

# Intentionality and Language Development <sup>1</sup>

Lois Bloom and Richard Beckwith <sup>2</sup>

CITATION: Bloom, L., and Beckwith, R. (1989). Intentionality and Language Development. Unpublished manuscript.

## ABSTRACT

The purpose of this paper is to argue for explicit reference in child language research to the states of mind that underlie expression. As a result of taking this Intentional stance we can more cogently (1) address the development of capacities that make such representations possible; (2) explain certain well-known phenomena in language development such as the transitions to using words and learning grammar; and (3) explore the developmental relation among different systems of expression such as between speech and affect. Expressions, whether through action, speech, or affect, are a license to attribute the representations that underlie them. Such attributions are basic in research with children learning language. Our goal is to highlight this practice, and, thereby, offer a theoretical framework for unifying the perspectives within which research in language development is ordinarily pursued.

---

<sup>1</sup>The ideas here evolved in the context of research supported by Research Grants to Lois Bloom from the National Science Foundation, 1981-1989, and the Spencer Foundation, 1981-1986, for which we are grateful. We thank Julie Gerhardt, Margaret Lahey, Peggy Miller, David Palermo, Herb Terrace, and Sue Savage-Rumbaugh for their comments on an early draft of this manuscript.

<sup>2</sup>Lois Bloom is the Edward Lee Thorndike Professor Emeritus of Psychology and Education, Teachers College, Columbia University. Richard Beckwith is Research Psychologist in the Experience Insights Lab of Intel's Anticipatory Computing Lab.

## INTENTIONALITY AND LANGUAGE DEVELOPMENT

The perspective on language development presented in this paper explicitly addresses the contents of conscious states of mind that co-occur with actions and, especially, acts of expressing and interpreting. These states of mind include the beliefs, desires, and feelings that we express as we relate to one another in everyday contexts. We propose that language has evolved in societies because of its facility for making such expression possible. It follows, then, that children learn language in the effort to make known to others the contents of their own beliefs, desires, and feelings and to attribute beliefs, desires, and feelings to other persons. The perspective we propose is a theory of expression. As such, it brings together two major aspects in the mental life of the young child: cognition and emotion.

Any successful effort toward an understanding of psychology, in general, or language development, in particular, must consider the fact that what individuals think about in their conscious states of mind underlies their actions (Miller, Galanter & Pribram, 1960). These, in turn, determine their development (e.g., Brandstadter, 1984; MacMurray, 1957; Piaget, 1937/1954). The states of mind that underlie acts of expression and interpretation can be thought of as "mental spaces" with contents that are about events and objects (Fauconnier, 1985). The contents of these mental spaces are representations constructed out of what we perceive and what we know. They occur along with a psychological attitude toward them, attitudes like what we believe, desire, or feel about them. We propose that children actively engage in acquiring words and constructing the grammar of a language in their endeavor to express the contents of these states of mind.

This theoretical framework has its origins in *Intentionality*—the term is borrowed from philosophy; the construct is common to both philosophy and psychology. We chose to use the term Intentionality with some trepidation, given the possibility of its being misunderstood for the volitional sense of intending. Of the words available for talking about the special relation between contents of mind and the external world, representation and Intentionality are most felicitous. While representation can mean what we want, it has other uses as well, such as when we speak of a word representing its referent, or when we speak of knowledge that is represented in long term memory. Intentionality, while not now having currency in the literature of psychology, does have precisely the meaning we sought in the literature of philosophy. Intentionality is about the contents of beliefs, desires, and feelings. Reference to these mental states is implicit in many assumptions and practices that are widespread in the study of child language, and, indeed, in virtually all of psychological theory and research. Our goal is to make reference to these mental states explicit in the effort to understand and explain the acquisition of language.

Theories of human behavior concerned with Intentionality have a long history in philosophy. That history begins with Aristotle and continues through Descartes to Brentano (1966) and Edmund Husserl (e.g., the papers in Dreyfus, 1982) at the turn of the present century. The banner of Intentionality is carried today in the work of such contemporary philosophers as Danto (1973), Dennett (1978), Fodor (1979), Searle (1983) and Taylor (1985). The work of Brentano and Husserl was, in part, a response to Wundt's (1894) "scientific methodology" which introduced experimental methods to the study of psychological phenomena. Experimental psychology resulted eventually in the rise of Behaviorism in Anglo-American psychology and the accompanying devaluation of "unobservable" phenomena. Psychologists in general did not again consider mental phenomena legitimate for study until the publication of *Plans and the Structure of Human Behavior* (Miller, Galanter & Pribram, 1960) which was written as a response to the behaviorist movement. Since then, work in cognitive science (e.g., Johnson-Laird, 1983; 1988), theories of mind (e.g., Wellman, 1990; Wimmer & Perner, 1983; the papers in Astington, Harris, & Olson, 1988); and linguistics (e.g., Fauconnier, 1985) has taken an Intentional perspective.

The word "intentionality" in the sense of intending is already used in language acquisition research in several contexts, with meanings that are related to but not the same as the sense in which we are using the word. For example, one such context is the proposal that language development depends on mothers attributing intentions to their infants during interaction. These intentions are desires for a goal or a change of state. By expressing these desires for her child, the mother provides experiences with the kinds of language that can achieve the goal (Bruner, 1975, 1981; Ryan, 1974), and the child comes to realize that vocalizations can serve to influence the behaviors of other persons (McShane, 1980). Another context is the application of speech act theory to pre-speech and single-word speech, where the intention of an expression was invoked as the "primitive force" or purpose for uttering words

(as in the "illocutionary force" of Austin, 1962) by Bates, Benigni, Bretherton, Camaioni & Volterra (1979) and Dore (1975). And in yet another context, the beginning of communication is identified with behaviors that are intended by the infant in the sense of being voluntary and purposive with sustained actions directed toward other persons and a goal (e.g., Bates, 1976; Dore, 1975; Greenfield, 1980; Harding & Golinkoff, 1979; Scoville, 1984). These several contexts have a theoretical continuity. Each suggests that children acquire language as a "tool" for achieving purposes and goals in their interactions with others, and the theory of language development that is promoted is an instrumental one.

However, "[i]ntending," in this ordinary sense, has no special role in the theory of Intentionality. "Intending to do something is just one kind of Intentionality along with believing, desiring, hoping, fearing, and so on" (Searle, 1984a, p. 60). A desire, to achieve a goal or to communicate, is one kind of Intentional state in which one intends to change something in the world to fit the contents of mind (Searle, 1983). However, many of the Intentional states that we hold in mind are beliefs and feelings, and the actions of their expression reflect the way we believe the world to be rather than the way we desire it to be. Language expresses, and the child acquires language to express, what these mental states are about. These include but are not limited to the intentions entailed in achieving goals and desires.

In sum, our theoretical perspective departs from the commonly held view that language is acquired by children as a tool for designating objects and events and influencing the actions of other persons. With language viewed as a tool, as in instrumental theories of language acquisition, the focus is on end states and the effect of the child's behaviors on the context. This focus on end states emphasizes the external dimension of language and how the child achieves the goal. However, the use of language as a tool should not be central for a theory of language development any more than it is to a theory of the emotions. Tool use, in general, is subordinate to the symbol making capacity of humans (Burke, 1935; Piaget, 1972/1973) and it is our symbol-making capacity that makes it possible for us to have goals and to use tools. The symbolic capacity allows us to manipulate entities and relations in our minds in recalling aspects of events from memory and anticipating new events. Language makes these mental contents manifest and puts them in a public space (Taylor, 1985). What should be central to a theory of language acquisition, therefore, is how development of the ability to construct and manipulate these representations in mental spaces relates to the ability to process language input for the linguistic procedures to use in expression.

When language is viewed as the expression of mental contents, the focus shifts from the external to the internal dimension of language. This shift in focus allows us to inquire into development of the capacities that are necessary for expression. And because infants are capable of expression through displays of affect long before language is acquired, we need to consider other cognitive capacities for thought and emotion along with the capacity for language. The perspective on language development that results, in this view, is a mental one rather than an instrumental one.

Expression is central to this perspective. All the functions of language, including its instrumental and designative functions, depend on the fact that what one has in mind determines what is said and what is understood of what others say. Language has many functions; the instrumental function of language is only one of them and expression is basic to all of them. Speech can function to influence other persons and get things done in the world only because language makes one's beliefs, feelings, purposes, and goals known to others. Expression, then, makes these functions of language possible and is not, itself, just one of language's functions.

Assuming that expression is central for language development can pull together the disparate theories that we now have in child language. For instance, certain theories consider the relevance of children's early conceptual development to language (e.g., Bates, et al., 1979; Bloom, 1970, 1973; Bloom, Lifter & Broughton, 1985; Clark, 1983; Nelson, 1974; Nelson & Lucariello, 1985; Sinclair, 1970). Other theories consider the procedures whereby children learn syntax (e.g., Braine, 1976; Gleitman and Wanner, 1982; Maratsos & Chalkley, 1980; Pinker, 1984). And still other theories explain the development of communication in social contexts (e.g., Bates, 1976; Dore, 1975; Ervin-Tripp, 1973; Halliday, 1975). As a theory of language development, each of these explanations is insufficient by itself because each sort of theory deals with only one or another aspect of the acquisition process. In fact, these several aspects of learning (world knowledge, linguistic procedures, and social convention) come together as the child acquires language, and they are integrated in the child's endeavor to express what the contents of states of mind are

about (Bloom, 1976; Bloom & Lahey, 1978). The fundamental assumption that words and sentences are expressions of Intentional states is already implicit in the cognitive, linguistic, and social interactive theories that we have for language development. By making this assumption explicit and the cornerstone of a research strategy, we can strive to encompass the explanatory goals of each of these theories.

The theoretical model we are advancing here also reflects certain theories of cognition because the mechanisms that are required by the model are familiar psychological phenomena. For example, the claim that the child acquires language in order to express the contents of states of mind is relevant to theory and empirical findings on short term memory (e.g., Klatzky, 1980) or working memory (e.g., Case, 1974; Pascual-Leone, 1970); the use of verbal reports in evaluating cognitive processes (e.g., Ericsson & Simon, 1980); the development of recall and recognition in infant memory (e.g., Mandler, 1983; Moscovitch, 1984); the nature of awareness (e.g., Klatzky, 1984; Yates, 1985); and the sense of "mental models" as used by Johnson-Laird (1983).

We have presented this brief introduction of the basic assumptions in the perspective we offer in order to show their relatedness to practices and assumptions in psychology in general and the study of language development in particular. The rest of the paper has five major parts. Our use of Intentionality to explain language development requires a cognitive theory in which Intentional states, knowledge, and semantics are among the unobserved elements that need to be accounted for. We begin, then, by showing how the contents of conscious mental states come from and yet are separate from (1) the contents of knowledge that are stored in memory and (2) the semantics used for expression. We then turn from these unobserved elements to the observed, and draw a distinction that will be important in what follows: the distinction between behaviors (observed movements) and actions (which have an unobserved element). The third part of the paper is taken up with connections between the observable and the unobservable in an account of expressions and the attributions that we can ascribe to expressions. Here we consider the modes of expression that children deploy and their significance for the child and for methodology in child language research. In the fourth part of the paper, we present our efforts to translate theory into method, and report results from several recent studies carried out within the theoretical perspective we are proposing. And in the final part of the paper we discuss the explanatory power of a model of language development that includes Intentionality.

#### INTENTIONAL STATES AND KNOWLEDGE

Inherent in the type of theory that we are proposing is the distinction between what we think about and what we know—the distinction between our momentary beliefs, desires, and feelings on the one hand and the knowledge that we have stored in memory on the other. Intentional states occur in what has traditionally been studied in psychology as short term memory. Short term memory was described by Klatzky (1980) as loosely analogous to a workbench with mental activity constrained by the physical limits of the space (i.e., its capacity) and the accessibility of materials that are stored nearby (i.e., procedural knowledge like language and other knowledge that is stored in long term memory). Intentionality, so construed, is the "leading edge" of the mind. It intervenes between objects and events that exist in the immediate context and knowledge about the world stored in memory. It is that aspect of cognition through which percepts and aspects of memory are related to one another, and both are related to words, sentences, and discourse.

The relation between Intentional states and knowledge is analogous to the relation between linguistic actions (speech and interpretation) and language. Again, relatively speaking, Intentional states contain what we experience "here and now." They are those momentary representations that determine the individual's course of action in the external world. Similarly, linguistic acts of speaking and interpreting are momentary constructions using data from memory and perception in the "here and now." But, in contrast, knowing a language is independent of current internal states and external conditions (Chomsky, 1966). Knowledge, likewise, exists in memory independently of the present state of internal and external affairs; the contents of knowledge are not directed to the here and now. While speech as well as beliefs, desires, and feelings are generally directed toward objects in the world, language and knowledge are not.

A corollary of the relative dependence/independence on present conditions is time-boundedness. Again, we use the analogy with linguistic actions and language. The linguistic acts of speaking and interpreting speech are bound in

time; they are dynamic, real-time phenomena. However, language itself is knowledge and must be thought of as existing independently of real-time phenomena.

Thus, in contrast to knowledge, Intentional states occur in real time and are constructed out of knowledge summoned from memory and the data of perception. They are snapshots of the stream of consciousness and as such they are always time-bound. But knowledge exists in memory independently of real time. Whereas elements of knowledge may or may not have a time associated with them, certain aspects of knowledge are not associated with any time at all. These timeless "elements of memory" (in the terminology of Tulving, 1983) include concepts of objects, knowledge of events, and knowledge of procedures. For example, the concept of what a dean is, the knowledge of what happens during events such as a breakfast, and the "procedural knowledge" for parsing sentences of spoken English, all exist in memory without any particular times associated with them. But other elements of memory, such as knowledge of specific events (episodic memory) do have a time or times associated with them, for example, the time we listened to the dean of our college speak at last year's commencement breakfast. Thus, elements of what has been called "declarative knowledge" may have a time associated with them (as with memory for specific events) or may not (as with object concepts and event knowledge). However, all elements of memory, whether they have a time associated with them or not, exist in the knowledge base independently of current Intentional states.

