responded with action. There was no evidence that Adam ever confused the two functions for which his mother used why-questions. Bruner concludes that Adam "evidently recognized the differing intent [behind his mother's use of the same form] quite adequately from

the start. He must have been learning speech acts, rather than simply the why interrogative form" (1983, p. 37). The fact that Adam's differential responding may have been based on linguistic (e.g. lexical content) and contextual cues (Shatz & McCloskey, 1984) does not diminish the significance of this result, as these are the same cues used by adults in interpreting utterances (Clark, 1979).

More evidence that children are sensitive to the communicative intentions of their adult partners comes from studies of their creative repairs (Golinkoff, 1986) or reformulations (Marcos, 1991; Marcos & Kornhaber-le Chanu, 1992) in response to adults' misunderstandings. Their behavior in these situations of communicative breakdown reflect considerable sensitivity to adults' communicative needs. The results of a recent study by Anselmi, Tomasello, and Acunzo (1986) are of particular interest because they indicate that one- and two-year-old children in the early stages of language production are able to differentiate between specific and general requests for clarification. These children tend to provide a repetition of their entire utterance in response to a general query such as "What?" or "Huh?", but respond with only the required information after a specific query such as "You want what?" Even though exact repetitions would form appropriate responses to specific queries, the children most often repeated only the asked-for information. This is evidence that they have not only understood the adults' utterance, but know that they are to "provide only that information of which the listener is unaware" (Anselmi et al., 1986, p. 144).

Furrow and Lewis (1987) extended this finding in an experiment demonstrating that the initial utterance in a contingent query sequence - that is, the utterance being queried - also influences the child's response to a request for clarification. Twenty-six children (nine two-year-olds) were videotaped playing for one hour. Twenty times during the play session an experimenter feigned non-comprehension of a comprehensible utterance by asking "What?". The social context of the child's

initial utterance, a rough indicator of the child's original intent, was shown to influence the child's response to the query . Specifically, there were fewer repetition responses (and more non-responses, or ignoring) when the child's initial utterance was a case of "private speech". Thus, these children not only provide information of which adults are unaware, they only do so when "the listener needs to be aware" (Furrow & Lewis, 1987, p. 476, my emphasis).

The results of Furrow and Lewis's (1987) experiment fit well with Shatz's (1978a, Experiment 2) data demonstrating that linguistic context (i.e., preceding discourse) affects children's responses to subsequent speech. In this experiment, 13 children were presented with "ambiguous" sentences that were preceded by either a sequence of imperatives, or a sequence of clear requests for information. The test sentences were considered ambiguous in that they could be taken as expressing either of two intentions: a request for information or a request for action. The results showed that the preceding linguistic context influenced children's reponses to subsequent ambiguous stimuli. Specifically, children were more likely to produce informing responses when the preceding sentences formed an "asking for information" context. Thus, two-year-olds seem sensitive to the overall pragmatic context in which adults' utterances are spoken. Shatz claims, however, that even at this stage, children may be "relatively insensitive to speaker intention" (Shatz & McCloskey, 1984, p. 32). This conclusion is based on a study of 18 children's responses to different sentence types presented in a "neutral setting" (Shatz, 1978a, Experiment 1).

Shatz (1978a) presented these children (aged 1;7 to 2;10 months) with eight sentence types, including declaratives and imperatives, as well as a number of forms typically used as indirect directives. She "tried to minimize nonverbal cues" (p. 280) in an attempt to provide a neutral context for these utterances. The main finding was the absence of a Sentence Type effect because action responding was

the dominant response mode for all the children. The fact that the children did not discriminate between any of the sentence types, but responded to all with action, was interpreted as evidence of an early action bias in responding to speech. Chapters 3 and 4 will examine alternative explanations for these results but, at this point, it is important to note that a recent study of children's responses to "pragmatically ambiguous" sentences showed no evidence of an action bias (Allen, 1991).

Allen (1991) asked sixteen children aged 1;5 to 2;4 what-questions that could take informational or action responses. These questions were presented with varying degrees of contextual support in the form of gestural accompaniments and preceding discourse. Although there was no significant effect of preceding discourse, the presence of gestures influenced the type of responses subjects made. Specifically, with no gestures, subjects made more informing responses. Conversely, the presence of gestures was associated with an increase in responses which combined action and verbal components. This increase was more pronounced for the two-year-old subjects. Allen concludes that even the youngest children had little difficulty in matching their responses to adult intent. They processed the test sentences pragmatically and did not "exhibit strong biases that are insensitive to linguistic features" (1991, p. 399).

Summary

The preceding reviews identified four major factors that influence the child's early comprehension strategies. First, his/her general world knowledge (Paul, 1990) or knowledge of event probabilities (Chapman & Kohn, 1978; Strohner & Nelson, 1974) influences the child's response strategies. Second, contextual cues such as gestures (Allen, 1991) and relative positions of referents (Bridges, 1980) affect both the probability and type of response the child produces (Allen & Shatz, 1983). Third, developing knowledge of lexical items (Chapman, 1978) and

prosody (Ferrier, 1985) also influences children's responses to adult speech. Finally, the language the child is exposed to influences his/her comprehension strategies. The relative strengths of semantic and syntactic cues present in the input language (e.g., Bates et al., 1984) and exposure to specific linguistic routines (Allen & Shatz, 1983) play important roles in determining how the young child responds to multiword utterances.

The cross-linguistic studies described above have indicated that, by 2;6, children are able to exploit the form-function relations in their native tongues, given detectable and reliable evidence of these relations in the input. MacWhinney et al. (1985) suggest that, at an earlier age, children may rely on more general response strategies such as the probable event strategy described by Chapman and Kohn (1978). However, even general response strategies based on event knowledge may not represent the first stage in the development of comprehension. Following Chapman (1978), a distinction can be made between a response strategy and a more general response bias, in which the child displays preference for a particular response mode, regardless of stimulus content or context. The following chapter introduces the possibility of an early bias in responding to speech (Shatz, 1978a), and tests this hypothesis in a longitudinal experimental design.

Chapter 3: The Action Bias Hypothesis

The preceding chapter has shown that young children's comprehension strategies are based on event probabilities and various contextual and linguistic cues. Although these early strategies certainly predate true syntactic comprehension, they may not represent the first stage in the development of comprehension abilities. It is possible that children first approach language learning with a more general response bias which is based on preference for a particular response mode, rather than on sentence content or context (Chapman, 1978). For example, Shatz and her colleagues (1978a; 1978b; Shatz & McCloskey, 1984; Shatz, Shulman, & Bernstein, 1980) have proposed that children initially possess a bias or constraint which causes them to respond to all sentences with action.

As a great part of a child's prelinguistic life is spent learning about objects and the actions that can be performed on them through active exploration and manipulation (Piaget, 1952), it seems likely that "their first representations of the world [will] be in terms of these action relationships" (Shatz, 1978a, p. 275). In fact, there is now a large body of evidence indicating that it is through caregivers' and children's repeated joint actions on objects that children first gain entry into language (e.g., Bruner, 1975; 1983). Thus, it appears quite plausible that a child might approach the language learning task with a bias to associate language with action. As a large proportion of parental speech to young children consists of direct or indirect requests for action (Akhtar, Dunham, & Dunham, 1991; Della Corte, Benedict, & Klein, 1983; Furrow, Nelson, & Benedict, 1979; Newport, Gleitman, & Gleitman, 1977; Schaffer & Crook, 1979; Shatz, 1978b; Shatz, 1979), children with such a bias would often appear to be responding appropriately.

Although parents do not intentionally use these speech acts in order to match their children's biases (probably the intention is to get things done), this unconscious collaboration of parent and child may facilitate language learning.

Brown (1977) has suggested that believing that a child can understand more than he can say is one factor that may lead parents into behaving in ways that facilitate language acquisition. Gleitman and Wanner (1982, p. 45) point specifically to the combination of parental use of directives and children's action bias and state that "such joint motivations in tutor and learner probabilistically increase the likelihood that the child's interpretation of the meaning of the maternal speech act will be correct". They also claim that these early interactions between parent and child allow the child to map quite transparently from initial lexical and propositional representations to meaning. Thus, a bias towards action responses may prove quite beneficial for children beginning to learn language.

Support for an early action bias comes from Chapman's (1978) review of the development of comprehension strategies. Some of the early strategies described by Chapman can also be interpreted as action-based strategies; e.g, "Do what you usually do in this situation", and "Locate the object mentioned". Additional evidence for an action bias comes from observations of children's errors in responding to speech. For example, the "child-as-agent" strategy seen in enactment tasks indicates that the child has interpreted the sentence as a request to perform an action himself, rather than to make one object act on another. At other times, errors consist of inappropriate actions, when a speaker did not intend to request any action from the child. Thus, a speaker's utterance might neither syntactically nor pragmatically request action, yet the child will respond with action.

In a recent study (Dunham, Dunham, Tran, & Akhtar, 1991) children were observed acting in response to declarative sentences which were not designed to elicit action. Two-year-old children were divided into two groups: contingent and noncontingent. In the first group, a robot responded contingently to all verbalizations by either imitating or expanding the child's utterance. In the noncontingent group the children were "yoked" to the contingent children such that

whatever the robot had said to a contingent child was replayed to the matched and yoked noncontingent child. Thus, each child in the noncontingent group was presented with a set of prerecorded utterances which were, by definition, not contingent on anything he/she was saying or doing. As these utterances were expansions of a contingent child's utterances, none were imperatives. In fact, none requested action even indirectly. Nevertheless, on several occasions children were observed to respond to the noncontingent robot with an action on the object of the utterance; e.g. to the sentence "There's a man on the table", one child responded by going over to the table, searching through the toys to find a toy figure, and then giving it to the robot. Thus, it appears that two-year-olds may often respond to language (in this case, noncontingent utterances) with action, regardless of the intentions of the speaker or the form of his/her utterance.

Shatz's proposal that children approach language learning with an action bias thus appears to have both theoretical and intuitive appeal. The presence of a response "bias" implies, however, that the young child does not pay attention to lexical and contextual cues, but responds to all sentences in the same way (in this case, with action), regardless of sentence content or context (Chapman, 1978). It should be noted at this point that the most explicit wording of the action bias hypothesis states that a young child will "respond with action a or with an action on some object o, where a and o are members of the set S the elements of which consist of actions or objects identifiable from the speech stream" (Shatz, 1978a, p. 275). Thus, it appears that the proposed bias does not preclude the possibility of the child processing lexical items. However, Shatz's claim is that, from the beginning, children essentially see interactions involving language as "calls for action". She describes the process of development as the gradual acquisition of linguistic and contextual "stop-action markers" (e.g., the word "Say"); i.e., in situations in which action is not feasible, children come to learn that another response is expected of

them. Thus, Shatz's view is that children are initially biased to act in response to speech and, after acquiring some lexical knowledge, use their limited comprehension of lexical items to determine the specific action to perform, or the object on which to act. In any case, the notion that two-year-olds evidence a bias in responding to sentences contradicts the bulk of the research reviewed in the preceding chapters. The reviews of the previous chapter in particular demonstrated that very young children's responses to multiword utterances are influenced by a number of factors, including knowledge of event probabilities, lexical knowledge, speech input, and contextual cues. Their responses to different speech acts (e.g., Allen, 1991) also indicates that they are sensitive to communicative intent, and not simply biased to act in response to all speech. It is therefore important to examine the empirical evidence on which the proposed action bias is based.

The main source of evidence is Shatz's (1978a, Experiment 1) study of 18 two-year-olds that was described briefly in Chapter 2. The reader will recall that these subjects produced a preponderance of action responses to a variety of sentence types, including declaratives; i.e. they did not differentiate sentence types, but responded to all with predominantly action responses. In addition, the direction of development was away from action responding; i.e., as MLU (mean length of utterance in words) increased in this sample fewer action responses and more informing responses were produced. Although these results support the action bias hypothesis, characteristics of the subjects, stimuli, and experimental context must be considered before generalizing the findings.

First, Shatz's subjects actually ranged in age from 1;7 to 2;10. These children also represented a range of linguistic abilities, as measured by mean length of utterance in words (MLU). Although it is not explicitly stated, it is quite likely that the oldest children were in the "high MLU" group and the youngest in the "low MLU" group (Conant, 1987; Miller & Chapman, 1981). If age and expressive

ability were confounded in this way, the high MLU group's superior performance could not be attributed solely to their linguistic sophistication, but may have been due largely to their experience and/or cognitive maturity. In any case, a longitudinal design is the only appropriate means of addressing the developmental issue. In the present study, we observed the same children at two ages (1;6 and 2;0) and employed a larger sample.

A more serious difficulty with the procedure used to test for an action bias involves the test sentences and the context in which they were presented. Shatz herself indicates the need for a neutral context if one is testing for a bias; i.e., one would not want aspects of the stimuli or the way they were presented to influence responding. However, there are at least two possibly problematic characteristics of the stimulus sentences employed in the original study. First, Shatz states that the majority of her sentences were "ambiguous" because they could be interpreted as either requests for action or requests for information. This may be true from an adult's perspective but to a child who is accustomed to hearing these forms used as directives, they may not be at all ambiguous or neutral.[11]

Second, all of the sentences contained action verbs and mentioned objects that were present and could be acted upon. Action verbs and names of objects that are present may both serve as cues for action responses. In fact, in a more recent reexamination of the original data it is observed that "two-year-olds ... respond with action to yes/no questions when action is mentioned in the question" (Shatz & McCloskey, 1984, p.26). As yes/no questions that did not mention action were not presented, however, the critical comparison cannot be made. In the present study, the presence of action verbs and object names were orthogonally manipulated within two types of yes/no questions which were presented in the same random order to all subjects.

As indicated above, it is not only characteristics of the test sentences that need to be examined or controlled. The context in which these sentences are presented is also an important factor. Although in practice it is difficult (if not impossible) to provide a truly neutral context, there are a number of contextual features that are known to influence children's responses and that should be controlled when testing for a response bias. For example, gestures such as pointing are strongly (although not exclusively) associated with action directives (Schaffer, Hepburn, & Collis, 1983), and are known to affect children's responses (Allen, 1991). Although Shatz attempted to avoid the use of gestures and other nonverbal cues such as intonation, it is not clear that she was successful. For example, even a relatively subtle cue such as the experimenter looking at the object mentioned in a sentence might influence a child to act on that object. Similarly, the fact that the relevant toys were actually placed in front of the child before a sentence was delivered could have cued the child to act on them. These problems are further compounded if the experimenter's use of nonverbal cues interacted with the age of the subjects. For instance, it has been shown that younger children tend to "elicit" more nonverbal cueing (i.e. gestures) from their mothers (e.g., Shatz, 1979), although these gestures may serve more as attention devices than as cues to illocutionary force (Chapman, 1981; Schnur & Shatz, 1984). In any case, the point is that young children may influence the verbal and nonverbal behavior of their social partners in subtle ways (Smolak, 1987; Snow, 1972) and this behavior can in turn influence child responses (Yoder & Kaiser, 1989).

