

**MATTHEW J. TRAXLER**

# **INTRODUCTION TO PSYCHOLINGUISTICS**

**UNDERSTANDING  
LANGUAGE SCIENCE**





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LANGUAGE SCIENCE**



 **WILEY-BLACKWELL**

A John Wiley & Sons, Ltd., Publication

This edition first published 2012  
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Blackwell Publishing was acquired by John Wiley & Sons in February 2007. Blackwell's publishing program has been merged with Wiley's global Scientific, Technical, and Medical business to form Wiley-Blackwell.

*Registered Office*

John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

*Editorial Offices*

350 Main Street, Malden, MA 02148-5020, USA

9600 Garsington Road, Oxford, OX4 2DQ, UK

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*Library of Congress Cataloging-in-Publication Data is available for this title.*

ISBN 9781405198622

A catalogue record for this book is available from the British Library.

This book is published in the following electronic formats: ePDFs [ISBN 9781444344325]; Wiley Online Library [ISBN 9781444344592]; ePub [ISBN 9781444344578]; mobi [ISBN 9781444344585].

Set in 10/12pt Minion Pro by SPi Publisher Services, Pondicherry, India

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# ACKNOWLEDGMENTS

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# PREFACE

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The last time I wrote a preface, I killed a guy. Well, I didn't actually kill him. I just said he was dead even though he isn't. (Sorry Eno!) One of my major goals in writing this preface is not to kill anyone who isn't already dead. My other major goal is to use the word "shenanigans."

I learned two things from my previous preface-writing experience. Lesson 1: Sometimes, people read the preface. In this case, it was Gerard Kempen, who was kind enough to interrogate me about my error while I was in the middle of hosting a major scientific conference. Gerard, if you're reading this: I promise not to kill anyone this time. Lesson 2: It stinks to screw up in a very public way. It's much better to screw up in private.

In the light of lesson 2, my editors and I have taken special care to ensure that the contents of this book are as accurate as possible at the time of printing. We have been assisted in this endeavor by a number of highly talented and thoughtful reviewers, to whom I am profoundly grateful. These reviewers include Chuck Clifton and several anonymous experts, all of whom are wise in the ways of language. Mark Seidenberg answered e-mails at all hours of the day and provided timely advice and guidance at critical junctures in the drafting process. Judy Kroll was also very generous with advice and pointers to useful information. It goes without saying that I am responsible for any errors or omissions that remain.

Before I started working on this book, I spent a long time teaching language and reflecting on disappointing teaching evaluations. Like many professors, and amateur mechanics everywhere, I blamed my tools. In particular, I blamed the textbooks that I was using. I decided that the only solution was to write my own book, and this is the result. I hope that the book presents language in a coherent way that is accessible to the average student. If it doesn't, I'm going to have to write another book.

Language scientists have discovered a lot of great things about the way the mind works. (We are the Kevin McHales of cognitive science. We score a quiet 20 points off the bench every game, but the flashy guys with the robots and the mirror neurons get all the headlines.) The field has developed strong momentum since I started observing it mumble mumble years ago, so this is an exciting time to be learning about language. I hope that the book conveys some of that excitement.

No book is the work of any one person. I am very grateful to my current and former editors at Wiley-Blackwell, especially Christine Cardone, who is a deep fountain of advice and encouragement. Anna Oxbury also deserves special mention for diligent copyediting and numerous suggestions of ways to improve the copy. Matt Bennett and Nicole Benevenia have also been wonderful.

I am also thankful to all the magnificent teachers and mentors that I have been fortunate to learn from over the years. Randy Fletcher gave me a great start doing research at the University of Minnesota. Morton Ann Gernsbacher showed me what it means to work (no one can match her—don't even try). Martin Pickering taught me how sentences work. Don Foss rescued me from being a fly-fishing guide in Colorado. Most days, that's a good thing. Thanks, Don.

I am also grateful to my students and colleagues at the University of California, Davis. Megan Zirnstein and Kristen Tooley deserve special mention for keeping me on my toes.

Finally, I am most deeply grateful for the continuing support of my whole family, but especially Rose and Tina. They put up with a lot of shenanigans.