Just as Intentional states of mind are not the same as the knowledge invoked in their construction, neither are they equivalent to the semantics of the language used for their expression. Intentional states are mental states, which are personal constructions; they consist of "domains that we set up as we talk or listen and that we structure with elements, roles, strategies, and relations" (Fauconnier 1985, p. 1). The meaning of an expression is what the contents of the mental space underlying the expression are about. Such contextualized meaning, or situational meaning, is the pragmatic aspect of an expression (in the sense of Morris, 1938) and is personal because the representation belongs to the individual. "[M]eaning is in the head of the person" and is assigned to environmental events by individuals on the basis of their personal theory of the world (Palermo, 1986, p. 7). This personal meaning is distinct from semantics, which is the culturally determined aspect of meaning encoded in a linguistic expression. Semantics is interpersonal because a community of users, not the individual, assigns semantic value to an expression. This semantic knowledge is socially determined and conventional; semantic knowledge does not change from one expression to another.

In the theory of meaning put forward by Miller & Johnson-Laird (1976, p. 8), "words and percepts are not linked directly to each other but . . . both provide avenues into a conceptual realm that is itself the central concern of cognitive psychology" [i.e., Intentionality]. They emphasized the relations between perception and words in this mental space, and on how individuals know that a perceived object is an instance to be named by one label rather than another. But the contents of mental spaces can be less about what is seen and heard in the context and more about objects and events recalled from memory. We contend that this is what happens with development. With added knowledge, and the ability to use more and different cues to recall aspects of knowledge from memory, the child comes to form and express mental contents that are increasingly elaborated and independent of the context. We will argue below that this elaboration and separation of Intentional states from context drives the acquisition of language.

In this theoretical framework, acquiring language is dependent upon developments in the cognitive capacities for representation in Intentional states as well as development of the contents of knowledge stored in memory. These cognitive capacities include at least several things. One would be the development of recognition schemas for perceptually processing objects and events. Another would be the ability to use this perceptual experience for forming concepts, constructing event knowledge, and acquiring procedural knowledge. And, along with developments in capacities for perception and developments in memory would need to come developments in retrieval and recall for accessing and integrating aspects of memory with data from perception in the mental representations that underlie action.

In sum, speaking and interpreting are here and now events and are manifested in behaviors that can be observed by other persons. But they are actions "done" by individuals based on sets of beliefs and expectations that are not,

themselves, observable. We turn next to the distinctions among characterizations of observable events, and between observable and nonobservable events.

### ACTIONS AND BEHAVIORS

Both actions and behaviors include bodily movements. In the classic view of behavior in psychology, as in "Behaviorism," only the bodily movement, shorn of anything mental, was considered worthy of study. A behavior is a bodily movement that is restricted to what can be observed without it being supposed that it is done by the mover. That is, the notions of "mover" or "doer" are not acceptable in Behaviorist accounts. But whereas behaviors are considered observable, action entails an unobservable mental component. Actions are done according to contents of mind. In the domains of both perception and action alike we have a "space between ourselves and what we perceive when we perceive directly, and what we do when we directly act" (Danto 1973, p. 50). These actions, that we do, are coherent with the expectations that we have in mind, expectations based on prior knowledge and present events that concern subsequent events.

Actions, then, by definition, have a mental component and a derived capacity to represent because of the representational properties underlying them (Danto, 1983). The importance of observable behaviors to psychology is understandable because behavioral descriptions in context are all that we have for attributing the representations underlying them. But to understand the behaviors that we see and their development, we have to inquire into the mental phenomena that they make manifest.

Speech acts (the acts of declaring, requesting, directing, and the like) are often attributed to children (e.g., Bates, 1976; Bruner, 1975; and Dore, 1975) to describe what they do, and how what they do affects their interactions with others. Speech act attributions are typically used without making explicit the representations that underlie them (as pointed out by Danto, 1973), even though speech acts are necessarily defined with regard to the Intentional states underlying them (Searle, 1983). What children have in mind when performing a speech act is a belief or desire directed toward some mentally present object or event, like seeing a clock, getting a cookie, or building a tower. Their utterances express these representations, and the resulting expressions allow the attributions that listeners make. This was recognized at least as long ago as Stern (1924) who described "early speech . . . [as] a striving after something, a turning away from something, a joy about something" (p. 149).

An utterance in a speech act influences the actions and beliefs of a listener when the listener correctly attributes an underlying representation to the speaker. The listener will interpret an expression by using information from other aspects of the context, and from memory, to construct a corresponding representation. Thus, the speaker succeeds when "the utterance is causally sufficient to initiate the sequence of psychological processes in the hearer which eventuates in . . . a mental state that corresponds to the one that the speaker [was] in" (Fodor, 1979, p. 104).

Behaviorist theory describes that aspect of this effort concerned with what is observable of the speaker and listener. A theory concerned with Intentionality, in contrast, attempts to explain the unobservable events that cause the behaviors to occur. We submit that the only way in which we can expect to understand the origins of language and its development in children is by taking this level of awareness seriously and attributing mental contents to the expressions that children deploy.

### EXPRESSION AND ATTRIBUTION

We begin this discussion of expression and attribution with children's modes of expression and the significance these have for child language research. Here we consider the data researchers can use in child language research and why it is reasonable to look to these data. We then turn to what we are licensed to attribute to the child based on the child's use of different types of expressions.

#### *Modes of Expression and Child Language Research*

An expression is "a set of material properties . . . [that] embody a given representation" (Danto, 1983, p. 252); an expression "makes something manifest in an embodiment" (Taylor, 1979, p. 73). It stands to reason then that such a manifestation is a license to attribute more to the actor than simply what is observed in the act of expressing.

Utterances are only the observable behaviors but we can make inferences about the representations underlying them. A criterial feature of expressions is that, in Taylor's words, "their expressing/saying/manifesting is something that they do. . . rather than something that can happen through them" (p. 76). Obviously, language is a mode of expression par excellence, and any study of language that admits of semantics or pragmatics is, by definition, the study of expression.

In studying child language, we tend to take expression for granted in the sense that it rarely finds its way into our research through the front door. However, as a back door practice, attribution based on language as expression is ubiquitous and has been so at least since the classic study by Stern & Stern (1907). We attribute some underlying conscious model to the child when we discuss replacement sequences, for example, "car / ride car" (Braine, 1976). We do the same when we discuss successive single word utterances, for example, "blanket / cover / head" (Bloom, 1973), or the unfolding of meaning in discourse. When we follow one particular word or set of words over time, we attribute something that allows those words to cohere. When we discuss event-based descriptions, we attribute a single underlying event that a series of utterances is about. In these cases, and many more, we assume that language is expression, that we know what it is an expression of, and, consequently, that we can see when two or more utterances express just one thing. We have not analyzed this particularly important background and ubiquitous practice (although, we can see that this certainly needs to be done). But we are suggesting that this practice be made explicit, which is surely a necessary step before analysis.

What sorts of expressions do children on the threshold of language use? We already know that linguistic action can be seen as expression but are there other forms of expression that we might look to, to help us to discover what is hidden in the child? Is this even a reasonable task? According to Freud, it is (1905/1963):

"When I set myself the task of bringing to light what human beings keep hidden within them. . . by observing what they say and what they show, I thought the task harder than it really is. He that has eyes to see and ears to hear may convince himself that no mortal can keep a secret. If his lips are silent, he chatters with his finger-tips; betrayal oozes out of him at every pore" (p. 96).

Freud's theory of human behavior employed the same implicit principles as a theory of Intentionality (Searle, 1984a). His was perhaps one of the earliest psychological theories to make use of modes of expression other than just the spoken word in Intentional state attributions. Still, the question remains as to what sorts of expression are available to us from the young child.

*Affect as Expression.* We know that emotional states are related to particular behaviors and affect displays are in place from the beginning of infancy. Are these appropriately considered expressions? Affect displays do allow us to say something more of an individual than simply that the display is apparent. The affect display, as the public aspect of the constellation of things associated with an emotion, is a manifestation of that emotion. At the least, we can say that the individual is experiencing some emotional state or is feigning that state.

Emotions are like a special kind of belief, and emotions and beliefs are similar in one important respect (as described in detail by Danto, 1973). We cannot have a belief because we want to have it. Likewise, we cannot feel an emotion because we want to feel it. Neither beliefs nor emotions can be done for a reason. In distinction to the way that we do actions, we don't do emotions any more than we do beliefs. Thus, our expressions of affect are not caused by our desires to express, any more than our feelings are caused by our desires for them. There must be reasons for feeling an emotion independent of the desire to feel it, just as there must be reasons for expressing an emotion independent of the desire to express it. "[W]hen an [affective expression] expresses an emotion, it has no purpose. It is almost as though purpose and passion are at logical odds" (Danto, 1973, p. 153). That one can feign emotion does not argue against this position; it only serves to highlight the potential symbolic function of these expressions (Eco, 1973). When we truly express our emotions in our interactions with other persons, they may have an effect. But whatever instrumental function that they have comes from their interpretation by others.

What can be attributed to the pre-linguistic child based on affective expression? Beliefs and emotions must be caused by something other than the desires of the person who holds the belief or feels the emotion or, at the very least, the person must believe them to be so caused. Since the object of an emotion must have caused that emotion, the object of an emotional expression will participate in the representation underlying that expression. This means

that the reasons for the feeling exist in the representation underlying the emotion and can be attributed to the expression of the emotion. So given the affective expression, we can attribute not only the emotional experience but also that the child's Intentional state includes the cause of the emotion. Affect displays, then, are expression and expression through affect is in place before any words are acquired for expression.

*Action as Expression.* Another possible form of expression, and one that is surely available to the young child, is action. Meaning in action is different from linguistic meaning because action does not use a set of signifiers with pre-established meaning (Taylor, 1979). Yet an action is, nevertheless, an expression. But when is action an expression? Do we know more of a person who is engaging in an action than simply that the person is moving? Taylor suggests that actions are expressions of a particular type; actions make something manifest in an embodiment. And to satisfy Eco's (1976) criteria for a symbol, we can lie with our actions, as when we act in a way so as to mislead those who would interpret our actions.

Certain "basic actions" (Danto, 1973), like raising one's arm, suggest only that someone did them; they are not representational. But other actions (such as raising one's hand to ask a question or to reach for something on a shelf) do point to something outside the action itself and it is this property that qualifies them as an expression. Gestures are actions, and certain gestures are among children's earliest expressions. Shaking the head to mean "no" might arise out of the child moving away from a feeding spoon in the first year as described by Allport (1924). Showing, giving, and pointing appear toward the end of the first year (Bates et al. 1979). One-year-old children's play with objects includes frequent actions of separating and constructing relations between objects, for example, connecting and disconnecting the cars of a toy train. Attributions of what children have in mind during these displacements provide evidence of developments in mental representation underlying their play and in relation to progress in learning words (Lifter & Bloom, 1989).

Thus, we can say that an action is an expression when it is an embodiment (medium) of some represented content (meaning). The same representation may find different embodiments, "the same meanings, as it were, appearing in different media" as, for example, speech and printed text are different embodiments of meaning in language (Danto, 1983, p. 251). Similarly, a child can express the same underlying representation (for example, connecting a toy train) with different embodiments. The child might either connect two objects in an action (like putting together the cars to make a train), or express their connection with a gesture (pointing), or with words (saying "train" or "make train"), or with an affect display (whining when unable to connect the train or smiling on completing the action).

In sum, in offering a strategy of research with children on the threshold of language, we suggest keeping in mind that several modes of expression are available to the young child and we are licensed to make attributions on the basis of each of them. To make these attributions, our research practices do not need to significantly change. We need only acknowledge and make explicit the practice of making attributions based on language as expression and then to expand the conditions under which we engage in this practice.

### *The License to Attribute*

Given these three modes of expression—language, affect, and action—we must address the question of what we are licensed to attribute to someone engaging in them. The issue of licensure in these attributions is likely to be problematic, since disagreement abounds as to what one is licensed to attribute to a child even based on language. For example, the dissent surrounding rich interpretation of child language is nothing if not an argument concerning the license to attribute (e.g., Bloom, Capatides & Tackeff, 1981; Golinkoff, 1981; Howe, 1976). Rich interpretation involves assigning semantic-conceptual categories to the words in an expression based on the conditions under which the expression was uttered (Bloom, 1970). If certain categories are attributed some criterial number of times, then the category is considered to be the best description for the child. The categories assigned in rich interpretation are based on our understanding of child language and developmental psychology as well as our understanding of what language is. But what understanding can we bring to attributions based on affect expressions and actions? Our knowledge of developmental psychology will be equally important in these tasks. And some things that we know about affect and action will assist us in our attributions and license the attributions we make.



Affect expressions are often seen as expressions of such discrete emotions as disgust, joy, and happiness (as in Darwin, 1872). As such, we should be capable of attributing at least these emotions to the displays in question. However, we do not know whether individual expressions of these discrete emotions would relate in any interesting ways to language development. Nor are we familiar with any theoretical or empirical work that makes such claims. And so this attribution, while possible, may not be interesting.

Another possibility, and one which we have pursued (Bloom, Beckwith, Capatides & Hafitz, 1988), is attributing what these emotions are about. As already noted, affect displays, as manifestations of emotions, are about something, and the emotions must be caused by something (Danto, 1973). For example, individuals at a party might taste a pie that disgusts them. If they were to express this disgust and someone were to ask what disgusted them, they could respond that it was the pie. If they were to say that nothing caused them to express the disgust, we might discount the expression as one of disgust. In order for something to be an expression of disgust, or any emotion, there must be something that caused it, something that it is about. We can often determine what caused the emotion by observing contextualized affect displays. A child's emotion may be disgust about a pie, or fear of a snake, or joy about receiving a present. The point is that the things the child's emotions are about are frequently part of the context so that thought about those things can be attributed to the child.