The solution to this problem of having human interactants delivering sentences to children is of course to use prerecorded test sentences; i.e. a tape recording of sentences eliminates the problems of nonverbal accompaniments, and any subtle influences the child might have on an experimenter's delivery of the test sentences. In the past it has been notoriously difficult to get young children to respond to tape

recorders (e.g., Shipley et al., 1969). Recent evidence suggests, however, that two-year-olds are quite willing to interact with an immobile robot who is fitted with a tape player (Akhtar & Dunham, 1991; Dunham et al., 1991). Dunham et al. (1991) have in fact demonstrated that two-year-olds' verbal responses to the robot's contingent speech do not differ significantly from their verbal responses to maternal speech. They respond as often with adjacent (mean = 31 utterances) and on-topic (mean = 19 utterances) speech in a five-minute session with the robot as they do in the same amount of time with their mothers in the same setting (an average of 24 adjacent utterances and 18 on-topic utterances). These results argue that use of a robot as a "social partner" to achieve experimental control does not sacrifice the ecological validity of the data obtained. Thus, in the present study a robot was used to deliver test sentences.

This small robot functioned as a novel stimulus which effectively held the child's attention and allowed for greater control over sentence presentation. As indicated above, when testing for a bias in children's responses to sentences, it is necessary to provide as neutral a context as possible. Use of the robot offers several advantages over previous tests of young children's responses to sentences. First, it eliminates subtle extralinguistic cues such as gesture and direction of gaze which are known to influence children's responses to sentences (Allen, 1991; Allen & Shatz, 1983; Chapman, 1978). Second, the use of prerecorded sentences allows for all aspects of the test sentences (e.g. prosody) to be held constant across children. Thus, there was no possibility of the child influencing delivery of the sentences. Finally, the positions of toys in the room relative to the speaker/robot and child were random. Toys were scattered throughout the playroom on the child's arrival, and were not placed "in the child's line of sight" (Shatz, 1978a, p. 280) prior to sentence delivery. These three advantages of having a robot present prerecorded sentences all have the effect of providing a more neutral context in which to test

Shatz's (1978a) action bias hypothesis. The main question addressed in this chapter is, given a more neutral context, do young children (aged 18- and 24-months) evidence a bias to respond with action to test sentences? The lexical content of these sentences was systematically varied such that half contained action verbs (the other half, copula verbs) and half contained names of objects/toys present in the immediate context. The orthogonal manipulation of sentence content (action verbs, object names) in a factorial design enables one to test whether the presence of these lexical cues influences a child's choice of an action response. Finally, the use of a longitudinal design allows for developmental analyses.

Method

Subjects

Thirty-two eighteen-month-olds, originally identified from birth records at the Grace Maternity Hospital in Halifax, Nova Scotia, participated in the study. All of the children had taken part in previous studies in the Infant Development Laboratory at Dalhousie University. Their mothers were contacted by telephone and were asked to participate in a study within two weeks of their child's turning 1;6. The data from one male and three female subjects were eliminated due to technical difficulties (one female), or because they were unable to return for the 2;0 visit (one male, two females). Thus, the final sample consisted of 28 subjects: 13 males (10 firstborns) and 15 females (six firstborns). Further information on the demographic characteristics of this sample is provided in Appendices A and B.

Apparatus and Procedure

The procedure consisted of three main phases, all of which took place in a 4.2 X 5.8 m playroom in the Dalhousie Infant Development Laboratory. The playroom contained an adult-sized chair and table in one corner and in the opposite corner a videocamera and operator were located behind a wooden partition. The camera

protruded above the partition, and the operator observed the scene on a closed-circuit television monitor. The experimenter sat in an adjoining room and observed through a one-way mirror. A child's table with two small chairs were located in the center of the room, and the robot (Radio Shack Model Robie Senior) stood next to this table. The robot had a painted smile and pupils, and wore a blue hat and white cotton shirt which covered the tape player, speaker and controls. At the beginning of each play session, the toys were placed in standard positions: a Duplo farm set on the child's table, two large stuffed frogs, a stuffed snake and two Nerf balls on the floor. A basketball net was located on one wall, and Duplo blocks were placed on the table beside the adult-sized chair. The reader is referred to Dunham et al. (1991, p. 1492) for a figure illustrating the experimental set-up.

After obtaining informed consent, the experimenter asked the mother to complete a comprehension checklist consisting of the content words that were used in the 24 test sentences. The mother was then asked to play with her child for a 10-minute warm-up session (Phase 1) which allowed the child to become familiar with the setting, and provided a corpus of maternal utterances from which measures of maternal speech style were obtained (see Chapter 4). Before leaving the room, the experimenter introduced the child to the robot, indicating that he was "sleeping" at the moment but would later wake up and play with him/her. The subjects were initially seated at the small table with the Duplo farm set, but mothers were told to feel free to allow their children to move about the room to explore other toys. A microphone hung from the ceiling above this table recorded maternal and child utterances.

In the second phase, the robot "woke up", introduced himself to the mother and child, and interacted with both of them. The mother was instructed prior to the session that when the robot began to speak she was to encourage her child to interact with it. During this phase (which generally lasted three to four minutes) a

female experimenter, hidden behind the one-way mirror, conversed with the child through a microphone connected to the robot's speaker. She began by saying "Hi, (child's name). My name is Robie. I want to play with you." During this phase, the experimenter contingently responded to all of the child's verbalizations (with repetitions or expansions) and actions (by describing the actions). The experimenter/robot also attempted to introduce the child to all of the toys that were mentioned in the test sentences, while maintaining a natural and spontaneous interaction with the child. Throughout Phase 2, the mother was able to speak to and aid her child in any way. Phase 2 ended when the experimenter determined that the child was at ease with the robot as a social partner. At this time, the robot asked the mother to have a seat in the large chair and complete some forms, which included a demographic questionnaire and a vocabulary checklist (Reznick & Goldsmith, 1989). The mother had been instructed previously to complete these forms without speaking to her child. She was told to smile or nod assurance if the child wanted her attention, but to do so without speaking.

Once the mother was seated, Phase 3 (Test Phase) began. In this phase, 24 prerecorded test sentences were presented to the child.These sentences consisted of two types of yes/no questions: "Can you _____?" and "Are you _____?". Yes/no questions were used as test sentences because they are considered an "ambiguous" sentence form in that they are used by adults both to request information and to request action (Keenan, 1974; Shatz & McCloskey, 1984). Within these two sentence types were two levels of the Verb (action, copula) and Object (object, no object) variables. Thus, six sentences contained an action verb but no object, six contained an object but a nonaction (copula) verb, six contained both action verbs and objects, and six contained neither. Table 1 lists the full set of test sentences. Sentences were presented in the same randomized order to all subjects (see Appendix C for a list of the sentences in the order in which they were presented).

Table 1

Test Sentences organized by condition.

CAN YOU	ARE YOU
I. COPULA, NO OBJECT	
Can you be big?	Are you being big?
Can you be good?	Are you being good?
Can you be happy?	Are you being happy?
II. COPULA, OBJECT	
Can you be a boy?	Are you being a boy?
Can you be a girl?	Are you being a girl?
Can you be a doll?	Are you being a doll?
III. ACTION, NO OBJECT	
Can you jump?	Are you jumping?
Can you dance?	Are you dancing?
Can you sit down?	Are you sitting down?
IV. ACTION, OBJECT	
Can you jump on the frog?	Are you jumping on the frog?
Can you dance with the doll?	Are you dancing with the doll?
Can you sit down on the chair?	Are you sitting down on the chair?

A microphone and tape player connected to the speaker in the robot enabled the experimenter in the adjoining room to control the robot's presentation of the test sentences. A pause button on the tape player allowed the sentences to be presented at varying intervals. This feature enabled the experimenter to select the most appropriate time to deliver a particular sentence. Sentences were not delivered if the child was already engaged in the action mentioned in the upcoming sentence, or about to manipulate the toy mentioned in the sentence in question. Declarative sentences describing the child's current activity and/or focus of attention were interspersed with the test sentences in order to hold the child's attention. The test phase lasted, on average, about 14 minutes and ended with the robot saying, " Thanks for playing with me, (child's name). I had fun playing with you but I have to go to sleep now. Bye." The same procedure was repeated when the child returned at 2;0.

Classification of Responses

Responses to the test sentences were transcribed and classified according to a scheme modified from those of Shatz (1978a) and Allen and Shatz (1983). This coding scheme is outlined in Table 2. Prior to applying the scheme, a decision as to whether the child had responded was made for each test sentence. In order for a response to be coded, there had to be some change in the child's behavior (vocalizations, gestures, or actions) within 10 seconds of sentence presentation. Continuing an action or verbalization initiated prior to sentence presentation did not count as a response even if a pause intervened. Thus, a pause was considered evidence of attention, but unless some clearly identifiable change in behavior followed the pause, no response was coded.

The coding scheme for responses involved three main levels of analysis: 1) Response Mode (Action, Informing, Other); 2) Response Type (e.g., Informing

Table 2.
Classification of Responses

CODE	DEFINITION	EXAMPLE
Action Mode		
ACTION	performs identifiable action, not accompanied by verbalization	R: Are you sitting down? C: (sits on chair)
ACTION + VERBALIZATION	verbalizes during or immediately preceding performance of action	R: Are you sitting down? C: Okay (proceeds to sit)
Informing Mode		
INFORM-Verbal	verbal response, not accompanied by action	R: Are you sitting down? C: Yes
INFORM-Gesture	pointing, nodding, shaking head, not accompanied by action or verbalization	R: Are you sitting down? C: (nods)
INFORM- V+G	verbal response accompanied by a gesture, but no action	R: Are you sitting down? C: Yes (nodding)
Other Mode		
IMITATION	verbal reproduction of all or part of R's sentence, not accompanied by action	R: Are you sitting down? C: Down
CLARIFICATION	verbalization requesting a repetition or more information, not accompanied by action	R: Are you sitting down? C: What?
LOOKING	shift in gaze in response to sentence looks at R or some object	R: Are you sitting down? C: (looks at R)
UNCLEAR	unclassifiable responses	R: Are you sitting down? C: (begins to walk over to chair, but stops)
Appropriateness		
APPROPRIATE	response would be considered appropriate by an adult	R: Are you sitting down? C: (sits on floor)
RELEVANT	response not technically appropriate, but shows some semantic relation to sentence	R: Can you give the frog a hug? C: (walks over and touches frog)
INAPPROPRIATE	response is clearly irrelevant and inappropriate	R: Are you sitting down? C: Big
UNCLEAR	unintelligible verbalizations, unclassifiable responses	R: Are you sitting down? C: xxx

responses can be purely verbal, purely gestural, or some combination)[12]; and 3) Appropriateness (Appropriate, Relevant, Inappropriate, Unclear). Only Action and Informing response (which together constituted approximately 50% of all responses) were coded for appropriateness. Examples of responses falling in each of these categories are given in Table 2. The same coding scheme was applied to any responses children made to the filler declaratives.

Reliability Coding

An independent coder who was blind to the hypotheses coded all the responses of six subjects at each age. Average agreement was 85% for Response Mode (range = 71 to 96%), and 96% for Appropriateness (range = 88 to 100%). These figures did not change substantially when computed separately for the two age levels.

Results

The results are presented in three main sections: Responsiveness, Response Mode, and Appropriateness. Responsiveness analyses examined the distribution of all responses (collapsed over Mode; i.e. all Action, Informing, and Other responses were considered together) across age and stimulus conditions. Response Mode analyses examined only Action and Informing responses as a function of the various stimulus conditions and age. As not all of these responses could be coded for Appropriateness (e.g., some Informing responses were unclassifiable because they were unintelligible), a separate log-linear analysis was conducted on the frequency of Action and Informing responses that were classified as Inappropriate, Relevant or Appropriate.

Responsiveness

Tables 3 and 4 present the frequency of each response type as a function of the stimulus conditions for the 18-month and 24-month data respectively. On average, children responded to 13.7 of the 24 test sentences at 1;6 (st dev = 3.6, range = 6 to 23) and to 17.3 at 2;0 (st dev = 4.4, range = 7 to 24). A 2 (Age:1;6 and 2;0) by 2

Table 3

Mean frequency of each response type in each cell of the experimental design at 1;6. Standard deviations are in parentheses.

	CAN-YOU Questions				ARE-YOU Questions			
RESPONSE TYPE	no object copula	object copula	no object action verb	object action verb	no object copula	object copula	no object action verb	object action verb
Action	0.07 (.26)	0.14 (.36)	0.50 (.58)	0.57 (.63)	0.18 (.39)	0.11 (.31)	0.32 (.61)	0.29 (.46)
Action + V	0.14 (.36)	0.25 (.44)	0.43 (.57)	0.32 (.48)	0.14 (.36)	0.25 (.52)	0.21 (.42)	0.50 (.69)
ACTION MODE	0.21 (.42)	0.39 (.57)	0.93 (.72)	0.89 (.83)	0.32 (.55)	0.36 (.62)	0.54 (.64)	0.79 (.79)
Inform-V	0.36 (.62)	0.14 (.36)	0.25 (.44)	0.21 (.50)	0.29 (.46)	0.50 (.64)	0.29 (.46)	0.07 (.26)
Inform-G	0.11 (.31)	0.07 (.26)	0.00 (.00)	0.00 (.00)	0.07 (.26)	0.00 (.00)	0.00 (.00)	0.04 (.19)
Inform-V+G	0.00 (.00)	0.11 (.31)	0.07 (.26)	0.04 (.19)	0.04 (.19)	0.07 (.26)	0.14 (.36)	0.14 (.36)
INFORMING MODE	0.46 (.64)	0.32 (.48)	0.32 (.48)	0.25 (.52)	0.39 (.57)	0.57 (.63)	0.43 (.57)	0.25 (.52)
Imitation	0.07 (.26)	0.21 (.50)	0.04 (.19)	0.14 (.45)	0.14 (.36)	0.14 (.45)	0.07 (.26)	0.07 (.26)
Clarification	0.04 (.19)	0.11 (.42)	0.04 (.19)	0.11 (.42)	0.04 (.19)	0.04 (.19)	0.07 (.26)	0.04 (.19)
Looking	0.54 (.69)	0.29 (.53)	0.39 (.69)	0.43 (.63)	0.36 (.62)	0.39 (.69)	0.14 (.36)	0.54 (.79)
Unclear	0.39 (.79)	0.11 (.31)	0.14 (.36)	0.18 (.39)	0.21 (.50)	0.18 (.48)	0.43 (.57)	0.18 (.39)
TOTAL RESPONSES	1.71 (.98)	1.43 (.96)	1.86 (.93)	2.00 (.94)	1.46 (.84)	1.68(1.02)	1.68 (.90)	1.86 (.89)

Table 4

Mean frequency of each response type in each cell of the experimental design at 2;0. Standard deviations are in parentheses.

