I. Introduction

1. Perspectives on thought and language: Traditional and contemporary views

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Introduction

Each of the contributions to this volume began from a simple insight: If we are to understand fully either language or thought, we must understand how they develop and interact in children's minds. Philosophers have long speculated about the origins of our distinctly human abilities to speak and reason complexly. Only relatively recently, however, has the issue been the subject of serious scientific study. We are now in the midst of an explosion of such research. In the past twenty years we have witnessed many exciting advances in the study of language and cognitive development. Now more than ever before, the utterances of small children are being gathered, scrutinized, and incorporated into broader theories of human cognition. The purpose of the present volume is to report and reflect on these advances. The product is a set of detailed and compelling models of language–thought relations (specifically, meaning–concept relations) as reflected in the developing mind of the child.

There are two quite different motivations for focusing on development as a window onto language–thought relations. One motivation is that children's behaviors provide clues to constraints on language and on thought. We can determine how languages and conceptual systems are constrained by examining the forms and meanings that children construct, and which errors they *fail* to make. All natural languages must be learnable by children; thus, children

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provide clues to what is universal, not only in syntax but in semantics as well.

A very different motivation for taking a developmental approach is that it can provide valuable clues to the complexities of the system eventually acquired. A developmental approach is inherently concerned with process, and so is especially suitable for detecting the relations among the ingredients of a complex system (including input, learning conditions, and conceptual requirements). Studying development is thus a powerful methodological tool and potentially more revealing about the organization of the system than any attempt to infer it from the adult end product. Harsanyi (1960) argues that knowledge about how transitions are structured provides insight into how states are structured, but not vice versa. Thus, developmental models are inherently more powerful and predictive than static models.[1]

The three succeeding parts of the book address these concerns, each examining a different content area. Part II concerns the interplay between category learning and the acquisition of individual words. The focus is primarily on the development of object terms at the beginning stages of the acquisition period (i.e., before age 5). Part III focuses on the acquisition of language for complex and abstract systems of time, logic, and causality. Here more extended developments are traced throughout childhood. Part IV examines the interpersonal environment in which language is learned, including peer and parental discourse, which, by implication, clarifies the nature of the child's role.

Shatz and Wilcox aptly observe that "the relations between language and thought [are] neither simple nor unidirectional. Indeed, what makes the study of linguistic and cognitive development intriguing is that it is not" (Chapter 9, this volume). Accordingly, the chapters in this book do not provide a simple conclusion such as "Language comes first" or "Concepts are primary." They decidedly do not present global theories; rather, they forge more particular language–thought links, showing respect for the richness and complexity of the relations.

Nonetheless, each chapter owes an intellectual debt to the great theorists of language–thought relations, including Chomsky, Piaget, Whorf, and Vygotsky.[2] Allusions are made throughout the chapters to the provocative notions endorsed by these grand theorists (such as *linguistic determinism* and *internalization of communi-*

cative speech). However, we asked the authors not to dwell on such background theories, but to present their own positions instead.

The rest of this chapter provides a historical context for the chapters that follow. We discuss four recurring themes of the book that cross-cut the section boundaries: constraints on development, the complexity of conceptual systems, the role of theory, and communication and social interaction. For each theme, we summarize first the classic views most befitting it, then the current contributions. The final section presents some issues for future research.

Constraints on development

The notion of constraints on semantic structures stems in part from Chomsky's arguments concerning the acquisition of syntax. Chomsky stressed the significance of language development (in particular, syntactic development) as a window onto the human mind. As a starting point, he made three assumptions concerning language and the learning process. First, grammars are systems of complex rules that determine which utterances are acceptable. The sentences we speak cannot have been memorized (see Miller, 1967, pp. 79–80, for a stunning demonstration of the vast number of sentences that would have to be memorized in order to store just a small sample of the infinitely many grammatical sentences of English); rather, they are creative, generative constructions. Second, the information a child receives is "impoverished" both in practice (because of our human tendency to make errors, including slips of the tongue and false starts) and in principle (because we receive only incomplete, indirect evidence about the structure of language; "the stimulus does not contain the elements that constitute our knowledge" [Chomsky, 1980, p. 35]). It would seem, then, that children could not induce the structure of the language from the finite sentences they hear around them using only general learning principles (for the role of parental speech input, see also Furrow & Nelson, 1986; Gleitman, Newport, & Gleitman, 1984). Third, despite the complexity of the task and the fragmentary nature of the input, the process of learning language is fairly uniform across speakers and nearly complete at an astonishingly early age. Indeed, all normal children learn the basics by age 4, and in many parts of the world children learn two or three languages simultaneously. Chomsky notes "the vast qualitative difference between the impoverished and unstructured environment,