However, objects and events in the external context are not the only causes of emotions. Mentally represented plans have frequently been cited as relevant for both positive and negative feelings (e.g., de Sousa, 1987; Oatley & Johnson-Laird, 1987; Stein & Jewett, 1986). Negative emotions are often associated with negative outcomes of plans or perceived obstacles to plans. Conversely, positive emotions are often associated with positive outcomes of plans. When feelings are caused by beliefs that are organized around some goal in a plan, different sets of beliefs lead to different feelings. For example, as described by Stein & Jewett (1986), the emotions anger, fear, and sadness result from the following beliefs about the attainment or failure to attain some desired state of affairs. Anger and sadness both entail the belief that a goal is already lost, while fear entails the beliefs (1) that a goal is not yet lost and (2) some event is imminent that will result in loss of the goal. Once the goal is lost, anger entails additional beliefs about the cause of the loss or failure, whereas sadness entails beliefs about the consequences of the loss of the goal. Similarly, positive feelings of pleasure, satisfaction, and joy entail beliefs about achievement and success with respect to goals and plans (Rothbart, 1973). In many contexts, affect can serve as an index according to which planfulness may be attributed. Additionally, in many contexts, the elements that make up a plan are also themselves evident and thus attributable.

Actions can also be seen as expressions of plans (Miller, Galanter & Pribram, 1960). More generally, Taylor (1979) claimed that actions are the natural expression of desire. Just as with the emotions, desires are about things and so like emotions, we are often licensed to attribute what the desire is about in addition to the desire itself. A desire to act is not necessarily the same as action directed toward some goal. One can act with the only intent being to engage in that activity (as with Piaget's primary and secondary circular reactions), or the act may involve, that is be about, things in the external world. One set of rules for determining whether we are licensed to attribute some sort of planning to the child was suggested by Greenfield (1980). When we see someone act in a particular way, we are licensed to attribute to that person the desire to act in that way. If the person's action ceases after the action leads to some effect, we are licensed to attribute to that person the plan to achieve that effect. To the extent that the action and/or its effect involves things external to the action itself (e.g., tools or affected objects) and those things are apparent in the context, we are licensed to attribute to the child thought about those objects.

In sum, speech, affect displays, and action permit an observer to make an attribution of the state of mind of the expressor. Parents make these attributions routinely in their everyday caregiving practices and infants soon learn to do the same. Such mutual attribution forms the heart of the processes of intersubjectivity that sustain the individual in a social world. We propose that the underlying representations in these attributions are the units upon which the child operates in acquiring language.

### *Intentionality in Language Development*

Two assumptions follow from our pointing to beliefs, desires, and feelings in the effort to explain language development, and our contention that changes in the representations a child can hold in mind underlie the

acquisition of language. The first assumption is that children will acquire words and language structures as the contents of these mental states become increasingly discrepant from the data of perception. The earliest Intentional states in infancy are constrained to the data of perception: what the infant sees and hears determines what the infant has in mind. With developments in knowledge and in procedures for retrieval and recall, the infant can access objects and events from memory that do not match the data of perception. The ability to express something about the objects represented in the child's mental space but not present in the context requires language in order to enable understanding (i.e., interpretation) by others. The discrepancy between the contents of Intentional states and perception creates the demand for language since the child can no longer exploit a shared "here and now" context for interpretation.

The second assumption is that as the contents represented in mental spaces become increasingly elaborated, the child will require correspondingly more complex language for expression. That is, the more elements and relations between them that are constructed in a child's mental space, the more the child will need to know of the language for expression. For example, the period between two and three years of age in language development is noteworthy for the transition from saying simple sentences that express a single proposition, to the acquisition of complex sentences that express more than one proposition. This transition has been attributed to developments that make it possible for the child to hold in mind two propositions and the relation between them (Bloom, Lahey, Hood, Lifter & Fiess, 1980). If the capacity to generate expressions is to keep up with changes in the contents of the child's beliefs, desires, and feelings, then the child's knowledge of semantics and syntax must necessarily change. The child must acquire a language that can generate such expressions.

#### TRANSLATION FROM THEORY TO METHOD

Thus far, we have yet to describe the use to which we can put these attributions. Saying what we cannot do is easier. For instance, we cannot give a complete account of the relevance the expression might have from the child's developmental history. Nor can we give a complete description of the meaning that the child would assign the expression. What we can do is sometimes to describe, with more or less success, something of what the expression is about. But this, still, is not easy. Research concerning the language development of children on the threshold of language presents difficulties not altogether apparent in research with older children or adults. We believe, along with others, that the child makes a substantial contribution to the acquisition process. But the form of that contribution is obscured by the child's relative incapacity in language.

These difficulties converge on a particular problem, the problem in coming to the "preferred description" (Searle, 1983) of some expression for the child. The problem with preferred descriptions is easily exemplified. Consider a one-year-old toddling across our laboratory playroom on the upper West Side of Manhattan in New York. Infinitely many descriptions could be given to this behavior. A description that the child was walking west toward the Hudson River would accurately describe the behavior but it would not reflect the fact that the child did not know about the river below nor the polar coordinates of the direction of walking. A description wherein the child was walking to the window might not capture the intent, but the behavior in the two cases would be indistinguishable while the child was still in the middle of the room. The description that the child was looking at and walking toward the heap of toys on the floor of the room would not only coincide with the behavior but would also reflect the description that the child would give to the activity. It is the preferred description.

But we cannot be certain that our descriptions are the preferred descriptions. The preferred description is not available in speech, in affect displays, or in actions, and we cannot read minds. But we can use what we know of these modes of expression to make our attributions and come up with educated guesses and, fortunately, that is what we, as psychologists, have always tended to do. The surety with which these guesses can be made depends on an analysis of the justifications that we give for these background practices and, unfortunately, this analysis is not forthcoming. We could try to limit our appeals to "objective" descriptions of behavior but this is an impossible goal. The descriptions that we give are, of necessity, theory laden (e.g., Bloom, 1974a). The problem with theories that appeal to action (and this is shared by those that appeal to behavior) is that an infinite number of descriptions are possible and researchers must choose just one description. We need some kind of conservatism, then, in this less than conservative enterprise.

While conservatism is somewhat difficult to define in this case, we can say that something is conservative if we go no further than is usual (that is, not stretch the accepted practices but only highlight certain of them). We have three ways to use our attributions of expressions for finding relations between expressions in different modalities. First, we can look at sets of contiguous expressions and determine which have attributions of similar or related content. The claim that a series of coreferent expressions relate to each other, then, is the claim that they are multiple expressions about one mental space or Intentional state. This is identical to the claims that one can perceive an unfolding of meaning in discourse and that sequences of words and / or sentences refer to one mental event. In fact, the coding in our research (Bloom, Beckwith Capatides, & Hafitz, 1988) can be seen as an operationalization of such practices as the linkage of individual expressions and the defining of the child's event boundaries. Second, in addition to this sort of analysis, we can, conservatively again, look to what is expressed in different modalities such as in displays of affect and speech. Finally, within a modality, we can look for meaning invariants (or frequent meaning components) across sets of superficially identical expressions. We consider that these three ways of using our attributions are not only possible through careful observation but also conservative in the manner desired.

### *Methodology*

We have proposed that the child operates on the contents of conscious states of mind in order to acquire language. The fundamental assumptions are that (1) speaking and interpreting speech are determined by, and can only be considered in light of, the underlying representations that the expression makes manifest, and (2) limits on the contents of these representations describe limits on potential speech and interpretation. In our efforts to translate theory into method, we devised a coding scheme for attributing contents of the Intentional states underlying speech and affect expressions. We have used these attributions as a heuristic for explaining developments both within and between these two modes of expression (Bloom, Beckwith, Capatides, and Hafitz, 1988). Although the system we devised can be used to code any expression, as of now, we have used it to code language and affect but not action (but, see the analysis of action on objects in Lifter & Bloom, 1989).

The methods and coding scheme described here have been used so far only to study developments in the single-word period. However, in addition, we have also addressed the origins of categories of transitive and intransitive verbs in early sentences (Rispoli & Bloom, 1987), and the child's use of input for learning grammar (Beckwith, 1988) within the theoretical perspective offered here. We also see research by others in the field as converging upon the same theoretical perspective (e.g., Budwig, 1985; Ewing, 1984; Gee & Savasir, 1985; Gopnik, 1982; Mervis, 1984).

Coding the child's Intentional state would be an unreasonable task—that is, we would never be able to verify what the child was thinking at any one point in time. But we can make attributions of what the contents of the child's mental state are about, which is what caregivers do routinely when they interact with children. For instance, when a baby whimpers, the caregiver might attribute hunger or discomfort or an inability to obtain a toy. We have made the same sorts of attributions of what children are thinking about when they display an emotion or say a word. In coding these attributions, we use the kinds of cues that caregivers use: what the child says, what the child does, what has been said or what is subsequently said, what is observable in the context, and what we know of the child from past experience. Moreover, we can do what the caregiver cannot do. We can use our videotapes to watch and listen to the moments that surround an expression, over and over, and we can look ahead as well as backwards for relevant cues (Beckwith, Bloom, Albury, Raqib & Booth, 1985).

At the most general level, we chose to code the contents of mental states in propositional form, that is, as predicate/argument structures, for ease of coding onto a computer. This was not limiting since an effable system can be implemented in propositions. That is, any description of what one can be conscious of can be represented in propositions and this holds whether the conscious material is, itself, in propositional form. We do not suppose that our attributions are replicas of any sort. That is, they need not look like what underlies the expressions we base our attributions on, just as Washington D.C. itself need not look like a star because that is how it looks on a map. Our code is propositional in format without necessarily entailing a propositional theory of mind.

Coders decided whether the child desired the event to be the case or believed the event to be the case. Expressions based on belief or desire are relatively easy to distinguish and therefore to code, and belief and desire are the most fundamental of the psychological attitudes (Dennett, 1978). Coders also decided whether the event had already

taken place, was in the process of taking place, or was anticipated. When the attributed event was evident, in that it matched the events in the context because it either had already taken place or was in process, then data from perception contributed to the Intentional state. When, in contrast, the attributed event was anticipated, mental contents were derived from knowledge in memory, being more or less cued by perceptual data.

The three superordinate predicates we used for coding the contents of mental states are *be*, *do*, and *go*. The predicate *be* was attributed if the child appeared to be thinking about a static event, for example, when a child looked up at the clock on the wall and said "ticktock." The predicate *do* was attributed if the child appeared to be thinking about a dynamic event, for example, hugging a doll or banging a hammer. The predicate *go* was attributed if the child seemed to be thinking of a dynamic event that resulted in a change of location (or possession), for example, climbing up on a slide or giving a doll to the mother. Thus, the three predicates name static, dynamic, and change of location events.

The vocabulary that we used in the coding scheme is straightforward. Because attributions for young children can frequently depend on the context, the elements of the context in which we observed the children were particularly important. A substantial proportion of the vocabulary was the set of names for the objects and people in the playroom in which our observations were video recorded. A set of potential actions on and relations between these objects made up another significant portion of this vocabulary, as did a number of states of affairs. Examples of these subordinate predicates included *show*, *give*, *ride*, *push*, and so forth. These subordinate predicates, along with their arguments (objects) were, in turn, the arguments of the superordinate predicates *be*, *do*, and *go*. However, objects alone could be the argument of superordinate predicates, as when the child noticed the clock. With this vocabulary, coders could write the event descriptions for the underlying representations they considered the children had in mind during speech and affect expressions.<sup>3</sup>

In sum, this research strategy enabled us to look at relations between diverging forms of expression in the period from infancy to the emergence of language, and to inquire into the developments that such expressions require.

#### *Some Relevant Studies*

The integration of disparate, extant research may be reason enough for adopting a perspective wherein the mental representations underlying action are central. However, we have made this perspective the cornerstone of our research with children on the threshold of language, and have addressed several questions in child language from the perspective that we are offering here. We will briefly summarize these studies and several studies by other researchers, as relevant examples of the kinds of questions and answers that might be forthcoming from child language research that takes an Intentional perspective.

*Expression through Affect and Speech.* The usual analysis of the words that children acquire takes what Searle (1984) called a "third person perspective." Looking for what children know about words in the lexicon, researchers classify a child's words according to one or another categorization scheme that captures putative differences among words. Examples include names of general objects, actions, and personal social words (Nelson, 1973); or person names, object names, and relational words (Bloom, 1973); or even part of speech, i.e., nouns and verbs. The assumption is that different classes of words require different kinds of learning, and differences in their acquisition will explain the development of language in the single-word period.

In our research, we have instead attempted what Searle called a "first person perspective" to capture what the child has in mind in the expression of beliefs, desires, and feelings. This shifts the focus from the words that the child says and the affect the child displays, to the states of awareness underlying the words and affect expressions. Because emotional expression is in place well before speech begins, we have asked how expression through affect displays was related to expression through words as words were acquired in the single-word period.

Our subjects were 14 first-born infants, from different ethnic and socioeconomic backgrounds, living in the metropolitan New York area. Data were collected in videotaped monthly observations of each infant and mother interacting and playing with a group of toys in our laboratory playroom, from about 9 months of age until the

---

<sup>3</sup> Further details about the procedures used in this translation of theory into method can be found in Bloom et al. (1988).

children began to say sentences (and MLU was approximately 2.5 words). We identified three reference points that we have used in our studies to define the transition from infancy to language: first words (FW, mean age = 13 months, 6 days), a vocabulary spurt (VS, mean age = 19 months, 6 days), and the transition to multi-word speech (MW, mean age = 24 months). FW was the first use in the playroom of at least one word, said two times. VS was a sharp increase in the number of new words (defined as the first increase of at least 12 new words between monthly playroom visits, after the child had already acquired at least 20 words). MW was identified as the first month a child's mean length of utterance reached 1.5 words. See Figure 1. The procedures we used are described more fully in Bloom et al. (1988).

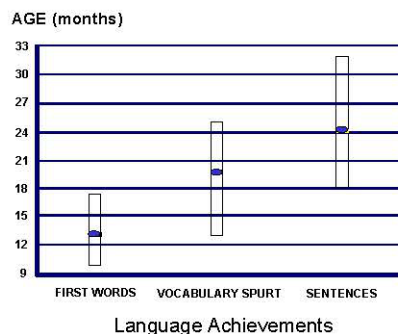
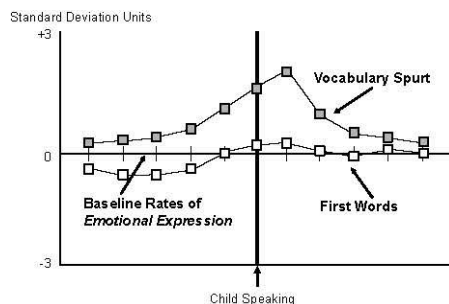


Figure 1. Mean Ages of language achievements and range in ages for the group of 12 children.