	CAN-YOU Questions				ARE-YOU Questions			
RESPONSE TYPE	no object copula	object copula	no object action verb	object action verb	no object copula	object copula	no object action verb	object action verb
Action	0.04 (.19)	0.04 (.19)	0.21 (.63)	0.21 (.50)	0.07 (.26)	0.04 (.19)	0.18 (.48)	0.00 (.00)
Action + V	0.11 (.31)	0.18 (.39)	0.46 (.79)	1.00 (1.02)	0.14 (.36)	0.18 (.48)	0.32 (.55)	0.61 (.69)
ACTION MODE	0.14 (.36)	0.21 (.42)	0.68 (.98)	1.21 (1.10)	0.21 (.42)	0.21 (.50)	0.50 (.64)	0.61 (.69)
Inform-V	1.04 (1.00)	0.79 (.76)	0.36 (.62)	0.46 (.79)	0.82 (.98)	0.68 (.90)	0.54 (.74)	0.61 (.83)
Inform-G	0.04 (.19)	0.04 (.19)	0.04 (.19)	0.00 (.00)	0.04 (.19)	0.00 (.00)	0.00 (.00)	0.00 (.00)
Inform-V+G	0.21 (.50)	0.29 (.46)	0.11 (.31)	0.07 (.26)	0.04 (.19)	0.11 (.42)	0.00 (.00)	0.04 (.19)
INFORMING MODE	1.29 (.98)	1.11 (.96)	0.50 (.75)	0.54 (.92)	0.89 (.96)	0.79 (.92)	0.54 (.74)	0.64 (.87)
Imitation	0.11 (.31)	0.21 (.50)	0.07 (.38)	0.00 (.00)	0.29 (.71)	0.25 (.59)	0.04 (.19)	0.11 (.31)
Clarification	0.04 (.19)	0.04 (.19)	0.14 (.59)	0.04 (.19)	0.04 (.19)	0.04 (.19)	0.04 (.19)	0.04 (.19)
Looking	0.07 (.38)	0.14 (.45)	0.18 (.39)	0.18 (.39)	0.07 (.26)	0.07 (.26)	0.25 (.52)	0.32 (.61)
Unclear	0.43 (.63)	0.61 (1.03)	0.50 (.75)	0.61 (.96)	0.39 (.92)	0.57 (.92)	0.75 (1.0)	0.54 (.74)
TOTAL RESPONSES	2.11 (.92)	2.32 (.94)	2.07(1.05)	2.57 (.69)	1.89 (.99)	1.89 (.88)	2.11 (.96)	2.29 (.71)

(Sentence Type: Can-You,Are-You) by 2 (Verb Type: action, copula) by 2 (Object: object, no object) repeated-measures analysis of variance on the frequency of responses revealed significant main effects of only Age, $F(1,27) = 15.63$, $p < .01$[13] (i.e., more responses at 2;0), and Verb Type, $F(1,27) = 11.8$ (i.e., more responses when the test sentence contained an action verb)[14]. Given the variability in response rates, both across conditions and across subjects, the following analyses on Response Mode were conducted on proportions. (The results reported below, however, remain essentially unchanged when frequency - the numerator of these proportion measures - rather than proportion data are used as the dependent measure.)

Response Mode

A five-way repeated-measures MANOVA with the four two-level factors described in the Responsiveness section (Age, Sentence Type, Verb Type, Object) as well as Response Mode (2 levels: Action, Informing) was conducted on the proportion of total responses. Only the main effect of Response Mode and interactions with this variable were included in the model tested. All other effects (i.e. those collapsing Action and Informing responses) are not conceptually meaningful (e.g., a main effect of Age would only indicate that more responses, Action and Informing, were made at one age) as they provide no more information than the Responsiveness analysis above. On the other hand, a Response Mode by Age interaction would suggest that the relative proportions of Action vs. Informing responses were different at the two ages.

The absence of a main effect of Response Mode, $F(1,27) < 1$, shows that overall the children did not show a preference for either response mode: an average of approximately 24 % of all responses were actions while 27 % were informing responses. The significant interaction of Response Mode and Age, $F(1,27) = 10.56$, however, indicates that relative rates of Action and Informing responses

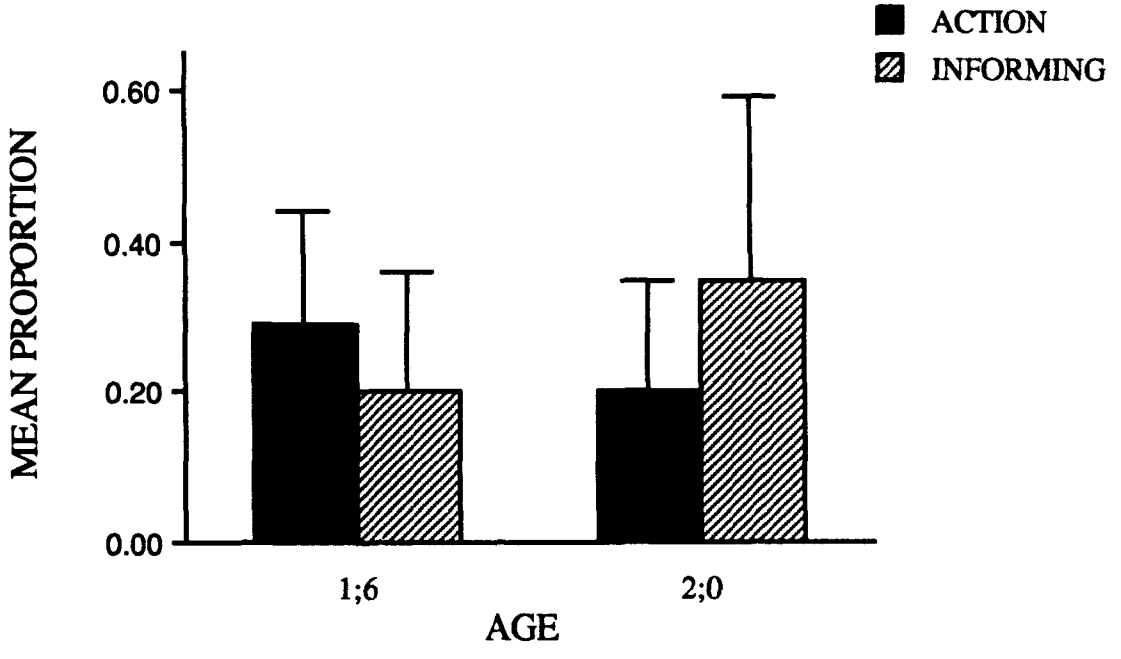


Figure 1. Mean proportion of Action and Informing responses as a function of Age.

varied with subjects' age (see Figure 1). Specifically, single degree of freedom comparisons using individualized error terms (Keppel & Zedeck, 1989) revealed that whereas there was no difference in the percentage of Action (29 %) versus Informing (20 %) responses at 1;6, $F(1,27) = 3.89$, $p > .05$, at 2;0 a significantly greater proportion of children's responses were Informing (35 %) as opposed to Actions (20 %), $F(1,27) = 7.77$.

Finally, Response Mode also interacted significantly with Verb Type, $F(1,27) = 46.43$. This interaction is displayed in Figure 2. Single degree of freedom comparisons indicated that when the stimulus sentences contained a copula verb the children were almost three times more likely to produce an Informing response (35 %) than an Action response (13 %), $F(1,27) = 35.70$. Conversely, when the test sentences contained an action verb children were more likely to perform an action (35 %) than to produce an Informing response (20 %), $F(1,27) = 10.17$. No higher-order interactions involving the Response Mode variable reached significance.

The data presented thus far do not seem to provide much support for the action bias hypothesis. First, when the data were collapsed over conditions and age there was no evidence that children acted more than they informed. Second, choice of response mode was dependent on at least one aspect (Verb Type) of the test sentences. However, given the trend toward more Informing responses with increasing age, it may be important to examine the appropriateness of the responses made. According to Shatz's proposal, in the initial stages of language learning the child acts indiscriminately in response to speech. Thus, if the majority of actions performed were semantically inappropriate (i.e. the child did something but not what comprehension of the verb would indicate), one might argue that these action responses reflected the vestiges of an action bias.

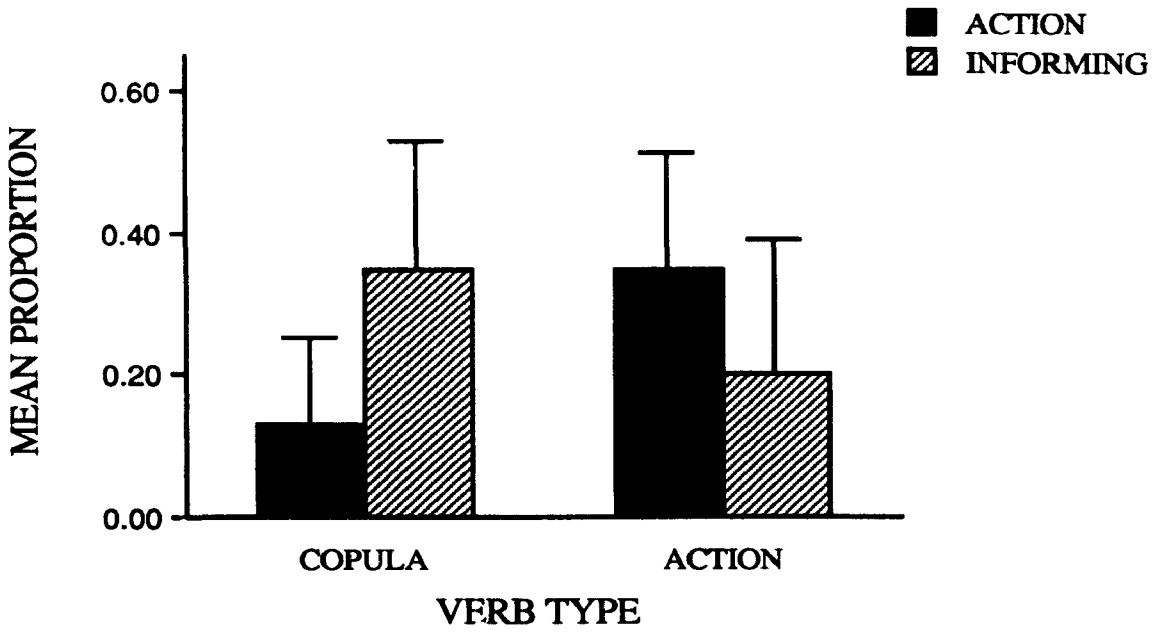


Figure 2. Mean proportion of Action and Informing responses as a function of Verb Type.

Appropriateness

Tables 5 and 6 present the frequency of inappropriate, relevant, and appropriate Action and Informing responses in each of the test sentence conditions at 1;6 and 2;0 respectively. As Object and Sentence Type did not interact with Response Mode in the preceding analyses, the data were collapsed over these two variables for the analyses of appropriateness. Thus, a log-linear analysis with four factors - Age (two levels: 1;6 and 2;0), Verb Type (two levels: Action, Copula), Response Mode (two levels: Action, Informing) and Appropriateness (three levels: Inappropriate, Relevant, Appropriate) - was performed.

A log-linear analysis is the equivalent of an analysis of variance for categorical or nominal level data (Knoke & Burke, 1980). Thus, it is used to test the significance of main effects and interactions between variables that form a multiway contingency table. The main assumption of this approach is that the natural logarithms of expected values in a contingency table represent a linear function of the main effects and interactions of the variables.[15] As in the previous section, the specific model tested was not the full factorial model as effects collapsed over Response Mode are not conceptually meaningful. Consequently, only the Response Mode by Appropriateness interaction and all higher-order interactions involving both of these factors were analyzed. A constant value of 0.5 was added to all cells to guard against small cell sizes, and the likelihood ratio chi square (L^2) was computed to test the significance of the interactions. Only the two-way interaction of Response Mode and Appropriateness and one three-way interaction (Verb Type by Response Mode by Appropriateness) reached significance.

The significant Response Mode by Appropriateness interaction, L^2 (2) = 39.57, depicted in Figure 3, reflects the fact that, whereas there was no Appropriateness effect in the Action mode (i.e., equal numbers of inappropriate (86), relevant (69) and appropriate (67) action responses, χ^2 (2) = 3.02, $p > .05$), a significant

Table 5

Frequency of Inappropriate (INAP), Relevant (REL), and Appropriate (APP) Action (ACT) and Informing (INF) responses in each cell of the experimental design at 1;6.

		CAN-YOU Questions				ARE-YOU Questions			
MODE	APP	no object copula	object copula	no object action verb	object action verb	no object copula	object copula	no object action verb	object action verb
ACT	INAP	3	6	12	9	7	7	5	12
	REL	0	4	5	15	2	3	5	7
	APP	2	0	8	1	0	0	5	3
INF	INAP	2	1	1	1	4	3	3	0
	REL	0	2	0	1	0	1	2	5
	APP	7	4	3	2	5	6	2	1

Table 6

Frequency of Inappropriate (INAP), Relevant (REL), and Appropriate (APP) Action (ACT) and Informing (INF) responses in each cell of the experimental design at 2;0.

