The Handbook of Linguistics
This outstanding multi-volume series covers all the major subdisciplines within linguistics today and, when complete, will offer a comprehensive survey of linguistics as a whole.
## Contents

List of Contributors ix  
Preface to the Second Edition xi  
Preface to the First Edition xiii  
List of Abbreviations xvii

### PART I  Starting Points  1

1. Origins of Language  
   **Andrew Carstairs-McCarthy**  3
2. Languages of the World  
   **Bernard Comrie**  21
3. Typology and Universals  
   **William Croft**  39
4. Field Linguistics: Gathering Language Data from Native Speakers  
   **Pamela Munro**  57
5. Writing Systems  
   **Peter T. Daniels**  75

### PART II  Theoretical Bases  95

6. The History of Linguistics: Approaches to Linguistics  
   **Lyle Campbell**  97
   **Thomas Wasow**  119
8. Functional Linguistics: Communicative Functions and Language Structure  
   **Robert D. Van Valin, Jr.**  141

### PART III  Core Fields  159

9. Linguistic Phonetics: The Sounds of Languages  
   **John Laver**  161
30. Linguistics and Reading
   Rebecca Treiman 617
31. Language and Law
   Roger W. Shuy 627
32. Translation
   Christoph Gutknecht 645
33. Language Planning and Policy
   Kathryn D. Stemper and Kendall A. King 655

Index 675
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<th>Institution</th>
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The second edition of The Handbook of Linguistics has been designed to offer an overview of the field of linguistics in the second decade of the twenty-first century. It has now been over two decades since we began work on the first edition of The Handbook of Linguistics, and although our general goals and topics remain much the same as in the first edition, the second edition has been updated to reflect new developments in linguistics since the dawning of the second millennium. New to this edition are chapters devoted to topics not covered in detail in the first edition: psycholinguistics, linguistic anthropology and ethnolinguistics, and second language pedagogy. Other topics that were covered in the first edition have completely new chapters. Specifically, the single chapter devoted to sociolinguistics in the first edition has now been replaced with two new chapters in the second edition, one on sociolinguistic theory and the second on language variation. The topic of language planning has a completely new chapter. Of the remaining chapters, most have been thoroughly revised and updated to incorporate new developments in the field and to refresh any ephemeral examples or references. In a few cases, chapters that have stood the test of time have remained unrevised from the first edition. These are the chapters on languages of the world, history of linguistics, phonetics, the lexicon, and formal semantics.

As in the first edition, the purpose of the Handbook is to provide an introduction to the various subfields of linguistics for the educated reader who does not necessarily have a background in linguistics. It is also a useful resource for linguists who may need to teach or to reference subfields outside their specific specializations. In each chapter, we seek to present a broad introduction to the central questions of the subfield and to illustrate how linguists go about answering these questions. Generalizations are supported with enough detail to provide depth, but we have tried to eschew the kind of minutia that would not be meaningful to the general reader or would not stand the test of time.

The order of topics remains much the same as in the first edition. We begin with the starting points for the study of linguistics: the origins of language, the raw material of language study (languages of the world, their typology and universal characteristics, and writing systems), and how language data is gathered from native speakers (field linguistics). The second section of the book considers theoretical bases, beginning with various approaches to the scientific study of language in the history of linguistics. Two chapters are given over to current theoretical perspectives: generative grammar and functional linguistics. We then proceed to the core fields of linguistics, those formal, structural aspects of language that would be covered in almost any general introductory course in linguistics: phonetics, phonology, morphology, the lexicon, syntax,
semantics, and historical linguistics. Chapters in the next section – on neurolinguistics, psycholinguistics, natural sign languages, and first language acquisition – all help to illuminate the relationship between language and the human mind. Our section on language use goes beyond the structural aspects of language to consider how language is used to communicate meaning within various social contexts, in the subfields of pragmatics, discourse analysis, linguistics and literature, linguistic anthropology, and sociolinguistic theory and language variation. The theme of languages in contact is addressed in chapters on multilingualism and second language acquisition. The book ends with chapters concerned with applications of linguistics: second language pedagogy, educational linguistics, linguistics and reading, forensic linguistics, translation, and language planning.

One of the strengths of the first edition of the Handbook was that the contributors were internationally recognized scholars in their fields. The same holds true for the second edition: the majority of the authors are senior scholars who contributed to the first edition, while some new chapters have been authored by younger scholars who have emerged as leaders in the field more recently. Our journey to the second edition has not been without detours and bumps in the road, and we are grateful to our contributors and our editors at Wiley Blackwell for their patience and forbearance. We owe a special debt to Agnes He, without whose encouragement, advice, and support this second edition would never have seen the light of day.

