

Learnability and Cognition
The Acquisition of Argument
Structure

Steven Pinker

A Bradford Book

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To the memory of
Clara Daly Wiesenfeld
(1902–1988),
who would have tried to read
this book

Series Foreword

This series in learning, development, and conceptual change will include state-of-the-art reference works, seminal book-length monographs, and texts on the development of concepts and mental structures. It will span learning in all domains of knowledge, from syntax to geometry to the social world, and will be concerned with all phases of development, from infancy through adulthood.

The series intends to engage such fundamental questions as

The nature and limits of learning and maturation: the influence of the environment, of initial structures, and of maturational changes in the nervous system on human development; learnability theory; the problem of induction; domain-specific constraints on development.

The nature of conceptual change: conceptual organization and conceptual change in child development, in the acquisition of expertise, and in the history of science.

Lila Gleitman
Susan Carey
Elissa Newport
Elizabeth Spelke

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I am in debt to a number of researchers who have shared their findings and disagreements. Melissa Bowerman has doubted whether constraints on lexical rules could get the child out of the learnability paradox I have addressed. Lila Gleitman has questioned how much of a verb's meaning a child could learn from the situations in which it is used. Jane Grimshaw and Janet Randall have warned

against neglecting properties of the grammatical representation of argument structure as a source of learning constraints. Janet Fodor has been skeptical about how productive children's use of rules really is. Kenneth Wexler has argued against assuming that the biological mechanisms of language acquisition remain unchanged through childhood. I think that all of these people are right about something, and I have strived toward a theory that is eclectic enough to encompass all of their insights in some form, though naturally these people can be expected to continue to find its weaknesses. What makes the topic so much fun to work on is that it is clear that the ultimate best theory, though eclectic, will not be a banal resignation to the effect that "anything can happen." There are striking regularities in argument structure and its acquisition, and I am glad to be part of a research community that is working toward discovering them.

I also have been fortunate to have worked on this project at MIT during a time when the Lexicon Project at the Center for Cognitive Science was in full swing. Beth Levin, director of the project through 1987, has offered many helpful comments on this work, and the theory owes a great deal to her research. Levin, Jay Keyser, and Kenneth Hale created a stimulating environment with a seminar series and technical reports that were an important catalyst in the research. A visiting position in the Department of Psychology at Brandeis University gave an official status to my very helpful discussions with Jane Grimshaw, Ray Jackendoff, Alan Prince, and Jerry Samet.

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Chapter 1

A Learnability Paradox

Some of the most rewarding scientific pursuits begin with the discovery of a paradox. Nature does not go out of its way to befuddle us, and if some phenomenon seems to make no sense no matter how we look at it, we are probably in ignorance of deep and far-ranging principles. For anyone interested in the human mind, language offers many such opportunities for discovery. Language is created anew each generation, so details of grammar, even subtle and intricate ones, are products of the minds of children and bear the stamp of their learning abilities.

This book is about a paradox in language acquisition. The paradox begins with a small linguistic puzzle: Why does *He gave them a book* sound natural, but *He donated them a book* sound odd? It is complicated by a fact about children's environment—that they are not corrected for speaking ungrammatically—and a fact about their behavior—that they do not confine themselves to the verb phrase structures they have heard other people use. In trying to resolve this paradox, we must face fundamental questions about language and cognition: When do children generalize and when do they stick with what they hear? What is the rationale behind linguistic constraints? How is the syntax of predicates and arguments related to their semantics? What is a possible word meaning? Do languages force their speakers to construe the world in certain ways? Is there a difference between a word meaning and a concept? Why does children's language seem different from that of adults? The goal of this work is to resolve the learning paradox and to show how the solution leads to insight into these deep questions.

The strategy I will follow comes out of what is sometimes called the learnability approach to language acquisition (Hamburger and Wexler, 1975; Pinker, 1979; Wexler and Culicover, 1980; Baker and McCarthy, 1981). This approach focuses on the logical nature of the task facing the child as he or she tries to learn a language and on the mental representations and processes that make

such learning successful. I will pursue the solution to the learning paradox relentlessly, trying to create a trail that leads from the prelinguistic child to the adult's command of subtle discriminations of linguistic structure. Though parts of the trail may be rough going, what is most important is that each segment link up with the next to form an unbroken path of explanation from children's experience to adults' knowledge.

In this chapter I outline the problem: first, the specific domain of language and why it is important, then the logic of language learning in general, then the juxtaposition of the two that creates the learning puzzle. Then I consider some half-dozen simple ways in which the problem might be eliminated. All can be shown to be incorrect or unsatisfactory. In my mind this is what elevates the problem from a puzzle to a paradox, which the rest of the book attempts to solve.

Chapter 2 discusses phenomena that point to a way out of the paradox and presents evidence that that path is the right one. The next three chapters outline a theory of adult linguistic knowledge that is logically capable of resolving the paradox while providing an explanation for the form of that knowledge. Chapter 3 tries to make sense of the phenomena, making them fall out of more general principles. Chapter 4 extends those principles so that the original linguistic problems can be solved in detail. Chapter 5 deals with representation; it presents and justifies an explicit description of the representational structures for verb meanings and rules that the theory needs.