on the one hand, and the highly specific and intricate structures that uniformly develop, on the other" (1980, p. 34; see also Chomsky, 1975, 1988, for reviews). Taken together, these assumptions illustrate how impressive the accomplishment of language learning is and raise the question of how it is even remotely possible.

Chomsky's view is that there are highly abstract innate structures that constrain the acquisition of syntax. Children have an inborn outline of what language will be like (a "Language Acquisition Device"), and this guides them in learning its delicately complex structures. Language develops, just like any other organ or system in the body, such as the liver or the visual system. According to Chomsky, "in certain fundamental respects we do not really learn language; rather, grammar grows in the mind" (1980, p. 134). Thus, the human genetic endowment is said to impose limits on developmental processes in language (as well as other cognitive faculties).

According to Chomsky, nonnativist approaches to language acquisition are fundamentally misguided in their appeal to domain-general learning mechanisms such as "conditioning" or "assimilation" and "accommodation." Such general mechanisms endow the young child with too little knowledge of linguistic structures. Chomsky appeals to the "argument from poverty of the stimulus" to propose that children must have some idea of what to look for when learning their native tongue:

> Were it not for this highly specific innate endowment, each individual would grow into some kind of an amoeboid creature, merely reflecting external contingencies, one individual quite unlike another, each utterly impoverished and lacking the intricate special structures that make possible a human existence and that differentiate one species from another. (1980, pp. 33–34)

Gleitman and Wanner (1982) point out that all explanations of language learning assume some native ability. Even extreme empiricists such as Bloomfield (1933) and Skinner (1957) presume that children are born with the capacity to note similarity, form analogies, and generalize information. The disagreement lies in how richly specified and domain-specific the innate knowledge is.

Approaches that are relatively nonnativistic are also notable in that they do not admit of modularity, or the existence of "separate systems [of the mind each] with their own properties" (Chomsky, 1988,

p. 161; see also Fodor, 1975, 1983). Just as modularity is assumed for different physical systems (e.g., visual vs. circulatory system), Chomsky suggests that it is reasonable to assume modularity for different mental systems as well. Although modular systems interact with other forms of knowledge (Sadock, 1983), they are assumed to operate each according to its own set of rules. Modularity implies nativism: "The belief that various systems of mind are organized along quite different principles leads to the natural conclusion that these systems are intrinsically determined, not simply the result of common mechanisms of learning or growth" (Chomsky, 1975, pp. 40–41). Conversely, a nonnativistic approach implies lack of modularity.

Chomsky's analysis can be extended to semantic development, given that children learn word meanings as rapidly as they construct grammars. Extrapolating from the vocabulary of a 6-year-old, children are thought to add between five and nine new words to their lexicon *daily* between 18 months and 6 years of age (Carey, 1978; Dromi, 1987). Furthermore, word meanings are rarely given explicitly; they must be inferred (see Quine, 1960, for arguments concerning the indeterminacy of meaning).[3]

Just as children are predisposed with regard to the syntactic structures they will find, so too their conceptual and semantic systems are informed by preexisting expectations. Yet the precise form of these constraints, the degree to which they are specified innately, and their relation to conceptual and pragmatic constraints are not yet known and are among the topics discussed in this volume.