		CAN-YOU Questions				ARE-YOU Questions			
MODE	APP	no object copula	object copula	no object action verb	object action verb	no object copula	object copula	no object action verb	object action verb
ACT	INAP	2	4	2	4	5	4	1	3
	REL	1	1	1	18	1	2	0	4
	APP	1	0	16	11	0	0	12	8
INF	INAP	5	2	3	0	3	2	2	0
	REL	0	16	1	1	2	7	4	13
	APP	29	9	9	14	17	10	5	5

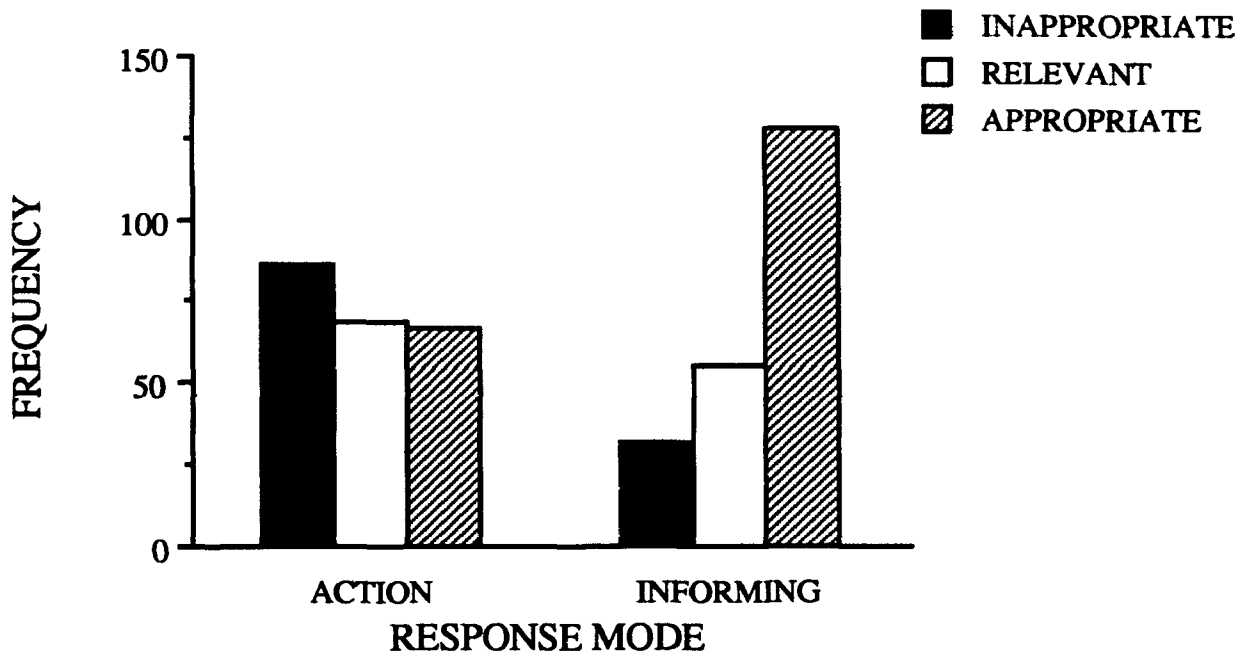


Figure 3. Frequency of Inappropriate, Relevant, and Appropriate responses as a function of Response Mode.

majority of Informing responses were appropriate (128) as opposed to relevant (55) or inappropriate (32), χ^2 (2) = 17.70. This general pattern, however, depended on the type of verb used in the test sentences as indicated by the significant three-way interaction of Response Mode, Appropriateness, and Verb Type, L^2 (2) = 20.52, depicted in Figure 4. Panel A depicts the Response Mode by Appropriateness interaction for sentences containing an action verb. In this condition there was no Appropriateness effect in either the Action mode, χ^2 (2) = 1.09, $p > .05$, or the Informing mode, χ^2 (2) = 4.23. Panel B shows a slightly different pattern in the Copula Verb condition. The Informing pattern is similar to the overall pattern- more appropriate (87) than relevant (28) and inappropriate (22) responses,χ^2 (2) = 19.98, but the Action pattern is different in that a greater number of Actions were inappropriate (38) than relevant (14) or appropriate (3), χ^2 (2)= 10.73.[16] Although a significant number of actions were inappropriate in the Copula Verb condition, it should be noted that the overall frequency of inappropriate actions was very similar in the Action Verb (48) and Copula Verb conditions (38). The three-way interaction between Response Mode, Appropriateness and Verb Type is complex, and may be due to the reverse trend seen in the Action responses in the Copula condition, or to the relatively high frequency of appropriate Informing responses in the Copula condition, or to a combination of these trends. However, problems inherent in the coding of Appropriateness (described in Footnote 16, and below) make interpretation of this interaction difficult.

In theory, inappropriate responses - both Action and Informing - are particularly interesting as they may represent the best evidence for response biases. For example, inappropriate action responses may reflect an action bias because they indicate that the child is acting without paying attention to sentence content. Similarly, inappropriate informing responses (especially verbal responses) may reflect a "speak when spoken to" bias or strategy (see Chapter 4 for further

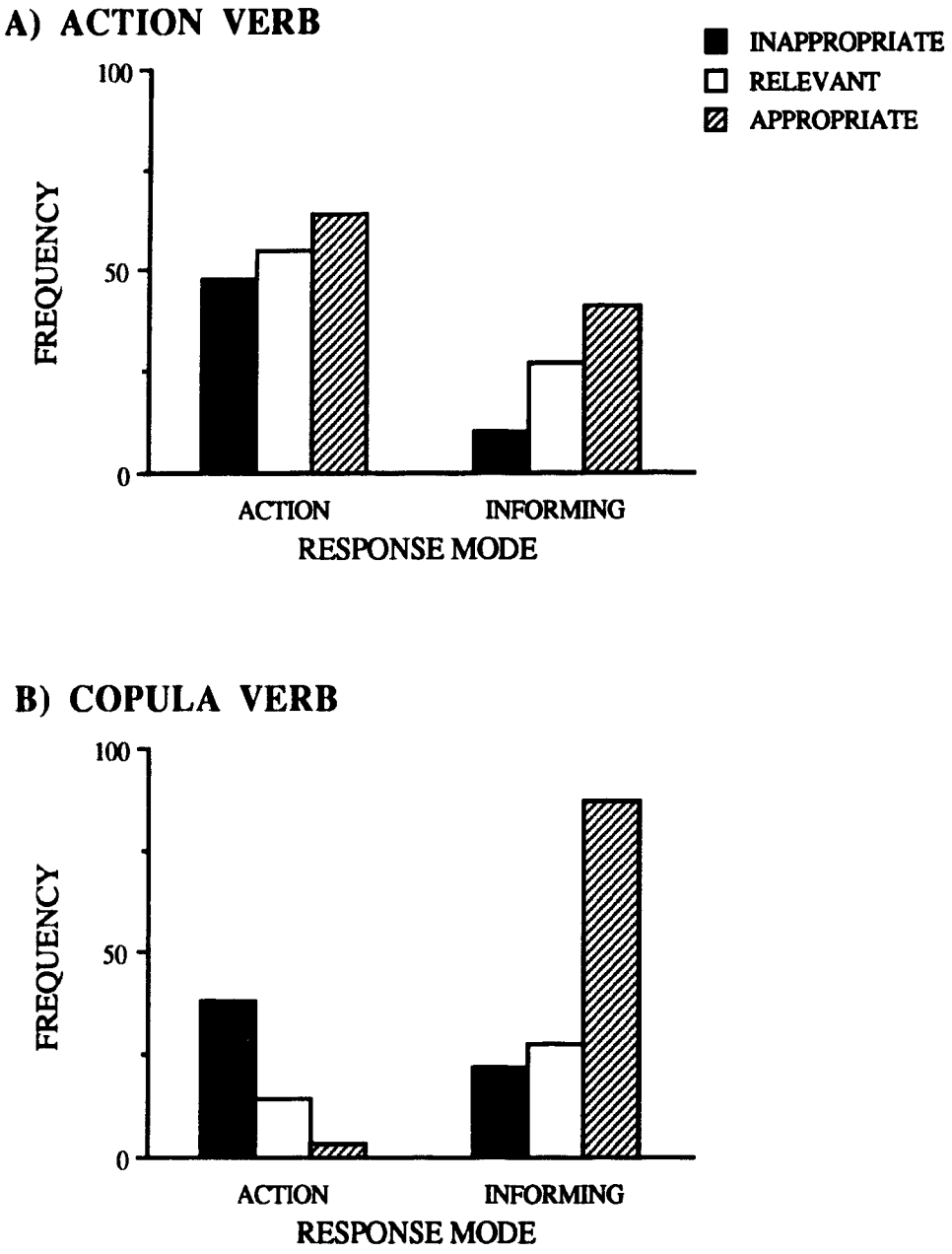


Figure 4. Frequency of Inappropriate, Relevant, and Appropriate responses as a function of Response Mode in A) the Action Verb conditions, and B) the Copula Verb condition.

discussion of individual differences in strategy use). A comparison of inappropriate actions and inappropriate informing responses may then provide a clue as to which of these "biases" is operating in the group of children as a whole. A comparison of these two frequencies does in fact reveal that overall there were more than twice as many inappropriate actions (86) as inappropriate informing (32) responses, but there are at least two reasons why this finding should be interpreted cautiously.

First, the frequency of inappropriate informing responses is most likely a very conservative estimate of a "speak when spoken to" strategy since it excludes all "no" responses and all informing responses which were unintelligible. In cases where a child's unintelligible verbal response was coded as Informing it was clear that he/she was responding to the test sentence (by pauses in behavior and/or looking at the robot), but the response could not be coded for appropriateness because it was not clear exactly what the child had said. As a large number of these unintelligible informing responses could plausibly be coded as inappropriate, there may actually be no significant difference between the frequency of inappropriate actions and inappropriate informing responses. In fact, when unintelligible verbal responses are included as inappropriate informing responses, there is no longer a difference in the number of inappropriate action (86) and inappropriate informing (77) responses.

Second, the form of test sentences employed in this study - yes/no questions - made it very easy for the children to make appropriate informing responses; e.g., a child had only to say "yes" or to nod in order to be credited with an appropriate informing response. Approximately 77% of all appropriate informing responses were in fact simple "yes" responses. These responses would not require any understanding of lexical content but, as indicated in Chapter 2, could be based on sensitivity to prosodic cues such as rising intonation. Appropriate action responses, on the other hand, would require, at minimum, comprehension of the action verb

used in a given test sentence. Given the relative ease of producing appropriate informing responses to yes/no questions, the frequency of inappropriate informing responses may be artificially deflated. Thus, the comparison between inappropriate actions and inappropriate informing responses may not be a valid reflection of the relative use of action and verbal strategies in the group of children as a whole.

Discussion

Overall little support for the action bias hypothesis was found. Collapsed over conditions and age there was no evidence that children acted more than they informed, and their choice of response mode was dependent on the type of verb used in the test sentences. Thus, they acted more in response to sentences containing action verbs, and informed more in response to sentences containing copula verbs. As noted earlier, all of the test sentences employed by Shatz (1978a, Experiment 1) in the original test of the action bias hypothesis contained action verbs. The strong action verb effect in the present data confirms that Shatz's finding that her subjects responded to all sentence types with action was due to the presence of action verbs in the stimulus sentences. Similarly, the fact that considerably more informing responses were made by subjects in the present experiment can be attributed to lexical content of the test sentences. The absence of a lexical cue to act (i.e. an action verb) in half the conditions in the present study allowed children the flexibility to choose other response types. Conversely, the presence of a copula verb can be thought of as a cue to inform. In any case, the fact that there were more informing responses in the copula verb condition than the action verb condition indicates that children were using lexical cues in forming responses. They did not rely exclusively on one response mode (action), but used lexical knowledge in determining which response mode to use.

The reader will recall that Shatz's (1978a) specific claim regarding two-year-olds is that they will have some lexical knowledge, and will pick out an action word

or object name from the speech stream and act it out or act on it. Although this version of the action default hypothesis may seem consonant with the Response Mode by Verb Type interaction found in the present study, it does not fit with the absence of a Response Mode by Object interaction. Mentioning an object present in the immediate context did not influence the child's choice of an action response; rather, children were equally likely to perform an action or informing response in the Object condition. Even more damaging to the action default hypothesis is the fact that there was no overall tendency to produce more action than informing responses at either age. Collapsed over sentence conditions, even at 18 months the children were equally likely to choose an action or informing response.

As indicated in the introduction to this chapter, it is not only sentence content that influences children's responses. The context in which sentences are presented is also very important. Although contextual cues were not systematically manipulated in the present study, a comparison of the present experimental context and Shatz's context is informative. For example, the absence of nonlinguistic "cues to act" such as gesture (Allen, 1991; Allen & Shatz, 1983) and direction of gaze (Chapman, 1978) in the present study may have increased the subjects' production of non-action responses. As argued in Chapter 2, very young children appear to be sensitive to lexical and contextual cues to communicative intent. The subjects in the present study were given every opportunity to demonstrate this sensitivity as the lexical content and context of the test sentences allowed for a range of different responses. Lexical content was systematically manipulated, but context was free to vary. For example, sometimes a child was near the object/toy mentioned in a given test sentence at the time the sentence was presented. At other times the object may have been out of view. Thus, the difference between results obtained in the present study and those of Shatz can be explained by difference in the content of stimulus sentences, as well as the way they were presented.

In a nutshell, the present findings indicate that 18-month-olds base their responses to utterances on the lexical content (in particular, verb type) of those utterances. Lexical comprehension does not, however, imply that children always respond appropriately. The relevant and inappropriate action and informing responses reported in the results section of this chapter indicate that the children were employing strategies in responding to the test sentences. For example, a child whose action responses were largely inappropriate might have been following an action strategy. Conversely, a child who verbalized in response to most test sentences, and whose verbal responses tended to be inappropriate, might have been using a "speak-when-spoken-to" strategy.

The idea that some children might employ an action-based strategy while others use a verbal strategy is contrary to the notion of a universal constraint or bias in early responding to speech.[17] In fact, the presence of individual differences in children's response strategies indicates that various factors - either internal to the child (e.g. temperament) and/or external (e.g., input) - influence a given child's preference for a particular response strategy. The standard deviations in Tables 3 and 4 indicate considerable variability in children's responses, which is consistent with the notion that there may be individual differences in children's tendency to act or inform in a given experimental condition. The interesting question is "Where do these differences come from?" What is it that causes children to prefer one response strategy over another? The following chapter explores this question first by providing a description of individual differences in children's response strategies, and then relating these differences to specific characteristics of maternal speech.