At FW, affect expressions were far more frequent than words, as would be expected. At VS, words were eight times more frequent than they had been at FW. This was neither surprising nor interesting because an increase in numbers of words was the criterion for the vocabulary spurt. However, although words and propositions attributed to words increased, the frequency of affect expressions and propositions attributed to affect expressions remained essentially the same from FW to VS (as can be seen in Figure 1).

At FW, affect expressions were far more frequent than words, as would be expected. At VS, words were eight times more frequent than they had been at FW. This was neither surprising nor interesting because an increase in numbers of words was the criterion for the vocabulary spurt. However, although words and propositions attributed to words increased, the frequency of affect expressions and propositions attributed to affect expressions remained essentially the same from FW to VS. This result means that the frequency of emotional expression (and number of propositions attributed to emotional expressions) did not change between the two language achievements. Thus, words did not replace affect in the period of word learning as has been suggested in the literature. Rather, these children learned language as a new system of expression for the contents of their thoughts and feelings, while they continued to express those feelings through displays of affect.

At the most global level, we were able to determine that these children's efforts at saying words clustered around the moments when they were also expressing emotional affect (Bloom & Beckwith, 1989). When we looked at the timing of emotional expressions relative to saying words, the frequency of emotional expression peaked and was substantially above the baseline rate of emotional expression for each child in the seconds immediately after a word. We assume, therefore, that these children were learning words to express what it is that their feelings were about. However, at First Words, the frequency of emotional expression was suppressed, relative to baseline, at about 5 seconds immediately before a word. At VS, children clearly talk about those things that cause a shift in affective state and the peak follows the utterance. We have attributed the dip in emotional expression before words to the competition for the young language-learning child's attentional resources. Before speech becomes automatic, the effort required for learning and saying words preempts the cognitive activity required for the experience and expression of emotion at the same time. But once the word is said, the child's mind is freed once again for the cognition required for emotion. This result is shown in Figure 2.



*Figure 2.* Deviations from baseline rates of emotional expression at First Words and Vocabulary Spurt, in the five 1-sec intervals before speech onset, during speech from onset to offset, and in the five 1-sec intervals after speech offset (adapted from Bloom & Beckwith, 1989).

At a more micro level, we used the contents of the attributions of Intentional states as a heuristic for comparing the meanings that children express with affect and with words (in Bloom, Capatides, & Hafitz, 1988). For this analysis we were interested in what the infant had in mind when saying words or expressing affect: (1) whether the infant expressed a desire (had as a goal to change the world), or expressed a belief (in the way the world was), and (2) whether the contents of their desires and beliefs concerned themselves or other persons (the mother most often).

Desires were expressed more frequently than beliefs, with both emotional expression and speech. At FW, the ratio of desires to beliefs attributed to emotional expression was 2 to 1, but the ratio for word attributions was less, 1.3 to 1. At the time of VS, the ratio of desires to beliefs was essentially 2 to 1 for both emotion and word attributions. However, words at FW tended to express beliefs somewhat more often than did their emotional expressions at the same time, or their word and emotional expressions at a later time. This means that early words (at FW) expressed what the infant saw or imagined the world to be relatively more often than did later words (at VS) or emotional expression at either time. Thus, when words first appeared they were less likely than affect expressions (or words at a later time) to be used as instruments for achieving goals or changing the world to fit the child's view.

The desires that these infants expressed at both FW and VS, for both speech and affect overall, were most often desires concerning the children themselves as actors, rather than their mothers. They expressed what they, themselves, wanted to do or were in the process of doing to change the world more often than they expressed what they wanted their mothers to do. The ratio for affect expressions was somewhat higher than for words: the ratio for affect expressions of desires with the self as agent rather than the mother was almost 6 to 1 at FW and 4.4 to 1 at VS. The ratio for words at both FW and VS was 4 to 1. Thus, the children expressed desires concerning their own actions in regard to their own purposes and goals primarily. Their words and emotional expressions were not used primarily as tools to influence the actions of other persons.

*Developments in Word Learning in the Second Year.* The group of studies we will discuss here was concerned with the words that these children acquired in the same period (e.g., Bloom & Hafitz 1985). We began with a third person perspective and applied several of the lexical categorization schemes that are in the literature to these data, in the effort to describe the kinds of words that our subjects learned in this period. However, the development that occurred in the period between FW and VS, which essentially represented the beginning and end of the single-word period for most of the children, was not in the kinds of words they said. For example, 6 of the children increased in the relative frequency of relational words ("up," "no," and the like) in this period, while names of objects increased in frequency of use in the speech of 5, and the 3 other children showed no change in the kinds of words they said. A sequence of development from object words to relational words or from relational words to object words, reported in other studies of only one or a few children (e.g., Bloom, 1973; McCune-Nicolich, 1981; Menn & Hazelkorn, 1977) were characteristic of individual children, but not the group. In a second such analysis, we applied Nelson's (1973) criteria to distinguish between children who acquire primarily referential vocabularies (with more than 50% of their first 50 words being "general nominals") or expressive vocabularies (less than 50% general nominals). However,

only 2 of 12 children reached the 50% criterion for a "referential style." We concluded from these analyses that such categorization schemes for classifying the children's words did not really help us in our efforts to understand the development that occurred in this period of word learning from FW to VS.

Consistent with a first person perspective, we analyzed the attributions of underlying Intentional states for the children's words as shown in Figure 3.

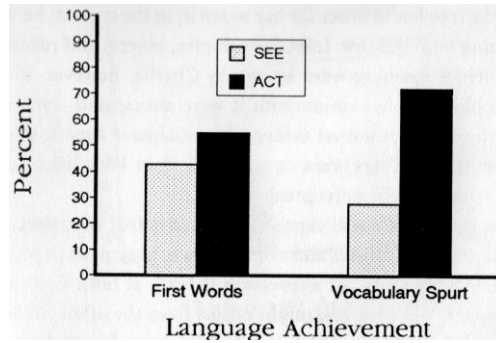


Figure 3a. Relative proportion of SEE and ACT meaning

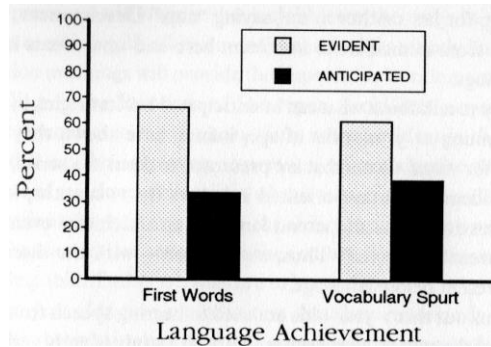


Figure 3b. Relative proportion of EVIDENT and ANTICIPATED Meaning

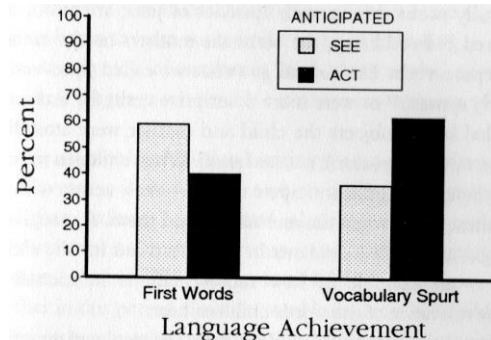


Figure 3c. Relative proportion of Anticipated SEE and ACT meaning

Figure 3. Attributions of propositional content to the children's words at First Words and Vocabulary Spurt

We focused on two aspects of the content expressed. The first was what we are calling "propositional content" and was derived from the predicates *be*, *do*, and *go* in combination with different arguments. The two categories of propositional content at this level of coding were SEE and ACT. The category of SEE content was the combination of the predicate *be* with arguments of presentation, including *point*, *see*, *show*, *give*, and *have*. The category ACT included the predicate *be* with action arguments and the dynamic predicates *do* and *go*.

The first result was that the frequencies of SEE and ACT were not different at FW. However, in the interval between FW and VS, the increase in expressed ACT content was greater (ratio of VS to FW = 11 to 1) than the increase in expressed SEE content (ratio of VS to FW = 6 to 1), with Chi-square (1,  $N = 14$ ) = 47.889,  $p < .001$  (Figure 3a). At the time of VS, the proportional representation of ACT meaning was greater than SEE meaning,  $t(13) = 6.717$ ,  $p < .001$ , and the ratio of VS ACT to VS SEE was 2.3 to 1. These results mean that when they began to learn words, at FW, the children's early words expressed stative/presentational kinds of content (SEE) about as often as activity/happening kinds of content (ACT). The development that occurred from FW to VS was in the greater increase in talk about dynamic action events, which came to predominate at VS, relative to stative events.

We then analyzed what we are calling "evidential content" and this analysis was based on another level of coding: whether the event in mind had already taken place in the context, was in the process of taking place, or was anticipated. The two categories of evidential content were evident content, when the event was happening or had happened, and anticipated content, when the child's expression preceded the event in the context that the expression was about.

The result, in Figure 3b) was that anticipated expression increased, relative to evident expression, from FW to VS, Chi-square (1,  $N = 14$ ) = 5.273,  $p = .022$ . Moreover, this increase in anticipated expression was greater for ACT than for SEE content, Chi-square (2,  $N = 14$ ) = 12.86,  $p = .002$  (shown in Figure 3c). The ratio of anticipated to evident ACT expressions changed from 1 to 3 at FW to less than 1 to 2 at VS. We interpret this result to mean that the development in word learning in the single-word period came with the increased ability to talk about something the child had in mind that was not yet evident in the context.

The ratio of anticipated to evident SEE expressions did not change and was approximately equal (1 to 1) at both times. The presentational SEE content of expressions included, for example, a desire (anticipated) that the mother see the cup, as when the child held out a cup saying "cup." These were a continuation of the sorts of protodeclaratives (pointing, showing, giving) that were described for prelinguistic infants just prior to the emergence of speech by Bates et al. (1979). They did not change in either relative frequency or evidential content over time. Development occurred instead in expression of activity/happening kinds of content, and, especially, the ability to express such content in anticipation of the activity/happening in the context.

In sum, looking at the kinds of words these children learned in this period did not reveal the development that occurred. The words themselves were not suitable diagnostics of development. Rather, their development was in the capacity for representing anticipated, non-present events that involved action and change in the mental states underlying expression.

*Constructing Grammar from the Input.* Another of our research projects was a simulation of children's analysis of the language they hear (Beckwith 1988). This simulation incorporated assumptions about the level of awareness into a hypothesized "language acquisition device" and addressed the question of how the child uses input data for learning grammar. The study is a response to certain claims made in learnability-theoretic research. In particular, the claim typically made, following Chomsky (1965), is that the input data the child receives are insufficient for learning abstract syntactic categories (the "poverty of the stimulus" argument). If the categories cannot be learned from the input, and they are an aspect of adult competence, then they must be innate. However, poverty of the stimulus—the only reason to assume innate categories—is usually just stipulated. The only way to test whether the data are, indeed, insufficient is to construct a plausible model of data processing. If existing categories and domain general processes can be exploited to construct knowledge, then assuming that the categories are innate is unparsimonious.

This study began with categories that one can confidently presume the young child to know. The young presyntactic child surely knows names for things and actions and knows the roles that objects play in relation to one another, including the spatial relations between objects in particular. We assumed, further, that the child exploits this knowledge to learn language.

The level of awareness in this study was operationalized as a mental space in the sense used by Fauconnier (1985) in his analysis of meaning in language: "Language is not merely interpreted with respect to worlds, models, contexts, situations, and so forth. It builds up mental spaces, relations between them, and relations between elements within



them" (p. 2). For the adult, mental spaces are set up by sentences in discourse based on the semantics of the language and the shared psychological, cultural, sociological, and discourse context. The semantics of sentences, then, are not evaluated with respect to their reference to the real world (their "truth") but rather with respect to the mental spaces they construct. One of the primary assumptions made in this research was that children start to learn language with the ability to construct mental spaces in the absence of any specifically linguistic ability. For the pre-linguistic child, mental spaces are primarily set up by perception of objects and events in the context.

The potential spaces and targets that the pre-linguistic child is capable of constructing will not be identical to the spaces underlying the mother's utterances. Nor will the categories defining the elements in the child's mental spaces be identical to those semantic categories defining the mother's. But enough content will be shared between them for the child to use this ability to bootstrap language acquisition. The "semantic" level that the child assigns to input sentences, then, is derived from the space constructed in the perception of the "here and now" context. This account shares many features with "semantic bootstrapping" models (e.g., Pinker 1984). However, semantics proper does not come with the package. This is not semantic bootstrapping, per se, because the semantics the child has to learn is linguistic, modular, supports the building of non-here-and-now spaces, and is considered to be constructed. The child will first have to learn how the language constructs mental spaces.

Mental spaces are domains made up of elements and relations. The elements in each space have specific properties and are in specifiable relations to each other. For example, if a mother tells her child "You push the green truck," the words in the mother's sentence, together with the child's perception of objects in the context, sets up a space with two elements (the child and the truck), one property (green truck), and one action (push). In this space the child will act as an agent in the dynamic act of pushing the truck, which is the patient. This study addressed how children learn linguistic categories by analyzing input data from mothers' sentences and the situational context that the sentences were about.

The first step in building the processing model was to characterize the input that was clearly accessible to the child. Most models of language acquisition require that the mother talk about interpretable ("here and now") contexts, and research on mothers' speech to children suggests that mothers do just that (Broen 1972). Accordingly, the input to this model consisted of language (word strings) paired with situational representations. The assumption was that when mothers talk about interpretable contexts, children have in their Intentional states: (1) a representation of the speech string, (2) a representation of the present situation, and (3) a linkage between some elements of the speech string (the "referring" terms) and some elements in the situation (the target objects).