For instance, Eve Clark (Chapter 2) distinguishes conceptual constraints from lexical constraints, arguing that both are critical in acquiring not only conventionalized words but also direct, spontaneous lexical innovations by the child, such as *button-man* meaning a man who throws buttons. The lexical constraints include pragmatic principles: the conventionality assumption ("for certain meanings there is a form that speakers expect to be used in the language community") and the contrast assumption ("every two forms contrast in meaning"). The lexical constraints also include constraints on lexical meanings: the single-level assumption ("words apply at a single level [of abstraction]") and the no-overlap assumption ("the meanings of any two words do not overlap"). Clark argues that a full understanding of lexical acquisition requires an incorporation of conceptual universals as well as language-specific conventions of the

surrounding society. The chapter is important for its incorporation of three levels of analysis: conceptual, lexical, and pragmatic. Clark suggests that conceptual categories provide one important starting point for children's hypotheses about what words mean, whereas pragmatic principles help refine and shape children's early hypotheses.

Ellen Markman (Chapter 3) proposes three constraints on word meaning: the whole-object assumption ("[a label] refers to the object as a whole, and not to its parts, or substance, or color, etc."), the taxonomic assumption ("[a label] refers to other objects of the same kind or same taxonomic category, and not to objects that are thematically related"), and the mutual exclusivity assumption ("each object will have only one label"). She points out that these constraints, although reasonable first-order approximations of the system to be learned, will eventually come into conflict and proposes a model for the resolution of conflicting interpretations by young children. These views are supported by a series of elegant experimental studies of word learning in young children. Markman is agnostic as to whether the constraints are specifically linguistic and suggests interesting ways that they may reflect more general cognitive predispositions.

Sandra Waxman (Chapter 4) argues for "implicit biases" that guide the process of word learning and proposes an interplay between conceptual level and linguistic form. Drawing on cross-cultural studies of ethnobiology, linguistic analyses, and developmental work, she argues that basic-level categories (e.g., *dog, grape*) are named consistently across cultures. Languages exert their effects at nonbasic levels, both superordinate and subordinate. Whereas novel nouns are presumed to focus attention on taxonomic relations at the superordinate level, novel adjectives are presumed to mark subordinate-level distinctions. Thus, semantic constraints cannot be considered apart from linguistic form.

For the most part, constraint theorists have focused on nouns, although Clark, Markman, and Waxman discuss the implications that constraints have for the learning of other parts of speech. Shatz and Wilcox (Chapter 9) take the critical step of applying a constraints approach to a "complex and irregular system," the English modal system (including, e.g., *should, might, hafta*). They argue that the convergence of constraints may operate in other complex systems as well. They also propose broadening the notion of constraint to

include any "factors that channel or direct the process of acquisition," including input.

Although informed by Chomsky's approach, the chapters dealing with constraints make important departures as well. Semantic constraints are not assumed to be innately specified. (Indeed, on some views constraints may be the product of development; see Roberts & Goodman, 1985.) Perhaps most importantly, the present chapters examine closely the interplay between semantic biases and other factors, including world knowledge (Waxman), the language community (Clark; Shatz & Wilcox; Waxman), and general cognitive predispositions (Markman).

The complexity of conceptual systems

A second major theme is that language maps onto complex conceptual systems and that understanding these complex systems gets at the heart of the acquisition process. It is in part because of this complexity that Chomsky was motivated to propose constraints on acquisition. However, few thinkers have been as deeply fascinated with the nature of conceptual systems as the Swiss epistemologist Jean Piaget. We first provide an overview of his position regarding language–thought relations, then turn to a brief summary of some of the chapters addressing this theme.