# An Introduction to Language Science



*The rules aren't the ones we were taught in school.*

IVAN SAG

One of my favorite language scientists is Daniel L. Everett, a former evangelical Christian missionary who has spent more than 30 years living among and studying the *Pirahã* (pronounced “pee-da-HAN”), a group of about 300 hunter-gatherers, who live alongside a river in a largely unspoiled and remote part of the Amazon rain forest. Everett went there originally to learn the *Pirahã* language so that he could translate the Bible and spread the gospel to the *Pirahã*. To do so, he had to overcome the heat, tropical diseases, jaguars, hostile traders, gigantic anacondas,<sup>1</sup> biting insects, snakes that drop from the ceiling, electric eels, piranhas, caimans,<sup>2</sup> a tiny fish that tries to swim up any unguarded body cavity,<sup>3</sup> and much more. You can read about his adventures in the autobiographical book *Don't Sleep, There Are Snakes*. More importantly, for our purposes, you can read about what he discovered about the language that the *Pirahã* speak, and the ways that it differs from languages that citizens of industrialized nations are more familiar with. It turns out that Everett's research touches on some of the biggest, most general, and most difficult questions that language scientists have attempted to tackle. What does it mean to know a language? How do languages work? Where do they come from? What made languages take their current form(s)? How is language related to thought? Are thought and language identical? This chapter examines these questions, too, not because they have clear answers (most of them do not), but because taking a run at

Language Characteristics

Grammar, Language Origins, and Non-Human

Communication Systems

*Research on communication abilities in apes*

*“Monkeys don't talk”*

*Language origins*

Language and Thought

*Whorf, linguistic determinism, and linguistic relativity*

*Whorf makes a comeback*

A Description of the Language-Processing System

Summary and Conclusions

Test Yourself

*Introduction to Psycholinguistics: Understanding Language Science*, First Edition.  
Matthew J. Traxler.

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these questions can give us a deeper appreciation of what language is, how it got to be that way, and how our language abilities fit in with other cognitive (thinking) skills.

Part of Everett's research addresses one of the most fundamental questions in language science: What is language? What does it mean to know a language? This is the kind of *essentialist* question that *psycholinguists* (psychologists who study the mental and neural processes as well as the behaviors associated with language) tend to avoid whenever possible (Stanovich, 2009). However, the precise definition of language and a description of its component features greatly concerns researchers who want to know what mental abilities you need to use language, which of those abilities are used for language but not other kinds of cognitive tasks, and whether non-human animals share some or all of our ability to produce and understand language (Everett, 2005, 2007; Hauser, Chomsky, & Fitch, 2002; Jackendoff & Pinker, 2005; Pinker, 1994; Pinker & Bloom, 1990; Pinker & Jackendoff, 2005; Talmy, 2009).

## Language Characteristics

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Descriptions of language often appeal to Charles Hockett's (1960) design features. Let's focus on a subset of these features, because some of his proposed design features are not necessary for language (e.g., using the vocal channel for sending and receiving messages—sign language users do just fine without it), while others are not specific to language (e.g., cultural transmission—learning to make perogies or knit sweaters is also culturally transmitted). A set of central, possibly necessary, design features could include the following: *semanticity*, *arbitrariness*, *discreteness*, *displacement*, *duality of patterning*, and *generativity*. Let's consider each of these in turn.

*Semanticity* refers to the idea that language can communicate meaning, and that specific signals can be assigned specific meanings. This occurs at multiple levels in languages, as individual words can be assigned particular meanings, and so can longer expressions that contain more than one word.

*Arbitrariness* refers to the fact that there is no necessary relationship between actual objects or events in the world and the symbols that a language uses to represent those objects or events. For example, the word that goes with an object need not resemble the real object in any way. One result of arbitrariness is that names for objects can be completely different across languages (*koshka*, *gato*, *chat*, *neko*, and *mao* are all words for *cat*). The name could be changed as long as everyone agreed, and the name change would not affect the ability to express the concept in the language. Tomorrow, we English speakers could all start calling cats “lerps,” and as long as everyone agreed, this would work just fine. Sometimes, people point to *onomatopoeia* (words like “moo” and “oink”) in English as an example of a non-arbitrary relationship between sound and meaning. Sometimes people argue that the words for large objects have deep-sounding vowels made with the vocal cavity opened up to be big (*ocean*, *tower*), while words for small objects have high-sounding vowels with the vocal cavity closed down to be small (*pin*, *bitsy*). But *onomatopoeia* is not as systematic as people assume (the Dutch equivalent of “oink” is “knorr-knorr”), and there are plenty of counterexamples to the “big concept—big vowel” hypothesis (e.g., *infinity*).