The children were assumed to know (and the simulation received as input) the roles that objects played. The first role was called ENTITY, that object about which something was predicated or, more simply, that object in the context that was being talked about. If the object was stationary, the child was assumed to know which object was in close proximity, and which term referred to the state, BE. If the object was moving, the child was assumed to know the objects relative to which it moved, and which term referred to the movement, GO. These objects that were in proximity to the ENTITY filled LOCATION roles. Children were also assumed to know who (if anyone) was the CAUSE of the movement. Sets of linkages between a string of referring terms and these roles in the situation were analyzed. These categories for the situation code were "concrete" categories derived from aspects of world, not linguistic, knowledge and, therefore, assume a nominalist ontology (with the possible exception of CAUSE). The representation of the situation used a subset of Jackendoff's (1983) conceptual semantic categories motivated by concerns within the causal theory of meaning (Devitt 1981).

While the program's analysis was meant to reflect the child's own analysis of the input, the output of the simulation was meant to reflect the knowledge of the input language that could be acquired by the child. The output of the simulation consisted of verb general sentence frames and verb specific argument structures. The verb general frames can serve the role of canonical sentences in theories of language acquisition that require canonical sentences. In some theories, properties of canonical sentences are not considered to be learned and are, rather, assumed to be part of the innate component (e.g., Pinker 1984). However, the most frequent of the sentence frames in these mothers' input to their children were identical to those that have been assumed to be innate where properties of those sentence frames could be seen to reflect both concrete (non-linguistic) roles and thematic (linguistic) roles. If

frequency of encounter in the input enhances retrievability, then these sentence types can play a central role in a (non-innate) explanation for the role of canonical types in acquisition.

To answer the question of whether children do, in fact, learn the sentence frames in the input, the children's sentences were also analyzed by the program. This analysis revealed that, with respect to verb general sentence frames, the children used a subset of the mothers' frequently attested frames (those that were used more than once in any session). Across the broad spectrum of sentence types, all of the frames that the children used frequently were also used frequently by their mothers; frequency in the input determined frequency in the output. The frequently attested sentence frames were those frames referring to a movement event (GO), with one or more of three or four referring terms, where the CAUSE of movement and the moving ENTITY are distinct (for example, "Can you[CAUSE] push[GO] the truck[ENTITY]?"). For example, of the possible 96 combinations of 3 or 4 referring terms, 24 CAUSE-initial frames accounted for 97% and 96% of such sentences for the mothers and the children, respectively (Beckwith, 1988).

The verb specific frames—order and deletion alternations—were similar to the sentence types in the nominalist theory of language proposed by Harris (1951). According to his model, alternations of sentence types create sentence paradigms. It was the properties of these paradigms that specifically called for transformations and abstract syntactic categories in his account. If children construct paradigms of these sentence frames, then the perception of putatively abstract categories need no longer be considered innate. Thus, another frequently assumed innate category would be seen as constructible.

The order alternations in the children's verb specific frames were a subset of the mothers' frequent order alternations. This suggested that the children did, indeed, build a store of sentence frames (analogous to Harris' sentence types) from the input. We can presume, then, that the sentence frames and verb specific argument structures in the input can serve as data structures for the discovery of syntactic (abstract) objects.

In sum, the output of the simulation consisted of verb general sentence frames and verb specific argument structures. These sentence frames fulfill the function of canonical sentences which are presumed to be innate in several theories of language learnability. However, the sentence frames that were the result of the simulation do not, themselves, account for the presence of abstract objects in the child's early syntactic projections. For this reason, Harrisian transformations on paradigms of verb alternations were invoked to account for the abstract objects.

The contents of awareness and cognitive mechanisms assumed of a child in this simulation would be required of virtually any psychological theory and must, therefore, be consistent with virtually every theory of language acquisition. If these assumptions are sufficient to explain the child's language performance and, at the same time, offer an explanation of the acquisition of some aspects of the knowledge of language, then, clearly, the exploitation of awareness is a valuable strategy for developmental psycholinguists.

*Other Studies.* Finally, we offer other examples of child language research from the literature that demonstrate the value of a perspective that takes the contents of the child's awareness into account. Studies of infants and mothers have revealed again and again that communication between them occurs in a context of "joint attention" (e.g., Bruner, 1983; Sugarman, 1978; and the papers in Lock, 1978). However, mothers have been shown to differ in the timing of their response to their infants' vocalizations, and also in their tendency to mention the focus of the child's attention in what they say. Both of these factors influence subsequent vocabulary size, and the differences among mothers are reflected in differences among their children (Roth, 1987; Tomasello & Farrar, 1986). Children evidently learn more words when their mothers respond promptly and also say something about what they assume their infants have in mind.

Studies of the labels that mothers use in their interactions with their children (Mervis, 1984), provide another example of research that indicates mothers take an Intentional perspective. Because children's initial concepts of objects reflect a child-basic-object-level (e.g., a round candle is a ball) rather than the adult-level (candle), the extensions of children's early words are not identical to those of the adult. This is independent of mothers labeling instances of these concepts. For example, a mother may initially call a round candle a "candle." However, rather than continuing to label according to the adult-basic-level, the mothers studied by Mervis took their cues from their

children's actions (e.g., the child rolling the candle) or expressions (the child saying "ball") and used words that were consistent with the basic-object categories that the child had in mind.

In order to evaluate whether early word combinations consisted of semantic or syntactic relations, Ewing (1984) took an explicitly Intentional perspective and used attributions of underlying propositions as a heuristic. He proposed that the words in word combinations were syntactically related if two propositions could be attributed to the representations underlying the words that the child used together. Words were semantically but not syntactically related when both words could be derived from a single attributed proposition.

Researchers have also used children's actions to make attributions of what underlies their speech. In the period between one and two years of age, children learn relational words (such as *there*, *no*, *up*, *more*) as well as object names (Bloom 1973). From the results of a longitudinal study of the acquisition of relational words in this period, Gopnik (1982) proposed that the early meanings of such words are concerned with the plans that children have in mind. In particular, they use such words to express something about the relations among their actions, their aims, and aspects of the context. For example, *there* expressed the success of a plan; *no* and *gone* expresses failure; *more* expressed that a plan would be repeated.

By the age of three years, contrasting forms of the language are used to express aspects of underlying states of mind for creating contrastive interpersonal activities. In their study of the modal terms *will* and *gonna* with three year old children, Gee and Savasir (1985) identified two different activity types associated with the terms. *Will* expressed an interpersonal "undertaking" in which the speaker's negotiation entailed a commitment to the listener to act; an utterance with this modal meaning of *will* typically accompanied or was followed by the named action. *Gonna*, in contrast, lacked this sort of interpersonal cooperation and was used to express the "more cognitive activity-type" of "planning"; the children's utterances with *gonna* typically were not directed to the listener, and the action named in the utterance was rarely carried out. In using *gonna* the children were more likely to be just talking about the activity, often to themselves, whereas in using *will* they were committing themselves to their listeners.

We conclude this section with the following observation. The studies reviewed here and others like them differ from most of the child language studies in the literature in that they take a first person perspective in trying to discover how what the child has in mind influences how and what the child learns about the language. Most studies take a third person perspective in which speech is observed as it occurs in real time, and features of the utterance and context are compared to discover the child's knowledge of the lexicon, semantics, syntax, or discourse. For example, studies of the development of word meaning are almost exclusively studies of conditions and procedures for applying words. A first person perspective, in contrast, begins with the assumption that the actions of speaking and interpreting are determined by beliefs, desires, and feelings directed toward some mentally present content (e.g., object, event). This perspective has informed our efforts to understand the development that occurs with the transitions in language development from affect expression and prelexical vocalizing in infancy to the use of conventional words some time at the beginning of the second year, and the transition from single-word speech to a simple sentence grammar toward the end of the second year.

#### INTENTIONALITY AND EXPLANATION IN CHILD LANGUAGE

The rest of this paper will be taken up, first, with outlining some of the critical features of development which contribute to the child's Intentional states, and then with describing how this perspective on a theory of language development might contribute to explaining certain well-known phenomena in language development.

##### *Developmental Psychology and Intentional States*

The ideas that we have in mind, whether we express those ideas or not, occur in rapid succession, with overlapping contents more often than not. On the one hand, certain of these ideas originate from within, either with changes in physiological states as in an acknowledgement of hunger, or with an instance of recall as in the expectation of an apple in the refrigerator. On the other hand, our mental states can change when we notice something new, for example, when we open the refrigerator door and discover a piece of chocolate cake and give up the idea of the apple.

And Intentional states are interrupted or revised when someone says something, like suggesting that we wait for dinner.

All these things—internal states, knowledge in memory, aspects of the context, what others say—contribute to the representations that underlie acts of expressing and interpreting. The critical questions for the theory we propose are: What capacities are needed for the child to be able to use such cues as these for the contents of their beliefs, desires, and feelings? and how do these capacities develop? We know that language sets up the elements and their roles and relations in mental spaces (Fauconnier, 1985). However, children are not able to exploit the speech they hear for constructing the contents of mental spaces until they begin to learn the language. What are the sources of such mental contents for prelinguistic infants and how do these sources change developmentally? At the least, development occurs (1) in the types of knowledge stored in memory (including sensorimotor schemata, event knowledge, concepts, a lexicon, and syntactic rules), and (2) in capacities for recall and the cues that infants can use to access aspects of knowledge from memory.

In early infancy, it is reasonable (or, at least, most parsimonious) to assume that Intentional states are constrained to perception and what the child sees/hears/feels in the immediate present is what the child can hold in mind. Memory begins in earliest infancy with the formation of the first mental schemas (Piaget, 1937/1954), and at least short term retention of objects and events in the immediate context has been demonstrated in habituation studies with young infants (e.g., Cohen, 1976; Fantz, 1964; Ruff, 1976). As young as 8 weeks, infants are already able to demonstrate memory for prior events (Vander Linde, Morrongiello, & Rovee-Collier, 1985). Thus, infants begin to record their visual, auditory, and tactile-kinesthetic experiences very early on. The objects in the experiences leading to these early memories are undifferentiated from their initial contexts (e.g., Kagan, 1979; Piaget, 1937/1954). They are what Werner & Kaplan (1967) called subject-object "fusions" in episodic memories. The memories for these early experiences can be cued by "reencounters" with the same and similar episodic experiences (Rovee-Collier, Sullivan, Enright, Lucas, & Fagen, 1980). One aspect of cognitive development in infancy, then, is the ability to think about objects outside of the episodes in which they were originally experienced (e.g., Bloom, 1973; Bloom, Lifter, & Broughton, 1985; Corrigan, 1983; Mandler, 1984; Nelson, 1982; Piaget, 1937/1954).

When perceptual data begin to cue retrieval of items stored in memory, Intentional states are no longer constrained to perception, but recall may be constrained by perception because it requires a perceptual cue. Infants in the first year begin to have what Piaget (1936/1952) called "prevision"—the cuing of a familiar event by some "signal"—for example, expecting to see someone pass through a doorway after the door opens. An opening door does not guarantee that someone will enter and so the child can begin to experience discrepancy between the world as expected and the world as experienced.

A distinction between "Intentions in action" and "Prior Intentions" (Searle 1983) is relevant here. Prior Intentions are reflective, premeditated plans for action and are formed before the performance of an action. When children learn to talk, they talk about, i.e., express, their Prior Intentions. Intentions in action are spontaneous and are done without prior reflection; they are the mental states underlying an action in which an outcome was not intended. Pre-linguistic infants initially have only Intentions in action and learn from correlations between actions and their effects. For example, when an infant acts in such a way as to cause an unexpected effect, the infant can connect the action with its consequences. For example, if an infant reaches for a box and, grasping the lid, the box falls open, the infant will make the connection between the grasping and the opening. Sensorimotor schemata are the consequence of the infant's analysis of the contents of such Intentions in action as these. They enable the child to form Prior Intentions, where the child has an event in mind before acting, such as when the same child opens another box to put a bead inside.

These mental transactions between percepts and schemas are quite significant. Such comparisons result in new mental combinations of percepts with schematic events from past experience. They enable the child to begin to generate cues for retrieval from memory (see Klatzky, 1984). If, for example, when the door opens and the child expects the mother to enter through the door, but, instead, the father enters, the child may begin to appreciate that the entering person can be a variable in the context of opening doors. Thus may emerge primordial slots and an appreciation of slot and filler in event knowledge (e.g., Nelson, 1982).

With developments in the ability to generate cues for recalling absent objects, the contents of mind become increasingly directed toward nonperceived aspects of the world. This leads to discrepancies between what the child has in mind and data from perception. Expression, then, becomes necessary in order to make these mental contents public. What drives the child to learn language is that language not only expresses, it also articulates (to paraphrase Taylor, 1979) and makes explicit the contents of beliefs, feelings, and desires. Thus, changes in the representations they can hold in mind press children to extend the limits of their linguistic abilities in the effort to express what those representations are about.

But the child's nonlinguistic capacities do not determine all the categories to be included in a language. The language, itself, offers ways of conceptualizing the world (Whorf, 1956). Only through experience with language, can the child discover the "backgrounded meanings" that determine how one or another linguistic form is to be applied, meanings that are not, themselves, a part of the content of the expression (Bowerman, 1985). For example, verbs in English that take complements with *to* (such as *want to*, *like to*, *suppose to*, *show how to*) share an element of meaning that indicates "direction or movement towards the activity named by the complement verb" much like the meaning of the preposition *to* (Bloom, Tackeff & Lahey, 1984). In contrast, complement verbs that take the present participle do not have this meaning (Zwicky, 1968, cited by Bowerman). Thus, the complement connective *to* is not a meaningless semantic marker, as has been claimed (for example, Jespersen, 1964), but its meaning is learned through experience with the preposition *to* in language and is not directly available in nonlinguistic experience.

As children learn more language, they learn more about the world from the speech that they hear. Children learn social and cultural meanings for the concept of causality from the language they hear, and they could not learn such causal connections from evidential and physical causality (Bloom & Capatides, 1987; Gergely & Bever, 1987; Mervis, 1984). The words and syntactic rules that children acquire, even as they are being learned, contribute to the representations they can hold in mind. "Many of our Intentional states require . . . language as a necessary condition of their existence. Language, after all, provides us with a system of representation, and using that system, we are able to have Intentional states that we could not have apart from the system" (Searle, 1982, p. 275).