Like Chomsky, Piaget saw language as a window onto the mind. However, whereas Chomsky was intrigued with linguistic structures underlying language acquisition and use, Piaget focused on cognitive underpinnings reflected in language. Specifically, he considered "the role of language in the formation of intelligence generally and of logical operations in particular" (1968, p. 88). His work is notable for its portrayal of the rich conceptual knowledge that underlies adult language comprehension. Knowledge is not merely a passive accumulation of associations or isolated facts. Rather, knowledge is actively structured by the individual. It is "a specific form of biological adaptation of a complex organism to a complex environment" (Flavell, 1985, p. 4). By adulthood, the normal human can engage in sophisticated hypothesis generation and hypothesis testing, can consider the logical relations among propositions as distinct from their content, can reason about time and space from multiple perspectives, and can consider the hypothetical. According to Piaget, these thought processes can be modeled formally. Although

the particular logical systems Piaget proposed have been criticized by some as models of human thought (Brainerd, 1978; Flavell, 1985; Keats, Collis, & Halford, 1978), at the very least his work reminds us of the richness of adult conceptual understandings.

Piaget (1968) identified three points in development at which language might play an important role. He argued that the role of language is rather modest in all three cases.[4] The first point concerns the transition from sensorimotor intelligence (based solely in action, immediate perception, and the here and now) to representational intelligence (evident with the onset of language and the ability to evoke absent situations from memory or imagine future events). Whereas others before him attributed this change in thought to the onset of language, Piaget argued that language alone is not responsible for this transformation. Rather, other forms of the emergent semiotic function, such as motivated symbols found in imaginative play, deferred imitation of absent models, and images deriving from internalized actions are said to be equally responsible for (or indices of) changes in thought. Unlike Chomsky, who insists on the uniqueness and integrity of the language faculty (i.e., the biological abilities that underlie language), Piaget argued that language is responsible for changes in thought only as it is part of the semiotic function more generally. He also argued that language cannot be considered a mechanism of intellectual change, because the onset of intelligent thought in the form of sensorimotor schemes developmentally precedes the onset of language.

The second point of conceptual development that Piaget considered was the transition between preoperational and concrete operational thinking. He proposed that a hierarchical "logic of classes" emerges around age 7 to 8 in which children are able to relate subordinate and superordinate classes using necessary and sufficient criteria and are also able to form class intersections within matrices. At the same time children are thought to develop a "logic of relations" in which objects can be ordered by increasing magnitude. Again, where others have assumed that particular linguistic advances in predication, negation, and inflection (e.g., comparative endings) precipitate changes in categorical and ordinal reasoning, Piaget argued against this view. Among several pieces of evidence, he pointed out that children fail to demonstrate the logic of classes and relations until age 7 or 8. This delay suggested that language forms are assimilated to children's level of thinking. In essence, lan-

guage at most serves as simply one more form of experience within which contradictions to one's constructions are made evident.

In addition to the shifts from sensorimotor intelligence to preoperations and from preoperations to concrete operations, the third point of development at which language might seem to affect thought was the shift from concrete operational thought to formal operational thought. Piaget (1968, p. 95) conceded that language plays a role in the formation of propositional concepts such as implication (*if . . . then . . .*) and disjunction (*either . . . or . . .*) but argued that the appropriate linguistic forms are not themselves sufficient for prompting conceptual change. In this case, the properties of formal operations include not only the hypotheticodeductive use of propositions in inferential chains, but also 16 possible combinations of the component clauses of these propositions, the potential to organize propositions into a hierarchical lattice, and the potential to relate propositions by means of the mathematical group operations, including four transformations: identity, negation, reciprocal, and correlative (INRC). Piaget argued that these properties do not arise from language.

Piaget (1968) summarized his view on the relation between thought and language as follows:

> Language is thus a necessary but not a sufficient condition for the construction of logical operations. It is necessary because without the system of symbolic expression which constitutes language the operations would remain at the stage of successive actions without ever being integrated into simultaneous systems or simultaneously encompassing a set of interdependent transformations. Without language the operations would remain personal and would consequently not be regulated by interpersonal exchange and cooperation. It is in this dual sense of symbolic condensation and social regulation that language is indispensable to the elaboration of thought. Thus language and thought are linked in a genetic circle where each necessarily leans on the other in an interdependent formation and continuous reciprocal action. In the last analysis, both depend on intelligence itself, which antedates language and is independent of it. (p. 98)

Note that language is necessary for logical operations only in the sense that both language and logical operations depend on nonlinguistic intelligence.