Mark Aronoff
Janie Rees-Miller
Preface to the First Edition

For over a century, linguists have been trying to explain linguistics to other people whom they believe should be interested in their subject matter. After all, everyone speaks at least one language and most people have fairly strong views about their own language. The most distinguished scholars in every generation have written general books about language and linguistics targeted at educated laypeople and at scholars in adjacent disciplines, and some of these books have become classics, at least among linguists. The first great American linguist, William Dwight Whitney, published *The Life and Growth of Language: An Outline of Linguistic Science*, in 1875. In the dozen years between 1921 and 1933, the three best known English-speaking linguists in the world (Edward Sapir in 1921, Otto Jespersen in 1922, and Leonard Bloomfield in 1933) all wrote books under the title *Language*. All these books were very successful and continued to be reprinted for many years. In our own time, Noam Chomsky, certainly the most famous of theoretical linguists, has tried to make his ideas on language more accessible in such less technical books as *Language and Mind* (1968) and *Reflections on Language* (1975). And more recently, Steven Pinker’s *The Language Instinct* (1995) stayed on the best-seller list for many months.

Despite these efforts, linguistics has not made many inroads into educated public discourse. Although linguists in the last hundred years have uncovered a great deal about human language and how it is acquired and used, the advances and discoveries are still mostly unknown outside a small group of practitioners. Many reasons have been given for this gap between academic and public thinking about language, the most commonly cited being: that people have strong and sometimes erroneous views about language and have little interest in being disabused of their false beliefs; or that people are too close to language to be able to see that it has interesting and complex properties. Whatever the reason, the gap remains and is getting larger the more we learn about language.

*The Handbook of Linguistics* is a general introductory volume designed to address this gap in knowledge about language. Presupposing no prior knowledge of linguistics, it is intended for people who would like to know what linguistics and its subdisciplines are about. The book was designed to be as nontechnical as possible, while at the same time serving as a repository for what is known about language as we enter the twenty-first century.

If *The Handbook of Linguistics* is to be regarded as authoritative, this will be in large part because of the identity of the authors of the chapters. We have recruited globally recognized leading figures to write each of the chapters. While the culture of academia is such that academic authors find it tremendously difficult to write anything for anyone other than their colleagues,
our central editorial goal has been to avoid this pitfall. Our emphasis on the reader's perspective sets *The Handbook of Linguistics* apart from other similar projects.

The place of the field of linguistics in academia has been debated since its inception. When we look at universities, we may find a linguistics department in either the social sciences or the humanities. When we look at the American government agencies that fund university research, we find that the National Endowment for the Humanities, the National Science Foundation, and the National Institutes of Health all routinely award grants for research in linguistics. So where does linguistics belong? The answer is not in where linguistics is placed administratively, but rather in how linguists think. Here the answer is quite clear: linguists by and large view themselves as scientists and they view their field as a science, the scientific study of language. This has been true since the nineteenth century, when Max Mueller could entitle a book published in 1869 *The Science of Language* and the first chapter of that book “The science of language: one of the physical sciences.”

The fact that linguistics is today defined as the scientific study of language carries with it the implicit claim that a science of language is possible, and this alone takes many by surprise. For surely, they say, language, like all human activity, is beyond the scope of true science. Linguists believe that their field is a science because they share the goals of scientific inquiry, which is objective (or more properly intersubjectively accessible) understanding. Once we accept that general view of science as a kind of inquiry, then it should be possible to have a science of anything, so long as it is possible to achieve intersubjectively accessible understanding of that thing. There are, of course, those who deny the possibility of such scientific understanding of anything, but we will not broach that topic here.

We now know that the possibility of scientific understanding depends largely on the complexity and regularity of the object of study. Physics has been so successful because the physical world is, relatively speaking, highly regular and not terribly complex. Human sciences, by contrast, have been much less successful and much slower to produce results, largely because human behavior is so complex and not nearly so regular as is the physical or even the biological world. Language, though, contrasts with other aspects of human behavior precisely in its regularity, what has been called its rule-governed nature. It is precisely this property of language and language-related behavior that has allowed for fairly great progress in our understanding of this delimited area of human behavior. Furthermore, the fact that language is the defining property of humans, that it is shared across all human communities and is manifested in no other species, means that by learning about language we will inevitably also learn about human nature.