Chapter 4: Individual differences in response strategies

The results of the experiment described in Chapter 3 provided no evidence for a ubiquitous action bias in children's responses to the test sentences. Instead, as mentioned briefly in that chapter, there were hints of individual differences in the children's tendency to act or inform in a given treatment condition. These differences suggest that it may still be useful to conceptualize early comprehension strategies as falling into two general pragmatic categories: act and verbalize. For example, in the absence of specific lexical cues, instead of a universal action default strategy individual children may develop individual biases in one direction or another (i.e,. act vs. speak when spoken to). Evidence of individual differences in strategy use at an early age argues against an initial bias or preference for a particular response mode. Rather, it will be argued below that children's early responses are more a reflection of their communicative environments than of the operation of an initial constraint on their interpretations of speech acts.

One of the most obvious places to look for influences on strategy use is in the language the child hears. Bates and her colleagues (e.g., Bates & MacWhinney, 1989; Bates et al., 1984) have argued that children acquiring language exploit the form-function relations present in the specific language to which they are exposed. Children learning Italian tend to rely on animacy in interpreting sentences whereas children learning English treat word order as the most important cue to sentence interpretation. As this crosslinguistic difference is apparent by 2;6, Bates et al. (1984) conclude that "children are sensitive from the beginning to the information value of cues in their particular language" (p. 351). Thus, crosslinguistic differences in strategy use can be attributed to differences in input. Perhaps individual differences in early comprehension strategies <u>within</u> a language community - such as those found in the present study - can similarly be attributed to differences in children's communicative environments.

Numerous studies have documented individual differences in maternal speech style (e.g., Della Corte et al., 1983; Nelson, 1973; Olsen-Fulero, 1982; Pine, 1992a). In most of these studies two distinct styles have emerged: one a directive or social-regulatory style, the other a conversation-eliciting style. These speech styles are based on the intentions of mothers to either direct their children's behavior or to engage them in conversation. Of course all mothers express both of these intentions in speech to their children, but some tend to emphasize one intent more than the other. It is possible that children develop strategies for responding to speech on the basis of the most common communicative intents they encounter in input. Thus, children exposed to a somewhat directive speech environment may tend to associate speech with directive intents and thus act in response to speech directed to them. Conversely, children exposed to primarily conversation-eliciting environments with a lot of verbal turn-taking may be more likely to develop a "speak when spoken to" strategy in responding to speech. If in fact these aspects of the communicative environment are correlated with individual differences in early strategy use, it would indicate that children are sensitive to the communicative intents of the adults they interact with and that they use this knowledge of intentions to organize their responses.

However, a response strategy based on the "most common communicative intent" experienced would seem to represent a very low level of sensitivity to adults' intentions. All that can be inferred from this type of performance is that the child recognizes <u>one</u> function of adults' speech; i.e. the most common one. Adults typically express a range of communicative functions in their speech to young children (Della Corte et al., 1983; Pine, 1992a; Shatz, 1979). If young children are in fact sensitive to adults' intentions, they should be able to differentiate among at least some of these functions. One way parents could make it easy for children to identify various communicative functions would be to restrict the number of

functions actually expressed. Another would be to express each function with a single form, preferably the most common form associated with that function in the target language (Shatz, 1982).If, for example, questions were always used to request information and directives were always expressed as imperatives, it would be easier for a child to differentiate these two pragmatic functions. Is there any evidence that parents actually restrict the range of intents they use with their young children and that they use characteristic form-function pairs? And if so, do children make use of the information provided by these characteristic pairs?

Shatz (1979) addressed all of these questions in a cross-sectional study of 17 children aged 1;6 to 2;10. The children were divided into two groups, one low and one high, on the basis of the length of their word combinations. In examining the corpus of maternal questions, Shatz found that mothers of the low-group children did not differ from high-group mothers in the number of functions expressed by questions, but more of their questions were used as directives and they made more use of characteristic form-function pairs. However, there was no relationship between maternal use of characteristic pairs and children's rate of appropriate responding. Thus, Shatz concludes that, although mothers of low-group (younger?) children do tend to employ more characteristic form-function pairs, their children do not use these pairs to guide their responses. Before accepting this conclusion, one must examine both the adult and child measures more closely. Although there are a number of problems associated with using immediate responses to maternal questions as a measure of child's use of form-function pairings (e.g., presumably some of these questions were accompanied by various nonlinguistic cues to intent), a more serious interpretive problem involves the definition of a "characteristic pair".

One of the criteria used to classify a given form-function pair as "characteristic" involved group data; i.e. the pair had to occur in the speech sample of more than

half the mothers in a group. Such a measure does not allow for individual differences across mothers; thus, one mother could be entirely consistent in the use of a given form-function pair but would not be credited with use of this pair if it did not also occur in the sample of at least half of the other mothers. In addition, this definition effectively restricts the variability of the measure. Given this restricted variance, it is not surprising that correlations of maternal use of characteristic pairs with children's rates of appropriate responding were not significant. Finally, Shatz interprets the finding that low-group mothers produced more directives than high-group mothers as evidence of mothers matching their children's response biases. However, it may just as well be the case that her young subjects appeared biased to act simply because, in their experience, that was the intent they encountered most often in interactions with adults; i.e. the influence can just as easily be interpreted as from mother to child as vice versa (Nelson, 1990).

Recent work by Ninio provides evidence that mothers' one-word utterances to their children are often unifunctional (Ninio, 1985) and children when they begin to speak use these single words for the same functions as their mothers (Ninio, 1992). Thus, she argues that the "meaning children attribute to one-word utterances is in terms of the intentional communicative acts speakers perform in uttering these utterances' (Ninio, 1985, p.527). If this is true at the level of single words, it will likely also apply to the multiword utterances young children hear. Note, however, that Ninio links maternal communicative intents with children's early expression of those same intents in their single word utterances. Her work does not address the comprehension issue directly. It is important to determine whether children's responses to multiword utterances are related to the communicative intents expressed by certain multiword forms in maternal input.

What is needed is a study of form function pairs in input and their relation to children's response strategies. Ideally, the definition of "characteristic pairs" should

be based on individual speech samples as what is characteristic for one mother may not be so for another. In addition, rather than simply observing children's responses to maternal utterances, their response strategies should be assessed in a controlled and relatively neutral setting (as in Phase 3 of the experiment described in Chapter 3). If children's responses in this setting are related to or can be explained by the form-function pairs they experience in maternal input, one could reasonably assert that they are sensitive to adults' intentions and employ this sensitivity in responding to speech directed to them.

The following section describes individual differences in children's response strategies, concentrating on the younger age (18 months) where there was more variability in strategy use. This is followed by a description of individual differences in mothers' use of speech acts and the forms used to express these speech acts. The differences in maternal speech style are subsequently correlated with the individual differences in children's strategy use. The results of the correlational analyses indicate that some of the variance in early response strategies can be related to differences in maternal speech style.

Individual differences in children's strategy use

Tables 7 and 8 present each subject's data for the overall frequencies of action and verbal responses, as well as frequencies of inappropriate action and inappropriate verbal responses at ages 1;6 and 2;0 respectively. (As indicated in the previous chapter, inappropriate responses may be particularly good indicators of response biases.) In each table subjects are grouped by the response profile that best characterizes their pattern of responding (i.e. strategy use). The subjects' profiles fall in one of three categories when two criteria are used to identify "action responders" and "verbal responders": relative frequency of action and verbal responses[18], and relative frequency of inappropriate actions and inappropriate verbal responses[19]. To qualify as an action responder, a child had to have produced

Table 7

Individual subjects' data for frequency of Action and Verbal responses, Inappropriate Actions (InappAct), and Inappropriate Verbal responses (InappV) at 1;6. The data are organized by response profiles: Action, Verbal, Mixed (see text for defining criteria).

Response Profile	Subject	Action	Verbal	InappAct	InappV
ACTION	1	9	5	5	1
	2	6	3	5	2
	3	7	6	6	1
	4	8	2	3	0
	5	12	3	7	2
	6	2	0	0	0
	7	6	2	4	2
	8	5	3	2	1
	9	3	0	0	0
	10	6	0	2	0
	11	3	1	1	0
	12	5	2	3	1
	13	1	0	0	0
VERBAL	14	1	6	0	2
	15	3	8	1	3
	16	3	6	1	2
	17	5	11	3	4
	18	0	8	0	0
	19	4	10	2	9
MIXED	20	6	7	2	2
	21	3	4	2	1
	22	5	5	4	3
	23	2	4	2	1
	24	3	3	0	1
	25	2	2	0	1
	26	6	5	2	2
	27	5	12	3	2
	28	2	6	1	0

Table 8

Individual subjects' data for frequency of Action and Verbal responses, Inappropriate Actions (InappAct), and Inappropriate Verbal responses (InappV) at 2;0. The data are organized by response profiles: Action, Verbal, Mixed.

Response Profile	Subject	Action	Verbal	InappAct	InappV
ACTION	6	4	0	2	0
	7	12	7	1	0
	15	7	3	4	1
VERBAL	2	1	16	0	0
	3	6	17	0	1
	4	2	12	0	1
	8	8	12	0	1
	9	1	22	0	2
	10	0	11	0	1
	12	3	15	0	1
	13	1	11	0	1
	16	4	6	0	2
	17	4	12	0	1
	19	4	10	0	2
	20	1	12	0	1
	21	6	7	1	6
	23	1	10	0	1
	24	4	6	0	2
	25	1	12	0	0
	27	0	21	0	1
	28	4	19	3	4
MIXED	1	4	5	2	1
	5	10	12	4	1
	11	6	9	3	0
	14	3	6	1	1
	18	2	1	1	1
	22	4	9	1	1
	26	3	10	2	0

more action than verbal responses overall, and had to have made more (or equal numbers of) inappropriate actions than (and) inappropriate verbal responses. Thirteen subjects fit this pattern at 1;6; only three were classified as action responders at 2;0. Subjects with the opposite profile - more verbal than action responses and more (or equal numbers of) inappropriate verbal than (and) inappropriate action responses - were classified as verbal responders. Six subjects fit this profile at 1;6 whereas 18 were so classified at 2;0. The remaining subjects (nine at 1;6 and seven at 2;0) made approximately equal use of action and verbal responses to the test sentences.

It appears from the description above that there is a decrease with age in use of an action strategy and an increase with age in use of a verbal strategy; however, it is difficult to determine from the data in Tables 7 and 8 precisely how many subjects switched from one strategy to another. Table 9 presents the number of subjects who were classified in the same category at both ages (the top left to bottom right diagonal of the table) and the number of subjects who changed profiles across the course of the study (the remaining cell frequencies). The pattern of frequencies at 2;0 (see column totals) was significantly different from the pattern at 1;6 (see row totals), χ^2 (2)= 32.13, indicating that category membership did change with age. In fact, 21 subjects were classified differently at 1;6 and 2;0. Finally, these changes in strategy use across age were not random (i.e. children were not equally likely to switch from an action-based strategy to a verbal response strategy as from a verbal strategy to an action strategy), but reflected a developmental trend towards verbal response strategies. Whereas 15 children switched to a verbal response strategy, only one switched to an action-based strategy, and five switched to a mixed use of strategies.

These results suggest a progression towards verbal response strategies, which is understandable given that children's expressive abilities show a substantial

Table 9

Effect of age on response profiles. Row totals represent the numbers of subjects who fit each of the three profiles - Action Strategy, Verbal Strategy, or Mixed - at age 1;6. Column totals represent the same information at 2;0.

		2;0		
	ACTION	VERBAL	MIXED	RowTotals
1;6				
ACTION	2	8	3	13
VERBAL	1	3	2	6
MIXED	0	7	2	9
Column Totals	3	18	7	

increase between 1;6 and 2;0; productive vocabulary, as measured by the CDI Words Short Form (Reznick & Goldsmith, 1989), increased from a mean of 26.6 words at 1;6 to a mean of 68.6 words at 2;0 (see Appendix B). As most children seemed to be employing verbal strategies at 2;0 (or a mixture of action and verbal strategies), there is not enough variability for individual differences analyses. On the other hand, there was impressive evidence of individual differences at 1;6. Consequently, the remaining analyses focus on individual differences in strategy use at the earlier age.

Given the developmental progression towards verbal response strategies, it is important to determine first whether individual differences at 18 months reflect more than individual differences in expressive abilities; i.e., are the verbal responders at 1;6 simply the more linguistically sophisticated children? The absence of a correlation between frequency of verbal responses and total productive vocabulary at this age, $r(26) = .12$, $p > .05$, indicates that it was not just the more "advanced" children who were employing a verbal strategy. Thus, there are striking individual differences in strategy use at 1;6 that cannot be explained by overall expressive language ability.

Dividing the children into three mutually exclusive groups as in Tables 7 through 9 is a rather crude way of characterizing individual differences in strategy use. In correlational analyses, categorizing subjects into a limited number of mutually exclusive groups involves a substantial loss of information (Keppel & Zedeck, 1989). Thus, rather than categorize the 18-month-olds as action vs. verbal responders, their individual scores on variables assumed to reflect use of these strategies were used as criterion variables in the analyses reported below. Table 10 presents descriptive statistics on the criterion variables used in these correlational analyses.

High scores on the first three variables listed in this table reflect reliance on an

Table 10

Descriptive statistics for each of the criterion variables (i.e, measures of child's strategy use) at 1;6.

Variable	Mean	St.dev.	Range
Total frequency Action responses to Test Sentences	4.39	2.66	0-12
Frequency "pure" Actions to Test Sentences	2.18	1.52	0-6
Frequency Action responses to Declaratives	3.89	2.20	0-9
Total Frequency Verbal responses to Test Sentences	4.43	3.32	0-12
Imitations of Test Sentences	0.89	1.47	0-6
Imitations of Declaratives	1.89	2.23	0-9

action-based strategy. Thus, children who performed a large number of actions in response to the test sentences, a large number of "pure" actions (i.e, those unaccompanied by verbalization), and a lot of actions in response to the filler declaratives could be described as following an action strategy. Conversely, those who scored high on overall number of verbal responses, and on the specific verbal strategy of imitation (both in response to test sentences and the filler declaratives) could be described as using a "speak-when-spoken-to" strategy. The standard deviations in Table 10 reveal considerable variability in strategy use at 1;6. Intercorrelations among these criterion variables are shown in Table 11. These correlations indicate that the first set of variables (i.e., those reflecting an action strategy) are positively correlated with one another and either negatively correlated with or uncorrelated with the three variables representing the use of verbal strategies. Finally, this latter set of variables are positively correlated with one another, indicating that each criterion variable was tapping the particular strategy it was intended to tap.

