Précis of **A course in first language acquisition**

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Using language is as close to magic as humans get. We push air through our lungs, vibrate our vocal chords, and move our mouths, and as a result, we can provide to those who hear the resulting vibrations a record of past events, an understanding of our thoughts and desires, or a picture of the future. The sounds we produce can lead our interlocutors to perform actions or come to have new beliefs of their own. This magic is made possible by an aspect of mind, a cognitive system we call a mental grammar, that speakers and listeners of a common language share. This shared grammar represents the sounds that make up the smallest units of meaning, along with the rules that combine these units into larger words, phrases, and sentences. And this grammar enables us to produce and understand an unlimited number of sentences. Indeed, in the course of a single day, we produce and encounter hundreds of sentences that we have never heard before and very likely have never even been uttered before. We do so effortlessly and with hardly a thought about how.

Behind these grammars lies yet another piece of magic. Children are not born knowing a language. Yet, well before their fifth birthday, they can produce and understand sentences that match the language of their community in structure and complexity, whether that community speaks English, Igbo, Japanese, or Kaqchikel. How do they do it? How does a creature exposed to a certain kind of noise end up with a system of mind that enables them to produce and understand new sentences? Answering this question, and understanding the magic of human language and its acquisition, is the focus of this book.

In order to understand how children acquire a grammar for the language(s) they are exposed to, it is important to first understand (a) what learning and cognitive development are and (b) what a mental grammar is. These two issues are woven throughout the particular case studies discussed in the book as a way of providing students with the tools to think about (a) what is already understood about language acquisition, (b) what methods acquisitionists use to identify children's grammatical

knowledge, and (c) how to approach new problems in any area of grammatical acquisition. The case studies covered are chosen because of how they reveal fundamental properties of the kind of learning systems that are required to understand if we hope to understand children's language acquisition. As such, the book does not provide a complete survey of the field, but rather, covers a carefully selected set of phenomena. We believe that this will provide students with the tools they need to approach any novel question in the domain of developmental psycholinguistics.

The book is divided into five sections (see table of contents below). The first section, *Foundations*, begins by discussing the nature of linguistic knowledge as a symbolic system and introduces the puzzle of language acquisition by describing the distance between the kind of data children are exposed to and the complexity of the knowledge they come to have. We then talk about the nature of learning and information as a way to further explicate the problem of how grammatical systems are acquired. The key insight in this section comes from Shannon's famous proof that if the receiver of a communicative signal does not have prior knowledge of the space of possible signals, then the signal conveys infinite information. So, assuming that sentences convey information about the grammar that generated them (which seems necessary), it must be that language learners have some knowledge of the space of possible grammars.

We then move on to talk about learning in the animal kingdom, emphasizing the many ways that animals go beyond their experience in acquiring knowledge, drawing different inferences from the same data depending on the domain of learning. In our discussion of animal learning we emphasize the implications for knowledge acquisition more generally. Case studies include (a) how rats learn about what foods to avoid, (b) the cues bees use to learn about food course and landmarks, and (c) bees learning the solar ephemeris. In each case we emphasize the relative contributions of the innate knowledge of the organism with respect to the domain of learning, as well as the information present in the environment that animals use to drive learning.

In the second section, we turn to *Categories*. Categories provide one of the fundamental pieces of a grammar because they allow a speaker to treat a disparate set of elements (sounds, morphemes, words, phrases) as being alike despite their many

differences. In the domain of sound systems, we discuss findings about categorical perception and the development of phonetic categories, relating the classic results to findings from the animal audition literature suggesting that an initial categorical perception ability derives from mammalian auditory systems and not from anything linguistic. We then move on to discuss the role of contrast and the developing lexicon in the discovery of linguistic categories, which get layered over top of that preexisting auditory system's categories. We also review results from several methods and a wide range of languages demonstrating that children have acquired the phonological categories by the end of the first year of life. After discussing phonological categories, we then turn to morphosyntactic categories and the nature of linguistic productivity, reviewing the literature on the acquisition of the category determiner. In this section, we discuss asymmetries between data that come from children's production and data that come from their perception, introducing some extralinguistic contributions to linguistic behavior (such as working memory and executive function). We then turn to relations between syntactic categories and conceptual categories and tendencies for words from particular linguistic categories to have particular kinds of meanings (e.g., nouns tend to name object kinds, verbs to name events, and adjectives to name properties). Throughout this section, we review studies that demonstrate children's knowledge of the linguistic categories based on the kinds of semantic inferences they make about novel words within those categories.