Each chapter in this book is designed to describe to the general reader the state of our knowledge at the beginning of the twenty-first century of one aspect of human language. The authors of each chapter have devoted most of their adult lives to the study of this one aspect of language. Together, we believe, these chapters provide a broad yet detailed picture of what is known about language as we move into the new millennium. The chapters are each meant to be freestanding. A reader who is interested in how children acquire language, for example, should be able to turn to Chapter 19 and read it profitably without having to turn first to other chapters for assistance. But the physical nature of a book entails that there be an order of presentation. We begin with general overview chapters that consider the origins of language as species-specific behavior and describe the raw material with which linguists work (languages of the world and writing systems), frame the discipline within its historical context, and look at how linguists acquire new data from previously undescribed languages (field linguistics). The book then turns to the traditional subdisciplines of linguistics. Here we have followed most linguistics books in starting from the bottom, grounding language first in the physical world of sound (phonetics) and moving up through the organization of sound in language (phonology), to the combination of sounds into words (morphology), and the combination of words into sentences (syntax). Meaning (semantics) usually comes next, on the grounds that it operates on words and sentences. These areas are traditionally said to form the core of linguistics, because they deal with the most
formally structured aspects of language. Within the last few decades, however, linguists have come to realize that we cannot understand the most formally structured aspects of language without also understanding the way language is used to convey information (pragmatics) in conversation (discourse) and in literature, and the way language interacts with other aspects of society (sociolinguistics).

Fifty years ago, many of our chapters would have been absent from a book of this sort for the simple but dramatic reason that these fields of inquiry did not exist: language acquisition, multilingualism, sign language, neurolinguistics, computational linguistics, and all of the areas of applied linguistics to which we have devoted separate chapters (the one area of applied linguistics that did exist fifty years ago was language teaching).

The chapters are of a uniform length, approximately 10,000 words each, or about 25 printed pages. This length is substantial enough for a major essay, while being short enough so as not to overwhelm the reader. Applied linguistics is divided into several distinct areas that would be of interest to students and others who want to know what practical applications linguistics has. Because each of the applied linguistics chapters covers a more specialized area, these chapters are somewhat shorter than the rest (approximately 4,000 words each, or about 10 printed pages).

We have tried not to emphasize ideology, but rather to divide things up by empirical criteria having to do with the sorts of phenomena that a given field of inquiry covers. We have thought long and hard about whether some of the major areas, especially syntax and phonology, should be broken down further, with a chapter each on distinct theoretical approaches. Our final decision was not to subdivide by theoretical approaches, based on a belief that the reader’s perspective is paramount in books like this: readers of a companion do not want to know what the latest controversy is about or who disagrees with whom or who said what when. Rather, they want to have a reasonable idea of what linguistics or some subarea of linguistics can tell them. The authors have been able to do so without going into the latest controversies, though these controversies may occupy the linguists’ everyday lives. The one area to which we have devoted more than one chapter is syntax, but this reflects the dominance of syntactic research in linguistics over the last half century.

We do not see this handbook as an introductory textbook, which would, for example, have questions or exercises at the end of each chapter. There are already enough introductory linguistics texts. We see it rather as an authoritative volume on what linguists know about language at the start of the twenty-first century. Each chapter covers the central questions and goals of a particular subdiscipline, what is generally accepted as known in that area, and how it relates to other areas.

When we embarked on this editorial enterprise, we expected to enjoy the interaction with many of our most distinguished colleagues that the preparation of this book would entail, which is so much easier now in the age of electronic correspondence. What we did not realize was how much we would learn from these colleagues about language and linguistics, simply from reading their work and discussing it with them. We thank all of the authors for this wonderful opportunity and we hope that the readers, too, will share in the same great pleasure.

Mark Aronoff
Janie Rees-Miller
### List of Abbreviations

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Part I  Starting Points
1 Origins of Language

ANDREW CARSTAIRS-McCARTHY

1 Introduction

Among the inhabitants of some African forests about eight million years ago were ape-like creatures including the common ancestors of chimpanzees and humans. Visualizing these creatures is easy enough; one imagines something resembling a modern gorilla, living substantially in trees and walking on all four limbs when on the ground, and with a vocal communication system limited to perhaps 20 or thirty 30 calls, like a chimpanzee’s. But what about our ancestors two million years ago? By that stage they were a separate species from the ancestors of chimpanzees, but were not yet *Homo sapiens*. How did these creatures live, and in particular what sort of language did they have? Visualizing these more recent ancestors is harder. One feels that they must have been more like us, and in particular that their vocal communication system must have been more sophisticated than that of their ancestors six million years before. But how much more sophisticated? Which characteristics of modern human language did this communication system now possess, and which did it still lack?