Individual differences in maternal speech style

One hundred consecutive maternal utterances were transcribed from the 10-minute mother-child play session described in Chapter 3. (One mother did not produce 100 utterances in the 10-minute period; thus, the following analyses are based on 27 mother-infant dyads.) Excluded were single-word utterances and utterances that would have been coded as instances of social play (e.g., "This little pig goes whee-whee-whee all the way home"). All 100 utterances were coded for both communicative intent/pragmatic function, and syntactic form. Videotapes were consulted during coding so that preceding and accompanying context (verbal and nonverbal) could be used as cues to the intent of each utterance. Utterances were independently coded by two observers, using a modified version of the pragmatic classification scheme of Della Corte et al. (1983). The pragmatic categories used are

Table 11

Intercorrelations among the criterion variables: Total Actions (TOTAct), "Pure" Actions (PUREAct), Actions to Declaratives (DECAct), Total Verbal responses (TOTVerbal), Imitation responses (IMIT), Imitations of Declaratives (DECImit).

	PUREAct	DECAct	TOTVerbal	IMIT	DECImit
TOTAct	.74*	.42*	-.01	.00	.22
PUREAct	-	.21	-.30	-.21	-.02
DECAct	-	-	.07	.10	.06
TOTVerbal	-	-	-	.41*	.34*
IMIT	-	-	-	-	.62*
DECImit	-	-	-	-	-

* $p < .05$ (one-tailed)

defined in Table 12. It should be noted that only three main categories were used and that they are rather broad in that they include more than the corresponding categories of Della Corte et al. For example, the current Prescriptive category subsumes Della Corte et al.'s Prescriptive,Suggestion, and Proscriptive categories. Similarly, Descriptives include Della Corte et al.'s Labelling, Description, and Displaced Speech categories. The reason for collapsing categories is that together they capture the dimensions of most interest for present purposes; i.e., Prescriptives represent attempts to direct behavior, and Requests for Information (RQINs) serve, as the name suggests, to elicit information from the child. As utterances that would have been classified as Fillers, Social Play, or Conventional Social Expressions were generally omitted from the transcripts, very few utterances fell into the Other category. When coding communicative intent, observers were instructed to ignore the syntactic form of the utterance, and to rely on contextual cues in making coding decisions. Thus, if a mother said "Put that here" as she herself was placing an object on the table, the utterance was coded as a Descriptive rather than a Prescriptive, even though it was in the form of an imperative.

On the other hand, when coding form, preceding context sometimes had to be taken into consideration. This is because when mothers' utterances were elliptical, glosses of the utterances had to be provided, with the help of contextual cues. It was the gloss that was then coded as an Imperative, Declarative, Wh-question, or Yes/No question (these included tag questions, and simple declaratives spoken with rising intonation). Yes/No questions are of particular interest because this was the form of the test sentences used in the robot phase of the experiment described in Chapter 3; that is, children's responses to this "ambiguous" form were used to characterize their response strategies. Some children tended to respond to yes/no questions with action, others with information. The hypothesis being tested in the present chapter is that children whose mothers use yes/no questions primarily to

Table 12

Coding system for pragmatic speech categories.

Category	Criteria
Prescriptives	Commands or requests made in an attempt to direct the child's behavior or verbalizations (e.g., "Put the doll over here", "Can you say hi?"). This category also includes Proscriptives which are commands made in an attempt to inhibit the child's behavior or verbalizations (e.g., "Don't do that") and Attention Devices such as "Look at this".
Requests for Information	Attempts to gain information from the child, regardless of whether they actually elicit a verbal or gestural response (e.g., "What's that?, "Are you tired?").
Descriptives	Utterances describing or labelling a person's behavior, actions, feelings, etc., or describing or labelling an object or event (e.g., "That's a teddy bear", "Oh, it fell down"). This category also includes Praise and Encouragement (e.g., You can do it!", "Good girl").
Other	Utterances that could not be classified in any of the above categories.

request information will be children who tend to respond verbally to the robot's yes/no questions. Conversely, children whose mothers use yes/no questions mainly to request action (i.e., as prescriptives) may be more likely to follow an action strategy in responding to the test sentences. Thus, the main predictor variable in the correlational analyses reported below is the percentage of maternal yes/no questions used as prescriptives; the reciprocal percentage represents the proportion of yes/no questions used as requests for information.

Table 13 presents descriptive statistics for each of the measures of maternal speech style. Density of maternal speech was calculated by dividing the total number of utterances (100) by the time (in minutes) taken to produce these utterances. This variable was included because numerous studies have shown that it is a significant positive predictor of language development (e.g., Akhtar et al., 1991; Barnes, Gutfreund, Satterly, & Wells, 1983; Della Corte et al., 1983).

The first observer coded all 100 utterances for communicative intent and syntactic form. Six randomly chosen transcripts (representing approximately 20 % of all utterances) were coded by an independent observer. Cohen's kappas of .92 and .98, for communicative intent and syntactic form respectively, indicate excellent reliability for both classification schemes.

Relationship between maternal and child variables

Bivariate correlations between maternal style and child strategy variables are shown in Table 14. All correlations in Table 14 are Pearson product-moment coefficients with alpha set at .05 for one-tailed tests of significance. Density of maternal speech was a significant positive predictor of both overall frequency of child actions (r = .39) and total frequency of verbal responses (r = .32). Maternal prescriptives were negatively correlated with the child's imitation of declaratives (r = -.41), whereas RQINs were positively associated with the child's imitation of test sentences (r = .40) and declaratives (r = .47). Finally, the main predictor variable of

Table 13

Descriptive statistics for each of the predictor variables (i.e., measures of maternal speech style) at 1;6.

Variable	Mean	St.dev.	Range
Density (utterances per minute)	7.08	0.80	5.88-9.17
Frequency Prescriptives	32.37	9.40	12-49
Frequency Requests for Information	31.96	11.29	15-57
% Yes/No Questions used as Prescriptives	39.00	13.00	12-67

Table 14

Pearson's correlations between maternal speech characteristics and measures of child strategy use: Total Actions (TOTAct), "Pure" Actions (PUREAct), Actions to Declaratives (DECAct), Total Verbal responses (TOTVerbal), Imitation responses (IMIT), Imitations of Declaratives (DECImit).

Maternal speech	TOTAct	PUREAct	DECAct	TOTVerbal	IMIT	DECImit
Density	.39*	.13	.27	.32*	.37*	.07
Prescriptives	.03	-.16	-.08	-.08	-.25	-.41*
RQINs	.02	.05	.11	.15	.40*	.47*
%Yes/No Prescriptives	.30	.28	.24	-.21	-.33*	-.40*

* $p < .05$ (one-tailed)

interest - percentage of yes/no questions used as prescriptives - correlated positively with (although the correlations did not reach statistical significance) the three measures of an action-based strategy, and negatively with all three measures of verbal strategy use.

While these bivariate correlations form an interesting pattern, the individual correlations are not overwhelming. Also, as indicated in the first section of this chapter, the measures of child strategy use are intercorrelated to varying degrees. To address these issues, two composite measures of strategy use were computed to represent the action and verbal strategies employed by the children. These composite scores were constructed by converting the relevant raw scores into standardized z-scores and then averaging the resulting z-scores. Thus, for each subject, one mean z-score was computed as a measure of action responding, and another mean z-score was computed as a measure of verbal responding. These composite scores allowed for multiple regression analyses which address the statistical problems associated with multicollinearity across the criterion variables. These analyses essentially permit one to determine if one aspect of maternal style explains a significant amount of variance in children's response strategies when other aspects of maternal style (or other child characteristics, for that matter) are held constant.

Table 15 shows the correlations between maternal speech characteristics and the two composite scores, and basically confirms the pattern found with the bivariate correlations in Table 14. That is, Density was positively correlated with both types of strategy, RQINs were positively correlated with the verbal composite measure, and the percentage of yes/no questions used as prescriptives was positively associated with use of an action strategy, and negatively associated with use of a verbal strategy. It should be noted that the maternal predictor variables are all highly intercorrelated (see Table 16). Thus, it is not clear if these variables are redundant in

Table 15

Pearson's correlations between maternal speech characteristics and composite measures of child strategy use.

Maternal speech	Action Composite	Verbal Composite
Density	.33*	.32*
Frequency Prescriptives	-.09	-.31
Frequency RQINs	.05	.42*
%Yes/No Prescriptives	.34*	-.39*

* $p < .05$ (one-tailed)

Table 16

Intercorrelations among the predictor variables.

	Prescriptives	RQINs	% Yes/No Prescriptives
Density	-.01	.23	-.27
Prescriptives	-	-.74*	.53*
RQINs	-	-	-.69*
% Yes/NoPrescriptives	-	-	-

* $p < .05$ (one-tailed)

predicting child strategy, or if each makes a unique contribution to the variation in strategy use at 1;6.

Table 17 presents correlations of prescriptive yes/no questions with the two composite scores, while holding another predictor variable constant. These partial correlations show that the correlations between yes/no prescriptives and the action composite and verbal composite remain positive and negative respectively when the other predictors are entered individually as covariates. In fact, the correlations with the action composite score actually increase when Density, overall frequency of Prescriptives, and overall frequency of RQINs are held constant, indicating that suppression effects are operating in this data set (Cohen & Cohen , 1983). In any case, the pattern of correlations (positive with the action composite score and negative with the verbal composite score) provides support for the hypothesis that maternal use of the yes/no-prescriptive form-function pair influences children's strategy use. (The possibility of bidirectional effects is addressed in the Discussion below.)

Given this pattern of correlations, it is important to determine whether maternal use of yes/no prescriptives accounts for a significant amount of variance in children's early strategies, above and beyond any variance explained by general level of language development. To address this question, partial correlations between the composite scores and maternal use of yes/no prescriptives, holding productive vocabulary constant, were computed. When vocabulary is entered as a covariate, the correlations between maternal use of yes/no questions as prescriptives and the action and verbal composite scores are +.36 and -.41 respectively. Thus, there are links between this form-function pair in maternal speech and children's response strategies that cannot be explained by differences in the children's level of linguistic sophistication (as measured by the vocabulary checklist).

One final set of correlations examines the relationship between maternal speech

Table 17

Partial correlations of Prescriptive Yes/No questions with the composite Action and composite Verbal scores, holding one predictor constant.

Covariate	Action Composite	Verbal Composite
Density	.47*	-.33*
Prescriptives	.46*	-.28
RQINs	.52*	-.15

* $p < .05$ (one-tailed)

characteristics and children's response styles in two sub-groups of dyads: one in which mothers worked full-time in the home (Group IH; N = 8), and one in which the mothers worked outside the home (Group OH; N = 19). A comparison of these correlations with those from the entire group may prove instructive; as dyads with mothers at home full-time presumably spend more time together, one might expect maternal influences to be amplified in this sub-group (Dunham & Dunham, 1992). Table 18 presents descriptive statistics for maternal predictor variables for both sub-groups. Comparison of these data shows that mothers in these sub-groups did not differ significantly from each other, nor from the group as a whole on measures of speech characteristics. The correlations between these measures of maternal speech style and the composite action and verbal scores described previously are shown in Table 19. There are two main differences in the pattern of correlations for the two sub-groups. First, density of maternal speech is significantly negatively correlated with the action composite in Group IH, whereas it is significantly positively correlated with this response style in Group OH. Second, the main correlations of interest - those between maternal use of yes/no prescriptives and the two composite scores - are in the predicted directions (positive with action, and negative with verbal) in both groups of dyads, but are larger in the IH group than in the OH group. The correlation with the action composite is only marginally larger than the corresponding correlation in the OH group (r = .39, compared to r =.35). The correlation with the verbal composite score (r = -.77), on the other hand, is much larger in the IH group than in the OH group (r = -.31), and indicates that, in the sub-group with at-home mothers, maternal use of prescriptive yes/no questions accounts for approximately 60% of the variance in verbal strategy use. It appears that the pattern of correlations obtained in the entire group of 27 dyads is, as predicted, amplified in the sub-group of dyads who spend more time interacting together.

Table 18

Descriptive statistics for each of the predictor variables for A) Group IH: the sub-group of eight dyads with mothers working in the home; and B) Group OH: the sub-group of dyads with mothers working outside the home.

Variable	Mean	St.dev.	Range
A) Group IH			
Density (utterances per minute)	6.88	0.65	5.88-8.33
Prescriptives	31.88	12.69	12-49
Requests for Information	32.13	11.78	22-57
% Yes/No Prescriptives	42.00	17.00	12-67
B) Group OH			
Density (utterances per minute)	7.17	0.86	5.92-9.17
Prescriptives	32.58	8.05	15-43
Requests for Information	31.89	11.42	15-55
% Yes/No Prescriptives	37.00	11.00	20-65

Table 19

Pearson's correlations between maternal speech characteristics and composite measures of child strategy use in A) Group IH: the sub-group of eight dyads with mothers working in the home; and B) Group OH: the sub-group of 19 dyads with mothers working outside the home.

Maternal speech	Action Composite	Verbal Composite
A) Group IH (N= 8)		
Density	-.67*	.31
Prescriptives	-.23	-.52
RQINs	.14	.61
%Yes/No Prescriptives	.39	-.77*
B) Group OH (N= 19)		
Density	.64*	.32
Prescriptives	-.01	-.28
RQINs	.01	.40
%Yes/No Prescriptives	.35	-.31

* $p < .05$ (one-tailed)

Discussion

To summarize, correlational analyses revealed significant relationships between maternal use of yes/no questions as prescriptives and children's action and verbal strategies. Basically, this form/function pair positively predicts action-based responding, and negatively predicts verbal responding. When other maternal and child characteristics are used as covariates, the direction of these relationships remains the same (in the case of the negative correlations with the verbal composite score) or is strengthened. However, even the largest of these correlations is admittedly modest. What is more impressive than the overall amount of explained variance is the consistent pattern of correlations reported in Table 17: all positive with the action composite and all negative with the verbal composite. This pattern is amplified when a subset of the data - that from mother-infant dyads who spend more time together - is analyzed.

One obvious reason for the small size of the correlations found between maternal speech style and children's strategy use is that maternal style is only one of many possible influences on an individual child's preferred response strategy. For example, a motorically active child may be more likely to use an action-based strategy than a verbal strategy in responding to speech. This brings us to the issue of directionality; i.e., could the obtained correlations alternatively be explained as a child-to-mother influence? To be specific, perhaps active children influence their mothers to be more directive; that is, mothers could be responding to the inherent styles (reflected in overt behavior) of their children (Cross, 1977; Smolak, 1987).