*Discreteness* refers to the idea that components of the language are organized into a set of distinct categories, with clear-cut boundaries between different categories. For example, every speech sound in English is perceived as belonging to one of about 40 phoneme categories (e.g., a sound is either a /p/ or a /b/; it's either a /t/ or a /d/). For Pirahã speakers, every speech sound made by another Pirahã speaker will be recognized as one of 11 phonemes.<sup>4</sup> Think of how many different speakers a language has, how

different all of their voices are, how their speech can vary from occasion to occasion in how fast they talk, whether they speak clearly or not, and so on. Despite all of the vast differences between speakers, and differences within speakers over time, people who speak the same language will fit every sound made by every speaker into one of the available categories.

*Displacement* refers to a language's ability to convey information about events happening out of sight of the speaker (*spatial displacement*), about events that happened before the moment when the person speaks, and events that have not yet taken place as the person is speaking (*temporal displacement*). Different languages accomplish displacement in different ways. English has a system of auxiliary verbs (e.g., *will, was, were, had*) and affixes (e.g., *pre-* in *predates*; *-ed* in *dated*) to signal when an event occurred relative to the moment of speaking or relative to other events. Other languages, such as Mandarin, lack these kinds of *tense markers*, but use other means, such as adverbial expressions, to achieve the same means (so you would say the equivalent of, “Yesterday, the man goes” rather than “The man went”). Displacement is a ubiquitous feature of human languages, although the degree and scope of displacement may be more limited in some languages than others (Everett, 2008), but it is largely or completely absent in animal communication systems. Primates may call to one another to signal the presence of predators or food, as will bees, but these behaviors have more the flavor of a reflex, rather than being the result of a controlled, intentional desire to convey information (Tomasello, 2007).

*Duality of patterning* refers to the fact that we simultaneously perceive language stimuli in different ways; for example, as a collection of phonemes and as a set of words. The word *wasp* consists of four basic speech sounds or *phonemes* – /w/, /o/, /s/, and /p/. Normally, we “see through” the phonemes and the individual word-sounds to the meaning that a speaker is trying to convey, but each of these kinds of patterns, speech sounds (phonemes) and words, can be detected if we decide to pay attention to the form of the speaker's message, rather than its meaning.

Finally, *generativity* refers to the fact that languages have a fixed number of symbols, but a very large and potentially infinite number of messages that can be created by combining those symbols in different patterns. English has about 40 phonemes, but those 40 phonemes can be combined in an infinite number of ways. Similarly, the average high school graduate knows the meanings of about 50,000 different words, but can combine those words in new patterns to produce an unlimited number of meanings.

Language scientists agree that all of the preceding characterize human languages, but they do not all agree on other aspects of language. Many of these disagreements revolve around a component of language called *grammar* (or *syntax* by some theorists). At a very basic level, languages provide us the means to associate sounds with meanings (Hauser et al., 2002). Other animals are also able to associate arbitrary sounds with objects in the environment, similar to the way people associate sounds and meanings. Vervet monkeys make one kind of call when they see an airborne predator, and a different kind of call when they see a predator on the ground; and they respond in the appropriate way depending on which call they hear. If it's an eagle call, they dive into the bushes. If it's a leopard call, they head up into the trees. Vervets lack the capacity to combine sets of calls into longer messages (but see below for evidence that some apes have this ability). If vervets had a system of rules that enabled them to combine calls into more complex messages (e.g., “look at the size of that leopard!”), we would say that they have a *grammar*.

*Grammar* is one of the two chief components of a language. The other is the *lexicon*, the part of long-term memory that stores information about words (Sag, Wasow, & Bender, 2003). Languages need both of these components so that speakers can formulate messages that express *propositions* (statements of who did what to whom, roughly). To create such messages, a speaker searches for symbols in the lexicon that match the concepts that she

wishes to convey. The grammar tells her how to combine the symbols to create the appropriate signals (speech sounds) that will transmit her message to a listener.