In sum, with developments in world knowledge and the capacities to use more and different cues for recall, the child can construct increasingly elaborate Intentional states. Given the ability to perceive and reproduce the units of a language, the child can proceed to learn words and acquire the grammar for expressing aspects of the representations in these states of mind.

### *The Construction of Language*

Certain transitions in child language are the developmental discontinuities that theories of language development seek to explain. The first of these is the transition from prelexical vocalizing and affect expression in infancy to the use of conventional words sometime toward the end of the first year or beginning of the second year. The second is the transition from single-word speech to what we call a simple sentence grammar toward the end of the second year. The third is the transition from simple sentences to complex sentences that begins sometime between children's second and third birthdays. And the fourth of these transitions is the acquisition of the categories of abstract syntax, which have their origins in the structures of complex sentences between two and three but continue to develop well into the school years. These discontinuities produce certain predictable quantitative changes in the form of the child's speech: utterances increase in length and frequency. But quantitative increases such as these in the child's output are only a surface indication of qualitative change in the child's knowledge, and it is the transformations of knowledge that need to be explained. How is it that the prelexical infant discovers the phonology of language and the meaning of words? And how does the two year old child discover syntax and proceed to construct a grammar?

*The Transition to Words.* The transition from prelexical vocalizing to conventional words probably owes more to maturation than do subsequent transitions, both physiological maturation of the anatomy required for speech, and maturation of the sensory motor connections between audition and production systems (see Studdert-Kennedy 1979). The sequence in which different sounds appear in infant pre-speech vocalizing is determined largely by maturation in the first year of life (e.g., Lieberman, 1967). However, infants as young as three months of age already give evidence of vocal contagion in interaction with adults. Infant vocalizations sound more syllabic and "speech-

like" when adults respond contingently on the infants' own vocalizing than when adults vocalize randomly (K. Bloom, Russell, & Wassenberg, 1987). Despite the fact that the speech sounds that emerge in words, beginning in the second year, are dependent on the continued maturation of the vocal mechanism and auditory-kinesthetic connections, it is the personal and interpersonal (and not biological) context of that maturation that determines that a symbolic system will be learned.

Infants observe language used by others as one component of a complex event. When the child perceives a lexical item, or perhaps a larger speech unit like a phrase or sentence, these are registered along with other types of perceptual and personal data about the event. The speech unit, then, is one element of an episode that includes other elements like persons, objects, and actions. The spoken word or phrase may not even be dissociable from the episode. Inasmuch as the contents of the child's awareness inform the child's knowledge base, these early utterance/episode compounds can enter the memory system as a virtual fusion of form and content. Because of this linked storage, recalling the word is, at first, interdependent with recalling other aspects of the episode.

Virtually all developmental accounts of children's first words have noted the strong association between word and object or word and event, and the so-called "decontextualization" of words with development (e.g., Barrett, 1985; Bates et al, 1979; Bloom, 1973; Bloom & Hafitz, 1985; Dore, 1983; Nelson & Lucariello, 1985; Werner & Kaplan, 1963). When children first begin to say and interpret words, word and episode are summoned together from memory into Intentional states. Thus, when some aspect of the same or similar episode reappears, or the child hears the word, these serve as perceptual cues for recalling the word/episode compound from memory.

"Knowing" such words does not ensure that recall on demand is facile. The eliciting cues and conditions for both understanding and speaking these early words are responsive to the child's own agenda and are not easily manipulated by others. Witness the frustration that parents often have when they try to "show off" their child's talk. For example, the coaxing "Gia, what does the butcher give you? The butcher, what does he give you when you visit him? Come on, you know, what does the butcher give you?" draws a blank in Gia's living room. But as soon as she enters the butcher shop, Gia can say the word "bologna." Perceptual cues that are "reencounters" with something from the original episode are required for recalling a word in a word/episode compound. In sum, when an episode stored in memory has a word connected with it, then a reencounter with the same or similar episode will make it more likely that the child will use the word, because word and episode are recalled together.

The child's capacity for retrieval determines just how percepts and the elements retrieved from memory fit together. Early words occur in the context of a close match between perception and recalled content (i.e., a match between the perceptual field and beliefs about the perceptual world), as when a child looks at the clock and says "ticktock," holds out a cup and says "cup," or points to the stove and says "hot." These are instances of the expression of presentational content described in the studies reviewed above. In instances like these, the child's expressed beliefs about the world match what is perceived in the context, and what is perceived cues recall of the word.

Cued recall can also explain the child's use of words to express beliefs that do not match what is perceived. The development that occurred among the children whom we studied was in the expression of anticipated actions. Here, the child either used a perceptual cue or generated a cue that recalled an event in anticipation of something that had not yet happened in the context.

Children's overextensions in early word use provide another example of such early cued recall where what is recalled does not match what is perceived in the context. Overextensions have been typically interpreted as evidence for the limits of a word's intensional meaning for the child (e.g., Clark, 1973; Greenfield, 1973). However, when a child says "Daddy" on seeing a man who is not Daddy, seeing even a strange man could have cued recall of Daddy. Similarly, hearing the telephone ring cues recall of Daddy's voice on the phone. This would mean that the child saying "Daddy" is actually expressing something about Daddy, having recalled him to the contents of an Intentional state. Seeing another man or hearing the telephone ring cued recall of something about Daddy from memory which the child then expressed. Such so-called overextensions do not consist in labeling other men or the telephone as "Daddy."

Internal physiological states like hunger may cue recall and representations about food, the availability of food, and possible ways of getting food, and these representations can be discrepant from the perceptible context. Similarly, an external event can summon an aspect of a concept that may include more than just what is perceived in the event,

like when the child sees a pile of blocks and starts to build a tower, or sees a train car and searches for other cars or the tracks for the train. Seeing the blocks cues recall of something from memory that figures into a belief that a tower can be built; seeing the train car cues recall of an aspect of memory that suggests the belief that other train cars and train tracks may accompany this train car. And still other external events summon information from the knowledge store that have no direct corollaries at all in the present context, as when the ringing telephone sets off a chain of mental events that includes a representation of Daddy. As different experiences like being fed when hungry, building towers, or Daddy's voice on the telephone are stored in memory and world knowledge increases, the child's internal resources are enhanced for what can be brought to mind and represented in Intentional states.

The young child's feeling states are also about just such events as these. Affect displays in infancy allow caregivers to attribute not only emotions but also Intentional states to young infants, and infants come to depend on the attributions caregivers make. However, the words caregivers actually say in responding to their children's emotional expressions are words that name the objects and causes in the situation in which the emotion is experienced (Capatides, 1989). Thus, caregivers provide young children with the language for talking about the causes and consequences of their feelings and do not label the specific emotions per se. In turn, children's words in the single-word period are words like *Mama, baby, more, ride, fall down*, and the like -- words that express what their feelings are about.

Two things no doubt contribute to freeing words from the earliest schemas with which they were stored initially. For one, as concepts develop, with application to more instances as well as networks of relations to other concepts, the words are experienced with different contents. And, second, more different words are heard in the contexts that cue concepts. Both kinds of experience contribute to loosening the original word and episode of the compound so that they become less bound together. Certain words, however, will remain closely connected to particular types of experiences, as, for instance, when hearing a certain sonata invariably cues recall of the word "Mozart." This association of word and episode is now a complex, however, inasmuch as the elements are separable in a way that the elements in the early compounds were not.

This development—the abstraction of words from the utterance/episode compounds in which they were stored—results in coordinating words with new and different types of episodes and experiences. The result in the child's speech is typically a sharp increase in both the number of words that the child uses and the frequency in the use of individual words—a "vocabulary spurt" sometime toward the end of the second year (e.g., Bloom, 1973; Corrigan, 1978; Gopnik & Meltzoff, 1987; Nelson, 1973; Stern & Stern, 1907). The notion of decontextualization does not explain this development because expression and interpretation never occur out of some context, physical or otherwise (Bloom, 1974b). Rather, explanation can be found in developments in the child's knowledge, and in the kinds of cues that the child can use for ways into and out of memory. The relevant developments in the single word period, then, are in the sources for the representations that the child expresses through language, in the ways in which Intentional states are constructed, and the loosening of words from context.

*The Transition to Syntax.* The structures of early syntax are built upon sensorimotor and lexical categories, and, in particular, the manifestation of those categories in the arguments of classes of verbs (Antinucci & Parisi, 1973; Beckwith, 1988; Beckwith & Rispoli, 1984; Bloom, 1970; Hill, 1983). The acquisition of categories of verbs then becomes central in the transition to combinations of words and the construction of a simple sentence grammar (Bloom, Lightbown & Hood, 1975; Bloom, Miller & Hood, 1975). Beginning with acquisition of the transitive/intransitive distinction in the child's earliest word combinations (Bloom, 1981; Rispoli & Bloom 1987), the verbs that the child learns control the basic syntactic structures of early grammar.

The major cognitive development signaled by the transition to the beginning of complex syntax, between two and three years, is the ability to hold in mind the propositions underlying two simple sentences (Bloom et al., 1980). Categories constructed during the sensorimotor period continue to exert an influence on the acquisition of the forms of complex sentences. These include temporal notions of sequence and simultaneity, and causal notions of means-end and consequence relations. At first, complex sentences conjoin the structures underlying two simple sentences with *and*, and the relation is only an additive one (for example, "maybe you can carry that *and* I can carry this"). The conjunction *and* begins to assume different meanings, such as temporal ("Jocelyn's going home *and* take her

sweater off") and causal ("I'm gonna step in this puddle *and* get it all wet"). Before the age of three, other conjunctions are acquired to code these different meanings, for example, "I going this way to get the groceries *then* come back" (temporal), and "get them *cause* I want it" (causal) (Bloom et al. 1980). Thus, the syntactic connectives children acquire encode meaning relations that have their origins in knowledge that begins in infancy. At the same time as the complex sentences with conjunctions appear, children also begin to acquire complementation with complement-taking verbs that overtly mark psychological attitudes of belief and desire, i.e., the verbs *know*, *think*, *wanna*, and *gonna* (e.g., Bloom, Tackeff & Lahey, 1984; Bloom, Rispoli, Gartner, & Hafitz, 1989; Gee & Savasir, 1986; Limber, 1973; Shatz, Wellman, & Silber, 1983).

The expressive capacity of language is due to the fact that language is not a reflection of the world as it is, but, rather, language expresses representations of the way the world is or could be. The mind is capable of indefinitely many representations, and sentences are no more and no less than expressions of these in the forms the language affords. The representations in Intentional states guide the child in discovering the semantic categories of the language. Children begin by interpreting the nonlinguistic contexts that accompany the speech that they hear. If children can interpret the nonlinguistic contexts well enough, and once they understand words as signs for real world phenomena, then the semantic roles played by the words in others' utterances will begin to be transparent. The child will search for regularities in the input that correlate with the interpreted meaning (Beckwith, 1988). By considering that these mental contents are available, a theory of language development can argue that perceptible covariation of the surface structure of language with the objects, roles, and relations contained in the mental states that underlie contextual awareness provides the data on which the child's mechanism for learning words and simple syntax will operate.

*The Learnability Problem.* The child's ability to learn the rules of grammar has taken on considerable theoretical interest in the context of the study of learnability in language. Learnability is a property of a tripartite hypothetical construct that includes (1) a learning mechanism, (2) a target structure, and (3) some innate properties of mind. Learnability exists when the proposed learning mechanism is powerful enough to acquire the syntax of any natural language given some set of innate properties of mind. The learnability problem asks whether it can be logically proven that the target grammar is accessible to the learner given the learner's knowledge and learning capacities. Within the learnability framework, the role of the developmental psycholinguist is to define the combination of learning process and knowledge that allows access to syntax.

According to some psycholinguists, specific syntactic properties must be innately specified (e.g., Pinker, 1984; Roeper, 1981; Wexler & Culicover, 1980). In contrast, constructivists consider it unparsimonious to assume that innate properties are specific to any system of knowledge. Formal aspects of language are considered to be constructed by the child in the course of development—just as those of causality, time, and space—and are not dependent on non-general, innately specified formal structures of mind. The constructivist learning theory assumes that the learner has no specifically syntactic innate properties of mind and so accounts of learnability cannot depend on them.

Constraints on and stipulations of the contents of states of mind are the battlegrounds upon which many learnability arguments are fought because learnability proofs must make assumptions about the availability of representations to the child. Assumptions about the types of information in awareness and about the accessibility of information to awareness (or short-term memory) are central to all formal proofs of learnability and learnability-inspired developmental theory. This includes, for example, assumptions regarding what the child can hold in mind in analyzing the syntax of sentences. One widespread assumption is that the child is "one-memory-limited" (e.g., Wexler & Culicover, 1980). One memory limitation assumes that only one sentence at a time can be held in mind for analysis: An input sentence is analyzed and discarded, the grammar updated if necessary, and the next sentence analyzed. In contrast, constructivists have argued that the language learning child is not one-memory-limited, but, instead, operates on sets of sentences (Beckwith & Rispoli, 1984, Beckwith, 1988, and Dougherty, 1986). Because they deal with such assumptions as these, learnability arguments must be made in the context of a well-specified theory of Intentionality.



The importance of the contents of awareness to a constructivist account is clear. If the perception of features of the environment are to account for language acquisition then those features must be represented in the contents of mental states and, in particular, in the contents related to perceived sentences. While less clear, the same must hold of nativist accounts. For example, consider the mechanism of "triggering," often invoked in nativist accounts. An example of triggering would be the learner perceiving features of a sentence that make it possible to assign some distinct, imperceptible property to the language. In this case, the feature perceived in the sentence triggered knowledge of the property of the language. Such an account makes specific assumptions about what the child can hold in mind and the sorts of things that must occur in Intentional states for acquisition.