It is likely the case that many mother-child relationships in language development are in fact bidirectional in nature (Dunham & Dunham, 1992; Goldfield, 1987; Yoder & Kaiser, 1989). It should be noted, however, that in the current study there was no relationship between maternal use of prescriptives (an

index of general "directiveness") and children's use of an action strategy. On the other hand, maternal use of a specific form (yes/no questions) to express this intent was significantly positively correlated with use of an action strategy and significantly negatively correlated with use of a verbal strategy. It is unlikely that child influences on mother would be this specific; i.e., that an active child would influence his mother to use yes/no questions to express prescriptive intent. Furthermore, when overall directiveness is statistically controlled, the relationship between maternal use of prescriptive yes/no questions and children's use of an action strategy becomes stronger. As this result is not easily explained by child-to-mother influences, it is likely that maternal input accounts for at least some of the variance in children's response strategies (Smolak & Weinraub, 1983). This finding does not, however, preclude the possibility that inherent child characteristics such as temperament also play a role in early response strategies.

Another possible influence on language development that has received comparatively little research attention is the language input the child receives from fathers, siblings, and others in his/her communicative environment. Recent research indicates that this input may differ from maternal input in a number of significant ways (Barton & Tomasello, in press; Mannle, Barton, & Tomasello, 1991; Tomasello & Mannle, 1987), but that young children can and do respond to it (Mannle & Tomasello, 1987; Tomasello, Conti-Ramsden, & Ewert, 1990). It has been shown that 19- and 24-month-olds also comprehend and respond to speech that is not even addressed to them (Barton & Tomasello, 1991; Dunn & Shatz, 1989). Thus, another potential influence on children's language learning strategies is the speech they hear addressed to others (Oshima-Takane, 1988). Schaffer (1989) calls this the "overhearing hypothesis", and cites cross-cultural evidence showing that factors outside of the mother-infant dyad play important roles in language development.

Thus, there are numerous factors that potentially affect children's strategies in responding to speech. Some are internal such as temperament; others involve various environmental or social influences. The fact that speech characteristics of mothers who work at home (and therefore spend more absolute time interacting with their children) accounted for more variance in children's strategies provides some indirect support for the influence of others in the child's communicative environment. Given the multiplicity of possible influences on a given child's preferred strategy (action vs. verbal), it is quite remarkable that the relationships found between maternal speech style and child strategy use are as strong and consistent as they are.

Chapter 5: Conclusions and General Discussion

Two main questions were addressed by the research reported in this dissertation. First, is there a specific constraint on young children's interpretations of speech acts such that they tend to respond to all speech with action? A number of methodological improvements over previous tests of this hypothesis were included: the use of a robot to eliminate extralinguistic cues to intent, a longitudinal design, and the systematic manipulation of lexical content. Children's responses to controlled test sentences presented through a speaker in a robot were videotaped and coded as Action, Informing, or Other at 18 and 24 months. The experimental results indicated that, contrary to the predictions of the action bias hypothesis, there was no overall tendency for children to produce more action than other responses at either age. Rather, even at 18 months, children based their responses to test sentences on lexical content; that is, they tended to act when sentences contained an action verb, and they tended to inform when sentences contained a copula verb. These analyses were all based on group data.

A description of individual differences in children's response profiles indicated that some children tended to follow an action-based strategy, acting in response to the test sentences as well as to the filler declaratives. Other children relied more on verbal strategies such as imitation, indicating the use of a "speak-when-spoken-to" strategy. The second question concerned the source of individual differences in children's strategies. The specific hypothesis tested was that individual differences in early response strategies could be related to individual differences in maternal use of various speech acts. To address this hypothesis, various pragmatic aspects of maternal speech style were correlated with children's performance in the robot-phase of the experiment. The main finding was that maternal use of a specific form-function pair - yes/no questions used as prescriptives - was significantly correlated with children's strategy use.

Use of this form-function pair was positively correlated with children's use of an action strategy, and negatively correlated with the use of verbal strategies. This pattern was amplified in a sub-group of dyads with mothers working in the home. Thus, more of the variance in children's strategies was explained by maternal speech style when the children had considerably more exposure to this speech style. This result in particular argues for some influence of the speech environment on children's early response strategies (Dunham & Dunham, 1992). It should be noted, however, that this increase in explained variance was true only for the negative correlation of maternal yes/no prescriptives with children's verbal strategy use. Thus, maternal speech style may have more of an influence on verbal responding, while other factors (e.g., child temperament) may account for more of the variance in action responding. However, without replication in a larger sample of at-home dyads, and without data on other influences on children's strategies, this suggestion remains speculative. In any case, the experimental and correlational findings together indicate that, at 18 months, there is no universal tendency to act in response to speech and that children's early response strategies are influenced by specific characteristics of their communicative environments. Both of these main findings contradict earlier studies by Shatz (1978a, 1979).

As outlined in Chapter 3, there are a number of reasons why Shatz's (1978a) data supported the action bias hypothesis: aspects of the stimuli and experimental context could easily have influenced her subjects to produce a preponderance of action responses. Rather than interpret action responding in this context as evidence for a universal response bias, one can credit the child with sensitivity to contextual features and linguistic markers that are indicators of directive intent. Thus, a child who heard the sentence "Can you fit the balls in the truck?" spoken by an adult as she placed the relevant toys in front of him could have inferred that the adult wanted him to perform the action mentioned in the sentence. Evidence for this interpretation

of Shatz's original results was obtained in the present study. When physical context was made more neutral and linguistic cues were systematically varied, 18- and 24-month-olds' responses indicated that lexical content plays an important role in determining which response mode - action or verbal - is chosen. Thus, as a group, young children are sensitive to linguistic markers of communicative intent.

Individual response profiles, however, indicated that some children tended to produce primarily action responses, while others relied on verbal strategies such as imitation. Results of the correlational analyses showed that individual differences in strategy use were linked to the functions for which mothers used yes/no questions. Children whose mothers used yes/no questions primarily to direct behavior tended to act in response to the robot's yes/no questions, whereas children whose mothers used yes/no questions mainly to request information tended to employ verbal response strategies. Although Shatz (1979) found no correlation between maternal use of "characteristic form-function pairs" and children's responses, her sample was considerably smaller (17 children divided into two groups) than the present sample (N = 27), and her definition of a "characteristic pair" effectively restricted the variance of this measure. These two factors can account for the absence of significant correlations in Shatz's data. The analyses reported in Chapter 4 address both these issues and indicate that maternal speech style plays a role in children's early strategies in responding to speech.

These findings extend those of the crosslinguistic studies of sentence processing described in Chapter 2. The reader will recall that these studies showed that, from an early age, children are sensitive to the form-function relations of the specific language to which they are exposed (Bates & MacWhinney, 1989). For example, children learning English tend to rely on word order when interpreting sentences (Bates et al., 1984), whereas Hungarian children attend more to case marking cues (MacWhinney et al., 1985). As these are the most informative or

"valid" cues in the respective adult languages, it would appear that crosslinguistic differences in sentence processing strategies can be attributed to differences in input. The results of the present study indicate that individual differences in comprehension strategies within a language community can also be attributed to differences in input. That is, children's responses to yes/no questions are related to the functions for which their mothers use this particular sentence form. Thus, in addition to exploiting the general form-function relations of their native tongues, young children are also sensitive to the specific sentence form-function pairings employed in their communicative environments.

The specific finding of the present study indicating that the communicative environment plays an important role in the development of comprehension strategies was that 18-month-olds' strategies in responding to yes/no questions were predicted by the functions for which their mothers characteristically used yes/no questions. This finding corroborates those of Allen and Shatz (1983) and Ninio (1992). Allen and Shatz (1983) demonstrated that young children's participation in specific linguistic routines with their mothers influenced their responses to an experimenter's what-questions. Sixteen- and 18-month-old children whose mothers played "Where's your _____?" games at home tended to respond to the experimenter's what-questions as if they were locative requests. Thus, children interpreted the experimenter's utterances as if they were associated with the same functions as their mothers' wh-questions. Ninio's (1992) study demonstrated that young children are sensitive to the functions associated with single-word utterances in maternal speech. She found that 18-month-olds' single-word utterances tend to be modelled after those of their mothers in that they are used to express the same functions/intents. As noted previously, Ninio's statement that children initially assign meanings to single-word utterances in terms of the "intentional communicative acts speakers perform" is based on children's production data. The

fact that the current 18-month-old subjects' responses to robot-utterances were linked to the functions/communicative acts used by their mothers lends support to Ninio's conclusion and extends it to multiword utterances.

Thus, the results of the present study, along with those of Ninio (1992) and Allen and Shatz (1983), indicate that children interpret specific forms (whether single- or multi-word utterances) in terms of the functions typically associated with these forms in maternal speech. These results are interpreted as a reflection of young children's sensitivity to form-function pairings in maternal input, i.e., 18-month-olds are sensitive to the communicative intentions expressed by specific forms (sentence types) in maternal speech. This conclusion is of course based on evidence regarding only one form-function pair - yes/no prescriptives - and certainly future research needs to examine a range of form-function pairs and how they relate to children's response strategies. However, a more important issue is what is meant by "sensitivity to communicative intent".

Certainly the 18-month-old's understanding of intent (communicative, or otherwise) is not the same as that displayed by a four-year-old or an adult. First, it is not an explicit or conscious understanding. Second, there is no evidence (from the present study) that the 18-month-old understands the conventional nature of maternal communicative signals. The most mature level of understanding communicative intent would certainly involve conscious knowledge that a particular verbal act is produced for the same end regardless of whether the producer of this act is the child himself or another (i.e., explicit knowledge of the conventional nature of the act). However, this level of understanding does not appear full-blown at a given age. Rather, as with any cognitive skill, a developmental perspective would suggest that there are earlier stages in (or precursors of) the development of this understanding. Perhaps the first step in forming a concept of communicative intent is the simple discrimination of different speech acts. It is this level of

understanding - discrimination of one speech act from another - that was addressed in this dissertation.[20]

As described in Chapter 2, this discrimination is made easy for the child in his/her natural interactions by adults' relatively consistent use of various contextual and linguistic markers of intent. In the "real world", benevolent adults use gestures, intonation, and contextual cues to help a child achieve accurate speech act interpretations (Bridges, 1979; Bridges et al., 1981). Language comprehension in a naturalistic setting is rarely a matter of comprehension of language alone. Rather, interpreting an individual's meaning or intent in producing a given utterance involves drawing on a number of sources of information (Hirsh-Pasek & Golinkoff, 1991), some linguistic (lexical and/or syntactic), and some nonlinguistic (e.g., event knowledge, immediate context). As Hirsh-Pasek and Golinkoff (1991) note, it is rare that an adult attempts to confuse a young child by presenting conflicting sources of information; e.g. talking about something completely new, or presenting syntactic information that conflicts with the contextual cues to which the child is attending. Rather, children use the "coalition" (Golinkoff et al., 1992; Hirsh-Pasek & Golinkoff, 1991) of a number of redundant sources of information[21] to converge on correct interpretations of speech acts. As indicated in Chapters 1 and 2, from the earliest stages of language learning, children actively search for cues to adult focus and intent. Given this active involvement in the comprehension process, along with adults' benevolent guidance, it seems highly unlikely that two-year-olds would be biased to act in response to speech. The research presented in this dissertation has demonstrated that, rather than experiencing such an initial constraint on their interpretations of speech acts (Shatz, 1978a), young children demonstrate considerable sensitivity to the functions for which specific forms are used by their mothers.

This "constraint", like other linguistic constraints, was proposed to account for children's performance in a particular experimental setting. Consequently, it does not take into consideration the social-cognitive skills displayed by young children in more naturalistic settings. As constraints theories are often set in opposition to social-pragmatic theories of language acquisition (e.g., Tomasello, 1992a; in press), it is important to examine the concept of constraints in more detail. As used in the preceding paragraph, the word "constraint" implies a "restriction, limitation, or confining" (Nelson, 1988, p. 227) of children's initial response strategies. Nelson (1988) defines constraints as language-specific, species-specific, innate mechanisms that involve no developmental change. She argues that none of the constraints that have been proposed for early word learning meet all of these criteria, and that the strategies used by two-year-olds in early lexical acquisition are better viewed as principles "acquired as language learned, rather than ... as initial constraints on how it is learned" (p. 239).

Proponents of constraints theories, however, do not accept all of Nelson's criteria as defining characteristics of constraints (e.g., Behrend, 1990b; Golinkoff et al., 1992; Kuczaj, 1990; Shatz & Wilcox, 1991). Behrend (1990b), in particular, has argued that constraints are "internal processes that narrow the range of potential outcomes" (p. 327), and that the operation of these processes does not exclude the effects of environmental or social influences on word learning. These social influences, however, can only operate within a narrow range permitted by innate constraints. Note that Behrend's constraints - both cognitive/perceptual and linguistic constraints - are defined as internal (and presumably innate) processes. More recent discussions have widened the definition of constraints to include external influences such as input (Shatz & Wilcox, 1991).

Shatz and Wilcox (1991, p. 340) define constraints as "factors that channel or direct the process of acquisition". They acknowledge that, although input is not

usually considered a constraint, it falls under this broad definition. In a detailed review of the acquisition of English modals, these authors identify a variety of internal and external constraints. They conclude that the frequency of specific modals in input affects the course of acquisition, but this influence is mediated by processing characteristics and/or limitations of the child. Thus, the constraints Shatz and Wilcox describe are social (input) and cognitive (processing limitations), and not specific to the domain of language.[22] Furthermore, Shatz and Wilcox argue that, as each child's history (in terms of input and cognitive processing) will differ somewhat, one should expect to find individual differences in the acquisition process.

This latter notion of constraints is compatible with the main findings of the present study; that is, that specific characteristics of maternal input are associated with individual differences in children's strategies in responding to speech. Although the present study provided no data on child-based constraints, it is assumed that internal child characteristics (such as temperament and level of cognitive maturity) account for some of the variance in children's response strategies. Thus, both child-based (internal) and input-based (external) factors influence children's early comprehension of communicative intent. In fact, the acquisition of a conventional understanding of form-function relations can be seen as a "social convergence process" much like that described for word and category learning (Adams & Bullock, 1986; Mervis, 1984; Nelson, 1985). According to this view, conventional meanings (whether of words or, in this case, larger linguistic units) are inferred by the child from the ways in which language is used in context (Nelson, 1988; 1991), and the child is supported in his/her interpretive endeavors by parental guidance (Adams & Bullock, 1986; Rogoff, 1990; 1991). This process of deriving meaning from use (Vygotsky, 1978; Wittgenstein, 1953) has also been called "guided reinvention" (Lock, 1980), a term which emphasizes the child's

active, creative role in acquiring language, but at the same time serves as a reminder that this role is very much dependent on social interactions with more knowledgable partners. It is in this sense that social/environmental factors such as maternal input can be seen as "constraints" or guiding influences on the acquisition of linguistic knowledge.