Finally, we turn to Syntactic Bootstrapping and children's ability to make inferences about a word's meaning on the basis of its grammatical distribution. Here, we review effects of the complement taking properties of verbs on children's hypotheses about those verbs' meanings. In the bootstrapping chapter, we emphasize that the relevant inferences are driven by the child's knowledge of how syntax and semantics relate. But these findings then raise the question of where their syntactic knowledge comes from in the first place. We turn to this question in the book's third section.

The third section, *Hierarchical Structure*, begins by reviewing evidence for children's knowledge of hierarchical structure in language. We do so by way of two case studies demonstrating the degree to which children rely on relations defined over hierarchical structure to shape their interpretations of binding and scope dependencies.

Having established some findings on the acquisition of structure, we then turn to the question of how children discover the syntax of their language. We consider two proposals centered around the idea that knowledge from one domain of language can be informative about the structure of another. The Semantic Bootstrapping proposal concerns inferences from perceived sentence meaning to (a) the structure of the relevant sentence and (b) generalizations about the surface signals to syntactic structure. We review the basics of the idea, some initial evidence in favor of it, and then consider the problems inherent in perceiving meaning independent of syntax. With this in mind, we turn to the Prosodic Bootstrapping Hypothesis – the idea that prosodic structure can provide indirect evidence about syntactic structure. We review studies concerning infants' initial sensitivity to prosodic properties of speech, the identification of functional categories, and the combined use of functional categories and prosodic structure to infer syntactic structure. We then consider difficulties that may arise from focus and other information structural properties of speech that may distort the relation between prosody and syntax.

Having reviewed evidence for hierarchical structure in early language learning, section 4 turns to another hallmark of syntactic structure: *Dependencies*. We begin by reviewing evidence of infants' knowledge of the link between auxiliary verbs and the form of their complements (e.g., *is V-ing*, *has V-en*, etc.), and discuss theories of how children can use statistical information to discover these dependencies. We then turn to wh-movement dependencies and consider both the time course and theories of their acquisition, reviewing evidence that wh-movement is acquired in English by 18-months. Having established that children have acquired the syntactic dependency that underlies wh-movement, we then consider the acquisition of locality constraints on wh-movement. We review evidence of 3- and 4-year-old children's island sensitivity and consider theories of how this sensitivity could be acquired. Finally, we turn to the acquisition of Raising and Control dependencies. These constructions pose a puzzle beyond merely discovering the dependency, because their surface forms are identical (*NP verbs to VP*), but they nonetheless have different structures. We review studies arguing about whether preschoolers correctly identify the relevant structures and consider learning

models that use the distribution of animate and inanimate subject NPs as evidence for the acquisition of the underlying structure.

In the last section, we take up *Real-time Processing Considerations*, psycholinguistic factors that contribute to children's linguistic behavior. We review children's over-regularization of past tense morphology and discuss (a) the hypothesis that these productions reveal the rule-like nature of children's grammars and (b) the role of memory access in explaining why over-regularization happens so infrequently. We then turn to debates about children's subject-less sentences in languages that do not allow null subjects. We compare the hypothesis that these sentences reveal that children have acquired the wrong grammar against the hypothesis that they reflect extralinguistic performance factors. We then turn to the role of infant parsing mechanisms in learning, exploring how changing grammatical representations interact with on-ling parsing mechanisms to allow children to discover relevant generalizations. Finally, we turn to the question of how the acquisition of linguistic meaning is related to the acquisition of concepts, comparing arguments that languages shape the way we conceptualize the world against arguments that our non-linguistic conceptual systems are recruited for the discovery of linguistic meaning.

The book is designed for an audience of advanced undergraduate students or beginning graduate students, assuming a basic familiarity with the key concepts of generative linguistics, though many of these concepts are briefly reviewed in the relevant chapters. As we mentioned earlier, the book is not designed to provide a comprehensive review of the literature. Rather, we wish to provide the conceptual foundations for a theory of language acquisition and to discuss some of the key theoretical concepts that are required in any theory of grammar and its acquisition. The case studies covered here serve to highlight the dimensions along which explanations in this field can vary, and hence provide a kind of conceptual framework for developing new projects in the field. Each chapter is designed to cover one or two class periods for a term including 15 weeks of instruction. At the end of each chapter, we include supplemental readings and discussion questions for students or instructors who wish to go deeper into the topic.

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22) Parsing and learning

23) Language and thought