Before we go any further, we need to get straight a common misunderstanding of the word *grammar*. When people hear “grammar,” they often think of “grammar school” or the system of rules that your 8th grade English teacher tried to get you to memorize so that you could speak and write standard English. Like me, you probably failed to internalize many of your 8th grade English teacher’s lessons. This is partly because 8th grade English is unbearably boring and partly because the principles that your 8th grade teacher was trying to foist on you are completely arbitrary and artificial. For example, Mrs Heidemann tried to get me to believe that you cannot end a sentence with a preposition.<sup>5</sup> But then, there’s this kid whose dad always reads him the same story at bedtime. One night, when dad turned up with the same old horrible book, the kid said, *Hey, Dad! What did you bring that book that I didn’t want to be read to out of up for?* Five prepositions at the end, perfectly interpretable.<sup>6</sup> Mrs Heidemann was trying to teach me *prescriptive grammar*. Prescriptive grammars are collections of artificial rules. If you follow the grammar teacher’s prescription (like you follow a doctor’s prescription), your language will sound like that used by members of the upper class in England’s home counties.

The vast majority of language scientists are not interested in prescriptive grammar. The kind of grammar we are interested in is *descriptive grammar*, which is the set of rules or principles that governs the way people use language “in the wild.” That is, how people naturally and normally think and behave. Here is an example of a *descriptive* rule of grammar: “Each clause can only have one main verb.” You already know this rule, even though nobody, not even Mrs Heidemann, ever tried to teach it to you. As a result, you would never say, *Mrs Heidemann brewed drank the coffee*. Similarly, English descriptive grammar says, “Put verbs in the middle, not at the beginning of sentences.” Again, you already know this rule, because you never say things like *Drank the coffee Mrs Heidemann*. So when this book talks about grammar, remember that it is talking about *descriptive* grammar (the natural kind) not *prescriptive* grammar, the Mrs Heidemann kind. Language scientists who study grammar greatly prefer studying descriptive grammar because most of us are interested in the human mind and, as Ivan Sag and colleagues noted (2003, p. 42), “A theory of grammar is a theory about the mental representation of linguistic knowledge.”

Descriptive grammars explain why language takes the form that it does. Steven Pinker and Ray Jackendoff (2005) suggest that grammars regulate the combination of symbols into messages in three crucial ways. First, the grammar determines the order that symbols appear in expressions. In English, adjectives come before nouns (*red wine*). In French, the adjectives mostly come after the nouns (*vin rouge*), with a few exceptions (e.g., *grand dame*, “great woman”). Second, the grammar dictates different kinds of *agreement*. Agreement means that certain words in a sentence must appear in a specific form because of the presence of another word in the sentence. In English, we have number agreement (*girls like* but not *girls likes* or *girl like*, as in *Girls like books* but not *Girls likes books*). Other languages have other kinds of agreement, such as Spanish *gender* agreement (*el toro* not *la toro*). Finally, the grammar determines *case marking*, where words must appear in particular forms depending on what grammatical functions they fulfill. English has lost most of its case marking, but it still has some in its system of pronouns (*He left* not *Him left*; *I like him* but not *I like he*). Russian has tons of case marking, as nouns and other words appear in different forms depending on what role they play in the sentence (e.g., *vodka* changes to *vodku* as the noun moves from subject to object; *Водка здесь Vodka zdes’* “Here is the vodka,” but not *Водкx здесь Vodku zdes’*; *Я пил водку Ya pil vodku* “I drank vodka,” but not *Я пил водкa Ya pil vodka*).

To figure out what rules of grammar people actually carry around in their heads with them, linguists spend a great deal of time and effort observing people speaking spontaneously and recording the details of how they combine words into longer expressions. They then

take these records and try to determine why words appear in specific parts of phrases and sentences, and why they appear in particular forms. This type of analysis allows them to deduce the rules behind the patterns that appear in transcripts of speech. When this type of analysis is done on English, it leads to a number of conclusions about English grammar. For example, English is a *subject-verb-object* language. In declarative statements, the grammatical *subject* of the sentence, which is normally the focus of attention or the topic of the discourse, appears at the beginning of the sentence. The verb appears in the middle. The grammatical *object*, which normally is the thing that is acted upon, comes last. Other languages order these elements in different ways. Japanese, for example, puts its verbs at the end. Languages like Russian have free word order and make much greater use than English of different versions of nouns to express who is initiating the action and who is being acted upon. To figure out which system a language has, you actually have to go out and watch people use the language. Sometimes, doing that produces big surprises.