The next two chapters take up the psychological processes for acquiring the linguistic knowledge underlying the solution to the paradox. Chapter 6 is about learning; it discusses the computational problem of how the linguistic structures are acquired through interaction with the environment, and it outlines a proposal for how the child does this. Chapter 7 is about children's development; in it I compare the facts of child language with the acquisition problems and mechanisms discussed previously. In the concluding chapter I spell out some interesting implications that the solution of the paradox holds for language and cognition.

Much of this book is about words, and this calls for a special apology. People know tens of thousands of words, no two alike, making the mental lexicon a domain of immeasurable richness. Any theory that tries to find common organizing principles amongst this richness can be confronted with a huge number of empirical tests. While this makes for lively linguistic argumentation, at times it can be overwhelming. In the middle chapters (3, 4, and 5) I describe a theory of the mental representation of words and rules whose machinery is outlined explicitly and which is buttressed with many linguistic data. I have tried, however, to organize the material so that it can be absorbed by readers with varying degrees of expertise and interest, including those with little background in linguistics.

The key ideas of these middle chapters are presented in overview sections at the beginning and in summary sections at the end. The first section of chapter 3, section 3.1, is a capsule description of the theory discussed in that chapter, and similarly section 4.1 motivates and previews the claims of chapter 4. The final section of chapter 4 spells out the relationship between the two key parts of the theory, the one presented in chapter 3 and the one presented in chapter 4. The general justification for the theory of representation in chapter 5 is presented in sections 5.1 through 5.4, and the accomplishments of the theory are summarized at the end of the chapter. Finally, chapter 8 begins with a brief recapitulation of everything that went before.

The detailed linguistic discussions in the middle of chapters 3–5 are also modularly organized. In each one I begin with linguistic evidence that is independent of the problems I try to solve. These can be found in sections 3.2, 4.2, and 5.3–5.4. I present the theoretical claims explicitly in sections 3.3, 4.3 and 5.5. In the remaining sections I apply the theory to each of four linguistic phenomena, the dative, causative, locative, and passive alternations. Because the topic of this book is the psychology of language acquisition, I have chosen to organize the book around issues of representation and learning rather than around the linguistic phenomena, and this means that I discuss each of the four alternations a number of times. The sections in which the individual alternations are discussed are self-contained, labeled, and cross-referenced, and specialists with an interest in one alternation can skip or skim the others. Readers who want to see the theory applied in detail to one illustrative alternation are encouraged to track the discussions of the dative.

But let me get on with the paradox.

1.1 Argument Structure and the Lexicon

Human languages do not define straightforward mappings between thoughts and words. To get a sentence, it is not enough to select the appropriate words and string them together in an order that conveys the meaning relationships among them. Verbs are choosy; not all verbs can appear in all sentences, even when the combinations make perfect sense, as shown in (1.1).

(1.1) John fell.

*John fell the floor.

John dined.

*John dined the pizza.

John devoured the pizza.

*John devoured.

John ate.

John ate the pizza.

John put something somewhere.

*John put something.

*John put somewhere.

*John put.

These facts demonstrate the phenomenon often referred to as subcategorization: different subcategories of verbs make different demands on which of their arguments must be expressed, which can be optionally expressed, and how the expressed arguments are encoded grammatically—that is, as subjects, objects, or oblique objects (objects of prepositions or oblique cases). The properties of verbs in different subcategories are specified by their entries in the mental lexicon, in data structures called *argument structures* (also called predicate argument structures, subcategorization frames, subcategorizations, case frames, lexical forms, and theta grids). Thus the argument structure of *fall*, *dine*, and the intransitive version of *eat* would specify that only a subject is permitted. The argument structures for *devour* and the transitive version of *eat* would specify that a subject and an object are required. The argument structure for *put* would call for no more and no less than a subject, an object, and an oblique object.

Lexical argument structures play an extremely important role in modern theories of language. Beginning with *Aspects of the Theory of Syntax* (Chomsky, 1965) and continuing to the present, it has become apparent that many of the facts of grammar are caused by properties of the particular lexical items that go into sentences. Recent theories of grammar specify rich collections of information in lexical entries and relatively impoverished rules or principles in other components of grammar (e.g., Chomsky, 1981; Bresnan, 1982a). Sentences conform to the demands of the words in them because of general principles (for example, Chomsky's Theta-Criterion and Bresnan's Coherence and Completeness Principles) that deem a sentence to be grammatical only if the arguments specified by the verb's argument structure are actually present as constituents in the sentence and vice versa. Chomsky's Projection Principle specifies further that the demands of verbs' argument structures must be satisfied at every level of sentence representation, not just deep structure.

Since verbs' argument structures assume such a large burden in explaining the facts of language, how argument structures are acquired is a correspondingly crucial part of the problem of explaining language acquisition. (In fact, Elliott and Wexler, in press, have gone so far as to suggest that language acquisition may be *nothing but* the acquisition of information about the words in the language.) How argument structures are acquired is intertwined with the question of why