Both innatists and constructivists agree that information about syntax cannot be derived without an informed analytic framework. For innatists (e.g., Chomsky, 1965; Pinker, 1984), significant aspects of language must be innate if its properties are not so simple as to be trivial. For constructivists, the language must be derived from concepts and categories that have been acquired through previous experience (e.g., Bloom, 1970; 1973; Bowerman, 1982). Both agree that reality cannot be perceived or experienced directly without mental representations that fulfill the criteria for the possibility of experience (Beckwith & Rispoli 1984).

### *Cognition, Language, and Emotional Expression*

We have already seen that developments in cognition and language relate to one another by virtue of how knowledge and capacities for recall figure in the representation of the contents of mental states. Language expresses those contents and children acquire language for their expression. We have also seen that affect is expression. Some aspects of affective expression are in place virtually from birth. Since affective expression is developmentally prior to language, relations between emotional and linguistic expression might be expected when words begin to appear (e.g., Adamson & Bakeman, 1982; Bullowa, 1979; Stern, 1977). In our research to explore this relation, words did not replace affect expressions in the transition from infancy to language: The children we studied continued to express how they felt about the contents of mental states through affect displays as they learned the language for expressing something of what their feelings, beliefs, and desires were about. Thus, the development of language substantially enlarges the child's capacities for expression.

Affect displays and language coexist as complementary expression systems that convey meaning. They both permit an observer to make an attribution of the state of mind of the expressor. The forms of the two systems are fundamentally different (e.g., Sapir, 1921). Affective expression is a signal system and an emotional expression is tantamount to a symptom of the emotion that it is an expression of. However, as the child learns to control emotional displays, the status of the system will be revised (as pointed out by Danto, 1973). The system can no longer be considered only a signal system when it is under the child's control as, for instance, when the child learns not to express a felt emotion. Finally, the child will learn to feign emotions, that is, to lie with an emotional expression, and lying is, as pointed out by Eco (1976), the hallmark of the symbol.

The earliest words and gestures may also have an indexical, signal quality, but soon function as a sign system where the expression and the object expressed are not differentiated (the "nominal realism" described by Piaget, 1923/1926). A major development beginning in the single-word period is that the infant's signal system of words evolves into a symbolic system made up of a code of arbitrary and conventional linguistic units. (Signal, sign, and symbol being major categories in the sense of Peirce, 1867/1965-6). Thus, while both affective and linguistic forms of expression may begin as signal systems and eventually assume symbolic status, the two forms of expression have different developmental histories. First, emotional expressions continue to be interpreted as a signal system throughout the life span, whereas language is the major symbol making capacity of humans. And second, certain of the forms of affective expression are available virtually from birth; the forms of language have to be learned. However, each informs the other in the mental life of the individual to mutually enhance the power of expression throughout life.

## CONCLUSIONS

In closing, we offer the following conclusions. First, introducing Intentionality into a theory of language development embraces theories that deal with the acquisition of knowledge, with the procedures whereby children

process the surface features of speech and learn syntax, and with how children learn to communicate in social contexts. Cognitive, linguistic, and social interaction theories are vital to understanding language development and the perspective we offer here encompasses them. The details of an explanation of just how language develops remain to be worked out, but we propose that an Intentional perspective must play a central role in that explanation.

Second, the major thrust of such a perspective is the emphasis that it places on the mind of the child and its development. In this view, the control of language development belongs to the child (Bloom, 1987; Shatz, 1978, in another context), rather than to the events of the external context, the support that the child receives in familiar interactions with adults, or the interpretations that mothers give to their infants' actions. The emphasis in the present theory is on how development influences the representations that the child can hold in mind, and these, in turn, determine what the child expresses and interprets of what others express. Events in the context and interactions with others are necessary to this development, but it is the child's understanding of these external events that is the critical explanatory factor.

And, third, the theory that we offer is a mental theory rather than an instrumental one. The instrumental function of language, like many of its functions, happens between individuals in social events and is one aspect of language. A mental perspective, rather than allowing access to one aspect of language, can serve to integrate all its aspects because, as we have argued, it serves as the foundation for each of them.

Piaget spoke of a mountain too big for any one person to make a map of (Piaget, 1948/1967). However, many people had walked on the mountain and each had a somewhat different view of it. None of these views was complete but each one was correct. Piaget noted that if we wanted to understand the topography of the mountain, we should not ask one person what the mountain was like, but ask each one of the people to describe their perspectives and integrate the various perspectives into a larger view of the mountain, a view larger than any one person had had.

The field of child language is something like that mountain and the people exploring it frequently lose sight of the fact that many other people are exploring its other regions. Part of the reason it is so easy to lose sight of this fact is that we have no unifying theme. We each work in our own area thinking that we are somewhat self contained, and so we are. However, that does not mean that we can understand the mountain without reaching beyond our own area. We can no more understand child language and its acquisition from one perspective than we can appreciate the topography of the Pyrenees without leaving Andorra.

Intentionality can serve as just the sort of unifying element needed by cartographers drawing maps of the mind. Certainly, it is not the only one possible. Early in the 20<sup>th</sup> century, the success of the physical sciences suggested to many that physics might serve as the unifying perspective for the sciences of the mind, leading to the "unity of science" approach (Neurath, Carnap, & Morris, 1938). The ultimate failure of the unity of science approach was due, in part, to its assumption that psychology was a natural rather than an interpretive science (Lerner, 1976). At the same time, its relative success left psychologists with the realization of the importance of a unifying perspective. We are in need of just such a unifying perspective for the study of child language and its development. We hope that by emphasizing the states of mind that underlie expression and interpretation and the developments that contribute to them, in a theory of language development, we can integrate work in the field and open discussion to other frameworks within which our research can go forward.

## REFERENCES

- Adamson, L. & Bakeman, R. (1982). Affectivity and reference: Concepts, methods, and techniques in the study of 6- to 18-month old infants. In T. Field & A. Fogel (eds.), *Emotion and early interaction*, pp. 213-236. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Allport, F. (1924). *Social Psychology*. Boston: Houghton Mifflin.
- Anderson, J. R. (1983). *The architecture of cognition*. Cambridge, MA: Harvard University Press.
- Astington, J., Harris, P., & Olson, D. (Eds.) (1988). *Developing theories of mind*. Cambridge: Cambridge University Press
- Austin, J. (1962). *How to do things with words*. New York: Oxford University Press.
- Barrett, M. (Ed.) (1985). *Children's single-word speech*. London: Wiley.
- Bates, E. (1976). *Language in context*. New York: Academic Press.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L. & Volterra, V. (1979). *The emergence of symbols: Communication and cognition in infancy*. New York: Academic Press.
- Beckwith, R. (1988). *Learnability and psychological constraints*. Ph.D. dissertation, Columbia University, New York.
- Beckwith, R., Bloom, L., Albury, D., Raqib, A. & Booth, R. (1985). Technology and methodology. *Transcript Analysis*, 2, 72-75.
- Beckwith, R. & Rispoli, M. (1984). Constructing syntax: The logical possibility. Paper presented to the Jean Piaget Society, Philadelphia.
- Bloom, K., Russell, A. & Wassenberg, K. (1987). Turn-taking affects the quality of infant vocalization. *Journal of Child Language*, 14, 211-27.
- Bloom, L. (1970). *Language development: Form and function in emerging grammars*. Cambridge, MA: The M.I.T. Press.
- Bloom, L. (1973). *One word at a time: The use of single word utterances before syntax*. The Hague: Mouton.
- Bloom, L. (1974a). The accountability of evidence in studies of child language. Comment in *Monographs of the Society for Research in Child Development*, 39 (Serial No. 156).
- Bloom, L. (1974b). Talking, understanding and thinking: Developmental relationship between receptive and expressive language. In R. Schiefelbusch & L. Lloyd, L. (eds.), *Language perspectives—Acquisition, retardation, and intervention*, pp. 285-312. Baltimore MD: University Park Press.
- Bloom, L. (1976). An integrative perspective on language development, Keynote address, In *Papers and reports on child language development*, Department of Linguistics, Stanford University.
- Bloom, L. (1981). The importance of language for language development: Linguistic determinism in the 1980s. In H. Winitz (Ed.), *Native language and foreign language acquisition*, pp. 160-171. New York: The New York Academy of Sciences, 379.
- Bloom, L. (1987). Language Development is in the Mind and Action of the Child, Plenary Address, International Congress for the Study of Child Language, Lund University, Sweden.
- Bloom, L., & Beckwith, R. (1989). Talking with feeling: Integrating affective and linguistic expression in early language development. *Cognition and emotion*, 3, 313-342.
- Bloom, L., Beckwith, R., Capatides, J. & Hafitz, J. (1988). Expression through affect and words in the transition from infancy to language. In P. Baltes, D. Featherman & R. Lerner (eds.), *Life span development and behavior*, Vol. 8, pp. 99-127. Hillsdale, NJ: Lawrence Erlbaum.
- Bloom, L. & Capatides, J. (1987). Expression of affect and the emergence of language. *Child Development*, 58, 1513-1522.
- Bloom, L., Capatides, J., & Tackeff, J. (1981). Further remarks on interpretive analysis: In response to Christine Howe. *Journal of Child Language*, 8, 403-411.
- Bloom, L. & Hafitz, J. (1985). Developments in word learning in the second year. Paper presented at the meeting of the Society for Research in Child Development, Toronto.
- Bloom, L. & Lahey, M. (1978). *Language development and language disorders*. New York: John Wiley & Sons.
- Bloom, L., Lahey, M., Hood, L., Lifter, K. & Fiess, K. (1980). Complex sentences: Acquisition of syntactic connectives and the semantic relations they encode. *Journal of Child Language*, 7, 235-261.
- Bloom, L., Lightbown, P. & Hood, L. (1975). Structure and variation in child language. *Monographs of the Society for Research in Child Development*, 40 (Serial No. 160).

- Bloom, L., Lifter, K. & Broughton, J. (1985). The convergence of early cognition and language in the second year of life: Problems in conceptualization and measurement. In M. Barrett (ed.), *Single word speech*, pp. 149-180. London: John Wiley & Sons.
- Bloom, L., Miller, P. & Hood, L. (1975). Variation and reduction as aspects of competence in child language. In A. Pick (ed.), *Minnesota Symposia in Child Psychology*, pp. 3-53. Minneapolis, MN: University of Minnesota.
- Bloom, L., Rispoli, M., Gartner, B., and Hafitz, J. (1989). *Journal of Child Language*, 16, 101-120.
- Bloom, L., Tackeff, J. & Lahey, M. (1983). Learning *to* in complement constructions. *Journal of Child Language*, 10, 391-406.
- Bowerman, M. (1982). Reorganizational processes in lexical and syntactic development. In E. Wanner & L. Gleitman (eds.), *Language acquisition: The state of the art*, pp. 319-346. Cambridge: Cambridge University.
- Bowerman, M. (1985). Beyond communicative adequacy: From piecemeal knowledge to an integrated system in the child's acquisition of language. In K. Nelson (ed.), *Children's language*, Vol. 5. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Braine, M. (1976). Children's first word combinations. *Monographs of the Society for Research in Child Development*, 41, Serial No. 16.
- Brandstadter, J. (1984). Action development and development through action. *Human Development*. 27, 115-118.
- Brentano, F. (1966). *The true and the evident*. O. Kraus (ed.), London: Routledge & Kegan Paul.
- Broen, P. (1972). The verbal environment of the language learning child. *Monograph of the American Speech and Hearing Association*, 17.
- Bruner, J. (1975). From communication to language. *Cognition* 3, 255-287.
- Bruner, J. (1981). Intention in the structure of action and interaction. In L. Lipsett (ed.), *Advances in infancy research*, Vol. I, pp. 41-56. Norwood NJ: Ablex.
- Bruner, J. (1983). *Child's talk: Learning to use language*. New York: W. W. Norton.
- Budwig, N. (1985). On the use of pronoun 'I' and first name in child language. Paper presented to the Stanford Child Language Research Forum.
- Bullock, M. (ed.) (1979). *Before speech: The beginning of interpersonal communication*. Cambridge MA: Cambridge University Press.
- Burke, K., (1935). *Permanence and change: An anatomy of purpose*. Berkeley: University of California Press.
- Capatides, J. (1990). *Mothers' socialization of their children's experience and expression of emotion*. PhD dissertation, Columbia University.
- Case, R. (1974) Structures and strictures: Some functional limitations on the course of cognitive growth. *Cognitive Psychology* 6, 544-574.
- Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: M.I.T. Press.
- Chomsky, N. (1966). *Cartesian linguistics: A chapter in the history of rationalist thought*. New York: Harper & Row.
- Clark, E. (1973). What's in a word? On the child's acquisition of semantics in his first language. In T. Moore (ed.), *Cognitive development and the acquisition of language*, pp. 65-110. New York: Academic Press.
- Clark, E. (1983) Meanings and concepts. In J. Flavell & E. Markman, (eds.), P. H. Mussen (Series Ed.), *Handbook of child psychology*, Vol. 3. *Cognitive development*, pp. 787-840. New York: John Wiley & Sons.
- Cohen, L. (1976). Habituation of infant attention. In T. Tighe & R. Leaton (eds.), *Habituation: Perspectives from child development, animal behavior, and neurophysiology*, pp. 207-238. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Corrigan, R. (1978). Language development as related to stage 6 object permanence development. *Journal of Child Language*, 5, 173-189.
- Corrigan, R. (1983). Cognitive correlates of language: Different criteria yield different results. *Child Development*, 50, 617-631.
- Danto, A. (1973). *Analytical philosophy of action*. Cambridge: Cambridge University Press.
- Danto, A. (1983). Toward a retentive materialism. In L. Cauman, I. Levi, C. Parsons & R. Schwartz (eds.), *How many questions? Essays in honor of Sidney Morgenbesser*, pp. 243-255. Indianapolis, IN: Hackett Publishing.
- Darwin, C. (1872). *The expression of the emotions in man and animals*. New York: Appleton.
- Dennett, D. (1978). *Brainstorms*. Montgomery, VT: Bradford Books.