Based on observations of English and other languages, Chomsky and his colleagues have proposed that *recursion* is a core property of the grammars of all languages (Fitch, Hauser, & Chomsky, 2005; Hauser et al., 2002). Further, based on a detailed analysis of human language and animal communication systems, they proposed that recursion is the *only* property that is specific to human language. “The narrow language faculty includes recursion and this is the only uniquely human component of the faculty of language” (Hauser et al., 2002, p. 1569). Chomsky’s team proposes that all other properties of language are either shared with non-language thought processes or with non-human communication systems. What are they talking about and why does it matter? *Recursion* is defined as “the ability to place one component inside another component of the same type.” So, where language is concerned, recursion could happen if you could place one phrase inside another phrase of the same type or one sentence inside another sentence.<sup>7</sup>

English allows us to place one sentence inside another sentence. Here’s a sentence:

Tom likes beans.

We can place that sentence inside another sentence:

Susan thinks (X) (where X is a sentence)

The result would be:

Susan thinks Tom likes beans.

The degree to which this sort of recursion can go on is essentially infinite, and is limited only by the speaker’s ability and willingness to continue:

John knows Dave believes Jenny hopes Carol recognizes Bob realizes ... Susan thinks Tom likes beans.

Thus, recursion is one of the characteristics that gives language the property of *discrete infinity*, the ability to generate infinite messages (even infinitely long messages) from finite means.

Most of the languages that have been studied do have recursion, but there does appear to be at least one exception: Pirahã (Everett, 2005, 2008). In English, recursion is often used to create expressions that modify or change the meaning of one of the elements of the sentence. For example, to take the word *nails* and give it a more specific meaning, we could use an *object relative clause* such as *that Dan bought*, as in

Hand me the nails that Dan bought.

In this sentence, the relative clause *that Dan bought* (which could be glossed as “Dan bought the nails”) is contained within a larger noun phrase: *the nails (that Dan bought (the nails))*. So the relative clause is nested within a larger phrase, kind of like a stack of bowls. Pirahã expresses the same meaning in a much different form, one that does not involve recursion. To express the meaning that goes with “Hand me the nails that Dan bought,” a Pirahã speaker would say the equivalent of:

Give me the nails. Dan bought those very nails. They are the same. (Everett, 2008, p. 227).

In this case, none of the expressions are contained within other expressions of the same type. Pirahã even appears to lack a very simple form of recursion that happens when you use a *coordinate structure* to put two noun phrases together, as in *Dan and Ted went to Brazil* (E. Gibson, personal communication). In *Dan and Ted*, you have an overarching noun phrase (of the form *NP and NP*) that contains two separate noun phrases (*Dan, Ted*). To express a meaning like this, a Pirahã speaker would say the equivalent of, “Dan went to Brazil. Ted went to Brazil.” Instead of having a stack of bowls, Pirahã has the linguistic equivalent of a string of pearls. All of the statements are connected to each other in an important way, but none of them is contained within any of the others. If recursion does not occur in Pirahã language, which is still definitely a language on a par with other languages in its ability to convey meaning, then recursion is not a necessary characteristic of human languages, despite the fact that most of them have it anyway.

Why does Pirahã lack recursion? Everett’s (2008) answer is that Pirahã lacks recursion because recursion introduces statements into a language that do not make direct assertions about the world. When you say, *Give me the nails that Dan bought*, that statement *presupposes* that it is true that Dan bought the nails, but it does not say so outright. In Pirahã, each of the individual sentences is a direct statement or assertion about the world. “Give me the nails” is a command equivalent to “I want the nails” (an assertion about the speaker’s mental state). “Dan bought the nails” is a direct assertion of fact, again expressing the speaker’s mental state (“I know Dan bought those nails”). “They are the same” is a further statement of fact. Everett describes the Pirahã as being a very literal-minded people. They have no creation myths. They do not tell fictional stories. They do not believe assertions made by others about past events unless the speaker has direct knowledge of the events, or knows someone who does. As a result, they are very resistant to conversion to Christianity, or any other faith that requires belief in things unseen. Everett argues that these cultural principles determine the form of Pirahã grammar. Specifically, because the Pirahã place great store in first-hand knowledge, sentences in the language must be assertions. Nested statements, like relative clauses, require presuppositions (rather than assertions) and are therefore ruled out. If Everett is right about this, then Pirahã grammar is shaped by Pirahã culture. The form their language takes is shaped by their cultural values and the way they relate to one another socially. If this is so, then Everett’s study of Pirahã grammar would overturn much of the received wisdom on where grammars come from and why they take the form they do. Which leads us to ...

## Grammar, Language Origins, and Non-Human Communication Systems

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Many language scientists are concerned with the precise definition of language and with detailed descriptions of the grammars of different languages because having those two things nailed down can help us understand how humans think and how we compare with