It should be noted that, while it is being argued that the child's acquisition of meaning is critically dependent on social context, the present experiment was explicitly designed to minimize contextual cues. The reader will recall that a robot was used to present test sentences in an effort to eliminate nonlinguistic cues to communicative intent, and thereby provide a relatively neutral context in which to assess children's response strategies. If language learning takes place in context, what can removing contextual support tell us about acquisition? In Katherine Nelson's words, in experiments with "no real-world interactive context, no adult collaborator to support inferences and provide feedback ... the child is forced to rely on his or her own strategies of interpretation" (1988, p. 241). Thus, the answer to "What can be gained by removing contextual support?" is "Information about the child's own strategies or response style". The results of the experiment described in Chapter 3 indicate that, when contextual cues are stripped away, children can and do rely on linguistic cues in producing responses. Furthermore, it was shown that, in this situation of minimal contextual support, individual children adopt different strategies in responding to speech. The experimental results thus provide a description of children's response strategies but, on their own, do not provide information about acquisition (Nelson, 1988); i.e., what types of influences in the natural environment lead different children to adopt different response strategies?

It is here that data on the child's naturalistic interactions with significant others becomes important. Characterizing maternal speech style along a continuum from

directive to conversation-eliciting and correlating these measures with child-measures from the experimental phase proves quite informative. In essence, children's strategies in responding to the robot's utterances (i.e., in a situation with minimal contextual support) can be predicted by specific maternal speech characteristics. Thus, the experimental results yield a description of children's response strategies, and the correlational findings suggest that these strategies may be derived in part from interactions with their mothers (and presumably other social partners in their communicative environments).

It is important to note that what is being put forward here is not a simple model of mother-to-child influence. Rather, as indicated above, language learning is best viewed as a social convergence process or "collaborative project" (Adams & Bullock, 1986) in which the adult adapts his/her speech to the perceived level of the child's understanding and gradually and felicitously introduces adult-level concepts and/or labels (Mervis, 1984). Thus, the characteristics of maternal speech that predict children's response strategies are not simple reflections of an inherent and consistent maternal style, but are better viewed as properties of the dyadic interaction (Pine, 1992b); maternal speech characteristics are determined by both maternal style and maternal response to her child's style and/or perceived competence (Smolak & Weinraub, 1983). As indicated in Chapter 4, most mother-child relationships in early language are likely bidirectional in nature (Dunham & Dunham, 1992; Yoder & Kaiser, 1989). However, as argued in that chapter, some of the relationships found in the present study are difficult to explain in terms of direct child-to-mother influences. Overall, the pattern of correlations obtained, particularly in the group of at-home dyads, indicates that a significant portion of the variance in children's response strategies can be attributed to pragmatic differences in speech input.

The material reviewed in the introductory chapters and the data presented subsequently together indicate that, from a very early age, children actively undertake to determine adults' focus and demonstrate considerable sensitivity to communicative intent. These early abilities are scaffolded or supported in routine interactions with familiar adults. With these social pragmatic abilities (as well as various cognitive achievements) in place as the language learning process begins, there is no need to propose specific linguistic constraints on early acquisition (Tomasello, 1992a). Although it remains possible that linguistic/grammatical constraints operate later in acquisition (Bates et al., 1991; Shatz & Wilcox, 1991), in the early stages with which we have been concerned, such constraints are not necessary to account for children's performance. Rather, children's social-cognitive abilities and their interactions with benevolent elders (Bruner, 1990; Rogoff, 1990; 1991) provide a solid foundation for the early acquisition of language which subsequently serves as a bootstrap for, and/or guiding influence on, further linguistic achievements (Shatz, 1987; Shatz & Wilcox, 1991; Tomasello, 1992b).

Footnotes

[1] This conclusion is supported by Greenfield's recent review of the development of hierarchical organization in two supposedly separate domains: speech and object manipulation/tool use. Briefly, her review of brain physiology in humans and primates indicates that initially there is a common neural basis (in phylogeny and ontogeny) for both of these abilities but subsequent cortical differentiation (in human children) results in two "relatively modularized" abilities of grammar and complex combination of objects (Greenfield, 1991; also see Karmiloff-Smith (1991) and Lock (1991) for further discussions on the development of modules).

[2] This conclusion is in accord with Merriman and Bowman's (1989) review of research on the mutual exclusivity bias. These researchers found that there is no evidence that this "bias" operates before 2;6. It is not present in the initial stages of word learning but develops after over a year of exposure to, and experience using, language (Nelson, 1990).

[3] Research with older children has shown that when an event has an invariant temporal or causal structure children require less experience to develop an accurately sequenced representation (e.g., Fivush, Kuebli, & Clubb, 1992; Mandler, 1983).

[4] Most studies of early games have examined mothers interacting with their infants; it should be noted that infants also participate in these structures with fathers and siblings (Dunn, 1988).

[5] Although Scaife and Bruner (1975) reported that three of their youngest subjects (2 to 4 months) were able to follow an experimenter's gaze, their measure of a "positive response" involved the baby's making one head turn in the same direction as the experimenter's head turn. This very liberal response criterion may well have resulted in an overestimation of these young infants' abilities. Similarly, stricter coding criteria than those used by Butterworth indicate that infants may not match

the direction of adults' head turns consistently until 12-13 months of age (Corkum & Moore, 1992; Morissette, Ricard, & Gouin-Decarie, 1992). However, several procedural differences between these studies and those of Butterworth and colleagues preclude any definite conclusions about age of onset of joint visual attention in the match head turn paradigm; different task requirements may very well lead to different estimates of age of onset (Schaffer, 1984).

[6] Note, however, that a considerable amount of variance is probably accounted for by age. Unfortunately, partial correlations controlling for this factor were not reported (Lempers, 1979).

[7] This matching of perceptual (and affective) experiences is important as it may be one of the factors that eventually aids the child's development of a representational understanding of others' minds (Barresi & Moore, 1992; Moore & Barresi, in press; Moore & Corkum, 1992).

[8] I am using the term "representation" in the sense of "knowledge, and the way in which it is organized" (Mandler, 1983, p. 420), rather than the use of symbols. I certainly do not mean to imply that the infant's representation of objects, actions, and events is equivalent to that of adults. The form of early representations and how accessible they are to consciousness certainly undergo developmental change (Nelson, 1985, 1986; also see Bloom (1991), Mandler (1983), and Mounoud and Hauert (1982) for discussions of the developmental processes involved in mental representation).

[9] Note that this developmental sequence is derived from studies of children learning English as a first language and therefore may not be universal. Word order, for example, is a more reliable cue to sentence meaning in languages such as English, and children learning English may rely on this cue more than children learning a highly inflected language such as Turkish (Slobin & Bever, 1982). Crosslinguistic studies of comprehension strategies are discussed briefly below.

[10] Paul (1990) interprets the "child-as-agent" strategy as reflecting "the child's expectations for adult-child interactions; that is, that adults usually ask children to do something" (p. 66). This interpretation presupposes the child's sensitivity to adults' communicative intentions, an ability which is explored below.

[11] I will examine the issue of form-function pairings in input and their influences on children's responses in detail in Chapter 4.

[12] Note that one particular verbal response - "no" - is ambiguous (cf. Shatz & McCloskey, 1984); i.e. the child could be refusing to act or could be providing the speaker with information. Thus, all simple No responses, whether verbal or gestural (i.e. a headshake) were classified as UNCLEAR; an average of 12 % of all responses were of this type.

[13] All F-values reported are, unless otherwise noted, significant at α=.01; this more stringent value of alpha was used to guard against Type I errors associated with multiple comparisons.

[14] This finding could be interpreted as suggesting that the children made fewer responses to the odd or unusual sentences (see Copula condition sentences listed in Table 1). However, previous studies indicate that young children respond to semantically and syntactically anomalous sentences (e.g., Kramer, 1977; Wetstone & Friedlander, 1973). Even when word order is severely distorted (Wetstone & Friedlander, 1973) children are quite willing to make responses. Thus, it is unlikely that the reason for lower response rates in the Copula condition was due to the 18- and 24-month-old subjects' detection of the "oddness" of these sentences. In any case, the statistically significant difference in response rates (means of 14.5 and 16.4, in the Copula and Action verb conditions respectively) is rather small in an absolute sense, and may not be conceptually significant.

[15] It should be noted that log-linear analyses of contingency tables assume independence among observations. Strictly speaking, there is no repeated-measures

equivalent of log-linear models. Thus, the data reported below should be intertpreted with caution (Y. Oshima-Takane, personal communication).

[16] This result may not be surprising because it is difficult to conceive of an appropriate action response to sentences in the Copula condition. Indeed appropriate actions were very rare in this condition (only three in total) and, in fact, there were no actions coded as appropriate in the Copula plus Object condition (e.g., "Are you being a doll?"). For this reason, and others discussed below, interpretation of the results of the Appropriateness analyses is problematic, and will not be pursued in any detail.

[17] Note that even a universal early strategy or bias in responding to speech is not necessarily evidence of an innate or specifically linguistic constraint (e.g., Bates et al., 1988; 1991). Thus, even if all children evidenced an action bias, factors common in the experience of all young children could account for such a response tendency. For example, adults generally ask young children to do things (Paul, 1990). Generalizing from this experience might cause children to respond to most speech with action.

[18] For these descriptive analyses verbal responses consisted of all verbal Informing responses (unintelligible as well as intelligible), whether or not they were accompanied by a gesture, verbal "no" responses, and all imitative responses. The resulting category of Verbal responses is thus at the same time broader than the Informing category (in that it includes "no" responses and imitations) and more restricted (in that purely gestural responses were not included).

[19] Unintelligible verbal responses are also included in this measure.

[20] The reader will note that children's responses to only two speech acts - requests for action and requests for information were examined, but these are not the only functions to which two-year-olds are sensitive. For example, as indicated in Chapter 2, they can discriminate between general and specific requests for

information (Anselmi et al., 1986; Furrow & Lewis, 1987). No claim is being made that the two broad categories of speech acts that were examined in this dissertation are developmentally primary; i.e., that infants first carve the "world of intents" into requests for action vs. requests to speak or vocalize. There is no systematic evidence of the responses of prelinguistic infants (i.e., those in the earliest stages of language learning) to different speech acts on which to base such a conclusion.

[21] Note that these sources may not be weighted equally at different points in development (Hirsh-Pasek & Golinkoff, 1991). It may be that event knowledge and prosodic and contextual cues play particularly salient roles in early comprehension and, for example, syntactic cues become increasingly important as age and linguistic knowledge increase.

[22] Shatz and Wilcox's(1991) review of the literature revealed no evidence for an initial abstract grammatical category of auxiliaries which "argues against a universal grammatical constraint operating early in acquisition" (p. 345). They do, however, suggest that a universal grammatical constraint could "kick in" later in development.

Appendix A

Individual data for demographic characteristics of sample at 18 months: Sex (Gender of child subject), BO (Birth Order), Ear (number of ear infections in past nine months), Kids (number of children contacted on a regular basis), Voc18 (productive vocabulary as measured by Form A of the Reznick checklist), Work Status (H = mother at Home full-time; W = mother working), MomEd* (maternal education), and DadEd* (paternal education).

Subject ID	Sex	BO	Ear	Kids	Voc18	Work	MomEd	DadEd
416	M	2	2	3	15	W	3	3
409	F	2	0	1	46	W	4	4
415	M	1	0	0	72	W	1	1
419	F	1	0	0	35	H	1	-
418	M	1	2	0	-	W	4	3
422	M	1	0	3	57	H	4	4
421	M	1	0	0	3	W	4	2
430	F	2	0	1	52	W	3	1
424	M	2	2	2	56	W	4	3
423	F	1	0	0	3	H	4	4
426	F	1	3	15	12	W	5	4
429	F	2	2	1	32	W	4	4
434	M	1	2	1	10	W	4	5
440	F	1	0	0	23	H	2	2
433	F	2	0	2	37	H	2	2
444	M	1	0	0	22	W	4	5
441	F	3	0	-	40	H	2	3
449	F	2	0	3	24	H	4	5
448	M	1	0	1	6	W	4	4
508	M	1	0	2	35	W	3	4
451	F	1	1	1	4	W	2	3
452	M	2	0	2	11	W	3	3
455	M	1	2	12	25	W	2	2
454	F	3	1	3	11	W	4	2
453	M	1	1	0	18	H	3	3
457	F	2	1	3	2	W	3	3
462	F	2	0	5	38	W	4	5
464	F	1	0	0	29	H	3	4

* For parental education, 1 = less than high school, 2 = high school graduate, 3 = some college education, 4 = college graduate, 5 = advanced degree.

Appendix B

Descriptive summary of demographic data, including productive vocabulary as measured by Forms A (18 months) and C (24 months) of the Reznick checklists.

Variable	Mean	Standard Deviation	Range
Number of Children*	2.63	3.61	0-15
Ear Infections	0.68	0.94	0-3
Maternal Education	3.21	1.03	1-5
Paternal Education	3.26	1.16	1-5
Total Vocabulary (18 months)	26.59	18.96	2-72
Nouns (18 months)	17.22	13.05	0-47
Verbs (18 months)	3.19	3.19	0-11
Total Vocabulary (24 months)	68.64	30.67	11-116
Nouns (18 months)	40.71	16.44	6-64
Verbs (18 months)	11.54	6.43	0-21

* This variable represents the number of children (including siblings) that a given child interacted with on a regular basis.

Appendix C

List of test sentences in order of presentation.

1. Can you sit down?
2. Can you jump?
3. Can you sit down on the snake?
4. Are you being good?
5. Are you jumping?
6. Can you be big?
7. Are you being a doll?
8. Can you dance?
9. Can you be a girl?
10. Can you be a doll?
11. Are you jumping on the frog?
12. Are you sitting down on the snake?
13. Can you be happy?
14. Are you being big?
15. Can you jump on the frog?
16. Are you being a boy?
17. Can you dance with the doll?
18. Are you dancing?
19. Can you be a boy?
20. Are you sitting down?
21. Are you being happy?
22. Can you be good?
23. Are you being a girl?
24. Are you dancing with the doll?

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