- de Sousa, R. (1987). *The Rationality of Emotions*, Cambridge MA, MIT Press
- Devitt, M. (1981). *Designation*. New York: Columbia University.
- Dougherty, R. (1986). Computational principles of language acquisition. Unpublished manuscript.
- Dore, J. (1975). Holophrases, speech acts, and language universals. *Journal of Child Language*, 2, 21-40.
- Dore, J. (1983). Feeling, form, and intention in the baby's transition to language. In R. Golinkoff (ed.), *The transition from prelinguistic to linguistic communication*, pp. 167-190. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Dreyfus, H. (1980). Holism and hermeneutics. *Review of Metaphysics*, 34, 3-23.
- Dreyfus, H. (Ed.) (1982). *Husserl, Intentionality and Cognitive Science*. Cambridge, MA: The M.I.T. Press.
- Eco, U. (1976). *A theory of semiotics*. Bloomington IN: Indiana University Press.
- Ekman, P. & Friesen, W. (1975). *Unmasking the face: A guide to recognizing emotions from facial cues*. Palo Alto, CA: Consulting Psychologists Press.
- Ericsson, K. & Simon, H. (1980). Verbal reports as data. *Psychological Review*, 87, 215-251.
- Ervin-Tripp, S. (1973). *Language acquisition and communicative choice: Essays by Susan M. Ervin-Tripp*. Stanford, CA: Stanford University Press.
- Ewing, G., (1984). *Presyntax: The development of word order in early child speech*. Doctoral Dissertation, University of Toronto.
- Fantz, R. (1964). Visual experience in infants: Decreased attention to familiar patterns relative to novel ones. *Science* 146, 668-670.
- Fauconnier, G. (1985). *Mental spaces: Aspects of meaning construction in natural language*. Cambridge, MA: M.I.T. Press.
- Fodor, J. (1979). *The language of thought*. Cambridge, MA: Harvard University Press.
- Freud, S. (1905/1963). *Dora: An analysis of a case history of hysteria*. New York: Collier Books.
- Gee, J., & Savasir, I. (1985). On the use of WILL and GONNA: Towards a description of activity-types for child language. *Discourse Processes*, 8, 143-175.
- Gee, J. & Savasir, I. (1986). The use of the simple present in the speech of two 3-year-olds: Normativity not subjectivity. Manuscript submitted for publication.
- Gergely, G. & Bever, T. (1987). The mental representation of causative words. *Cognition*.
- Gleitman, L. & Wanner, E. (1982). Language acquisition: The state of the state of the art. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: State of the art* (pp. 3-48). New York: Cambridge University Press.
- Golinkoff, R. M. (1981). The case for semantic relations: Evidence from the verbal and nonverbal domains. *Journal of Child Language*, 78, 413-438.
- Gopnik, A. (1982). Words and plans: Early action and the development of intelligent action. *Journal of Child Language*, 9, 303-318.
- Gopnik, A. & Meltzoff, A. (1987). The development of categorization in the second year and its relation to other cognitive and linguistic developments. *Child Development* 58, 1523-1531.
- Greenfield, P. (1973). Who is "Dada"? Some aspects of the semantic and phonological development of a child's first words. *Language and Speech*, 16, 34-43.
- Greenfield, P. (1980). Toward an operational and logical analysis of intentionality: The use of discourse in early child language. In D. Olson (ed.), *The social foundations of language and thought*, pp. 254-279. New York: W. W. Norton.
- Halliday, M. (1975). *Learning how to mean—Explorations in the development of language*. London: Edward Arnold.
- Harding, C. & Golinkoff, R. (1979). The origins of intentional vocalizations in prelinguistic infants. *Child Development* 50, 33-40.
- Harris, Z. (1951) *Structural linguistics*. Chicago: Phoenix Books.
- Hill, J. (1983). *A computational model of language acquisition in the two-year-old*. Doctoral dissertation, University of Massachusetts at Amherst.
- Howe, C. (1976). The meanings of two-word utterances in the speech of young children. *Journal of Child Language*, 3, 29-47.

- Jespersen, O. (1964). *Essentials of English grammar*. Tuscaloosa: University of Alabama Press.
- Jackendoff, R. (1983). *Semantics and cognition*. Cambridge, MA: MIT Press.
- Johnson-Laird, P. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness*. Cambridge, MA: Harvard University Press.
- Johnson-Laird, P. (1988). *The computer and the mind: An introduction to cognitive science*. Cambridge, MA: Harvard University Press.
- Kagan, J. (1979). Structure and process in the human infant: The ontogeny of mental representation. In M. Bornstein & W. Kessen (eds.), *Psychological development from infancy: Image to intention*, pp. 159-182. Hillsdale NJ: Lawrence Erlbaum Associates.
- Klatzky, R. (1980). *Human memory: Structures and processes*. San Francisco: W. H. Freeman and Company.
- Klatzky, R. (1984). *Memory and awareness: An information-processing perspective*. New York: W. H. Freeman.
- Lerner, R. (1976). *Concepts and theories of human development*. Reading, MA: Addison-Wesley.
- Lieberman, P., (1967). *Intonation, perception and language*. Cambridge, MA: The M.I.T. Press.
- Lifter, K., & Bloom, L. (1989). Object play and the emergence of language. *Infant Behavior and Development*, 12, 395-423.
- Limber, J. (1973). The genesis of complex sentences. In T. Moore (ed.), *Cognitive development and the acquisition of language*, pp. 169-185. New York: Academic Press.
- Lock, A. (ed.) (1978). *Action, gesture and symbol: The emergence of language*. London: Academic.
- MacMurray, J. (1957). *Self as Agent*. London: Farber and Farber.
- Mandler, J. (1983). Representation. In J. Flavell & E. Markman, (eds.), P. H. Mussen (Series Ed.), *Handbook of child psychology: Vol. 3. Cognitive development*, pp. 420-494. New York: John Wiley & Sons.
- Mandler, J. (1984). Representation and recall in infancy. In M. Moscovitch (ed.) (1984) *Infant memory: Its relation to normal and pathological memory in humans and other animals*, pp. 75-101. New York: Plenum Press.
- McCune-Nicolich, L. (1981). The cognitive basis of relational words in the single word period. *Journal of Child Language*, 8, 15-34.
- McShane, J. (1980). *Learning to talk*. Cambridge: Cambridge University Press.
- Maratsos, M. & Chalkley, M. (1980). The internal language of children's syntax: The ontogenesis and representation of syntactic categories. In K. Nelson, (ed.), *Children's language*, Vol. 2, pp. 127-214. New York: Gardner Press.
- Menn, L., & Hazelkorn, S. (1977). Now you see it, now you don't: Tracing the development of communicative competence. In J. Kegl (Ed.), *Proceedings of the Seventh Annual Meeting of the Linguistic Society* (pp. 249-259). Chicago.
- Mervis, C. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (ed.), *Origins of cognitive skills*, pp. 339-370. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Miller, G., Galanter, E. & Pribram, K. (1960). *Plans and the structure of behavior*. New York: Holt-Dryden.
- Miller, G. & Johnson-Laird, P. (1976). *Language and perception*. Cambridge MA: Harvard University Press.
- Morris, C. (1938). Foundations of the theory of signs. In O. Neurath, R. Carnap & C. Morris (eds.), *International encyclopedia of unified science*, pp. 78-137. Chicago: University of Chicago Press.
- Moscovitch, M. (ed.) (1984). *Infant memory: Its relation to normal and pathological memory in humans and other animals*. New York: Plenum Press.
- Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development*, 38, (Serial No. 149).
- Nelson, K. (1974). Concept, word and sentence: Interrelations in acquisition and development. *Psychological Review* 81, 267-285.
- Nelson, K. (1982). The syntagmatics and paradigmatics of conceptual development. In S. Kuczaj (ed.), *Language Development (Vol. 2): Language, thought, and culture*, pp. 335-364. Hillsdale, NJ: Lawrence Erlbaum.
- Nelson, K. & Lucariello, J. (1985). The development of meaning in first words. In M. Barrett (ed.), *Single word speech*, pp. 59-86. London: John Wiley & Sons.
- Neurath, O., Carnap, R. & Morris C. (eds.) (1938). *International encyclopedia of unified science*. Chicago: University of Chicago Press.
- Oatley, K. & Johnson-Laird, P. (1987). Towards a cognitive theory of emotion. *Cognition and Emotion* 1, 29-50.

- Palermo, D. (1986). From the marble mass of language, a view of the developing mind. *Metaphor and Symbolic Activity* 1, 5-23.
- Pascual-Leone, J. (1970). A mathematical model for the transition rule in Piaget's developmental stages. *Acta Psychologica* 32, 301-345.
- Peirce, C. (1867/1965-6). *Collected papers of Charles Sanders Peirce*. Cambridge, MA: Harvard University Press.
- Piaget, J. (1923/1926). *The language and thought of the child*. London: Kegan Paul.
- Piaget, J. (1936/1952). *The origins of intelligence in children*. New York: International Universities Press.
- Piaget, J. (1937/1954). *The construction of reality in the child*. New York: Basic Books.
- Piaget, J. (1948/1967). *The child's conception of space*. New York: W. W. Norton.
- Piaget, J. (1972/1973). *The child in reality: Problems of genetic psychology*. New York: Penguin.
- Pinker, S. (1984). *Language learning and language learnability*. Cambridge, MA: Harvard University Press.
- Rispoli, M. & Bloom, L. (1987). The conceptual origins of the transitive/intransitive distinction. Paper presented to the Stanford Child Language Research Forum, Stanford, CA, April.
- Roeper, T. (1981). On the deductive model and the acquisition of productive morphology. In C. Baker & J. MacCarthy (eds.), *The logical problem of language acquisition*, pp. 129-150. Cambridge, MA: MIT Press.
- Roth, P. (1987). Longitudinal study of maternal verbal interaction styles. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Baltimore, MD, April.
- Rothbart, M. (1973). Laughter in young children. *Psychological Bulletin* 80, 247-256.
- Rovee-Collier, C., Sullivan, M., Enright, M., Lucas, D. & Fagen, J. (1980). Reactivation of infant memory. *Science* 208, 1159-1161.
- Ruff, H. (1976). Infant recognition of the invariant form of objects. *Child Development* 49, 293-306.
- Ryan, J. (1974). Early language development: Towards a communicational analysis. In Richards, M. (ed.), *The integration of the child into the social world*, pp. 185-213. London: Cambridge University Press.
- Sapir, E. (1921). *Language*. New York: Harcourt, Brace & Company.
- Schlesinger, I. (1971). Production of utterances and language acquisition. In D. Slobin (ed.), *The ontogenesis of grammar*, pp. 63-101. New York: Academic Press.
- Scoville, R. (1984). Development of the intention to communicate: The eye of the beholder. In Feagans, L., Garvey, C. & R. Golinkoff (eds.), *The origins and growth of communication*, pp. 109-122. Norwood, NJ: Ablex.
- Searle, J. (1982). What is an intentional state? In H. Dreyfus (ed.), *Husserl, intentionality and cognitive science*, pp. 259-276. Cambridge, MA: The M.I.T. Press.
- Searle, J. (1983). *Intentionality: An essay in the philosophy of mind*. Cambridge: Cambridge University Press.
- Searle, J. (1984a). *Minds, brains and science*. Cambridge, MA: Harvard University.
- Shatz, M. (1978). The relationship between cognitive processes and the development of communication skills. In C. Keasey (ed.), *Nebraska symposium on motivation 1977*, pp. 1-42. Lincoln, NE: University of Nebraska Press.
- Shatz, M., Wellman, H. & Silber, S. (1983). The acquisition of mental verbs: A systematic investigation of the first reference to mental state. *Cognition*, 14, 301-321.
- Sinclair, H. (1970). The transition from sensory-motor behavior to symbolic activity. *Interchange*, 1, 119-26.
- Stern, C., & Stern, W. (1907). *Die Kindersprache*. Leipzig: Barth.
- Stern, W. (1924). *The psychology of early childhood up to the sixth year of age*. (trans: Barwell, A.). London: Allen & Unwin.
- Studdert-Kennedy, M. (1979). The beginnings of speech. Haskins Laboratories: Status Report on Speech Research SR-58.
- Stein, N. & Jewett, J. (1986). A conceptual analysis of the meaning of basic negative emotions: Implications for a theory of development. In C. Izard & P. Read (eds.), *Measurement of emotion in infants and children*, Vol. 2, pp. 238-267. New York: Cambridge University Press.
- Stern, D. (1977). *The first relationship*. Cambridge MA: Harvard University Press.
- Sugarman, S. (1978). Some organizational aspects of preverbal communication. In I. Markova (ed.), *The social context of language*. New York: John Wiley & Sons.

- Taylor, C. (1979). Action as expression. In C. Diamond & J. Teichman (eds.), *Intentions and intentionality*, Essays in honor of G. E. M. Anscombe, pp. 73-89. Ithaca, NY: Cornell University Press.
- Taylor, C. (1985). *Philosophy and the human sciences: Philosophical papers*. Cambridge: Cambridge University Press.
- Tomasello, M. & Farrar, J. (1986). Joint attention and early language. *Child Development* 57, 1454-1463.
- Trevarthen, C. & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding and acts of meaning in the second year. In A. Lock (ed.), *Action, gesture and symbol: The emergence of language*, pp. 183-229. New York: Academic Press.
- Tulving, E. (1983). *Elements of episodic memory*. New York: Oxford University Press.
- Vander Linde, E., Morrongiello, B. & Rovee-Collier, C. (1985). Determinants of retention in 8-week-old infants. *Developmental Psychology* 21, 601-613.
- Wellman, H. (1990). *The child's theory of mind*. Cambridge, MA: MIT Press.
- Werner, H. & Kaplan, B. (1963). *Symbol formation*. New York: John Wiley & Sons.
- Wexler, K. & Culicover, P. (1980). *Formal principles of language acquisition*. Cambridge, MA: The M.I.T. Press.
- Whorf, B. (1956). *Language, thought, and reality: Selected writings of Benjamin Lee Whorf*. J. Carroll (ed.), New York: John Wiley & Sons.
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, 13, 103-128
- Wundt, W. (1894) Lectures on human and animal psychology. Leipzig.
- Yates, J. (1985) The content of awareness is a model of the world. *Psychological Review* 92, 249-284.