There is something eerie and yet fascinating about these intermediate ancestors. This fascination underlies innumerable science fiction stories as well as the perennial interest in rumors that such creatures may still exist, in some remote Himalayan valley perhaps, or as descendants of the tiny *nonsapiens* humans who may have lived as recently as 15,000 years ago on the island of Flores in Indonesia (Knight 2005; http://en.wikipedia.org/wiki/Homo_floresiensis). To many nonlinguists, therefore, it seems self-evident that research on the linguistic abilities of such intermediate ancestors (that is, research on the origins and evolution of human language) should be a high priority in linguistics. Yet it is not. As a research topic, language evolution is only now beginning to regain respectability, after more than a century of neglect. In the remainder of this section I will say something about the reasons for this neglect before turning in Sections 2 to 5 to the evidence recently brought to bear by anthropologists, geneticists, primatologists, and neurobiologists, who have for decades been more adventurous than linguists in this area. Then in Section 6 I will discuss the kinds of contribution which some linguists also are now beginning to offer.

Many religions provide an account of the origin of language. According to the Judeo-Christian tradition, God gave to Adam in the Garden of Eden dominion over all the animals, and Adam’s first exercise of this dominion consisted in naming them. The fact that there are now many languages rather than just one is explained in the story of the Tower of Babel: linguistic diversity is a punishment for human arrogance. So long as that sort of account was generally accepted, the origin of language was not a puzzle. But when secular explanations for natural phenomena
began to be sought to supplement or replace religious ones, it was inevitable that a secular expla-
nation would be sought for the origin of language too.

The fact that the origin of language must predate recorded history did not inhibit eight-
teenth-century thinkers such as Rousseau, Condillac, and Herder, who were confident that simply
by applying one’s mind to the situation in which languageless humans would find themselves
one could arrive at worthwhile conclusions about how language must have arisen. Unfortunately
there was no consensus among these conclusions, and in the nineteenth century they came to
seem increasingly feeble and speculative by contrast with the far-reaching yet convincing results
attainable in historical and comparative linguistics (see Chapter 15). At its foundation in 1866,
therefore, the Linguistic Society of Paris banned the presentation of any papers concerning the
origin of language. Many linguists still support this ban, in the sense that they believe that any
inquiry into the origin of language must inevitably be so speculative as to be worthless.

Since the 1960s, the theory of grammar has come to be dominated by the ideas of Noam
Chomsky. For Chomsky, the central question of linguistics is the nature of the innate biological
endowment which enables humans to acquire a language so rapidly and efficiently in the first
years of life (see Chapter 19). From this viewpoint, it seems natural to regard the origin of lan-
guage as a matter of evolutionary biology: how did this innate linguistic endowment evolve in
humans, and what are its counterparts (if any) in other primates? But Chomsky for a long time
discouraged interest in language evolution, and even suggested that language is so different
from most other animal characteristics that it may be more a product of physical or chemical
processes than of biological ones (1988: 167, 1991: 50). The paradoxical result is that, while Chom-
skyan linguists endeavored to explain characteristics of individual languages by reference to an
innate linguistic endowment (or Universal Grammar), they were generally reluctant to pursue
this inquiry one stage further, to the issue of how and why this innate endowment has acquired
the particular characteristics that it has. Exceptions (e.g., Newmeyer 1991; Pinker and Bloom 1990;
Pinker 1994) were relatively sparse.

In 2002, this situation changed dramatically with the publication of an article jointly written
by Chomsky and the animal behavior experts Marc Hauser and Tecumseh Fitch (Hauser, Chomsky,
and Fitch 2002). Since then, linguists associated with Chomsky have been willing to discuss lan-
guage evolution in the context of a general “biolinguistic” exploration of biological bases for the
language capacity (see e.g., Jenkins 2004). Their approach is, however, highly controversial (see
e.g., Pinker and Jackendoff 2005).

2 Evidence from Anthropology and Archeology

Anthropology is concerned not only with human culture but also with humans as organisms in a
biological sense, including their evolutionary development. (On human evolution in general, see,
e.g., Stringer and Andrews (2005).) Language is both a cultural phenomenon and also the most
salient distinguishing characteristic of modern Homo sapiens as a species. The question of how
and why humans acquired language therefore interests both cultural and biological anthropolo-
gists. So what light can anthropology shed on these questions?

The earliest direct evidence of written language is no more than about 5,000 years old (see
Chapter 5). It is therefore much too recent to shed any light on the origin of spoken language,
and we must resort to indirect evidence. Unfortunately the available evidence is doubly indirect.
The vocal apparatus (tongue, lips, and larynx) of early humans would tell us much if we could
examine it directly; but, being soft tissue, it does not survive, and for information about it we
have to rely on what we can glean from bones, particularly skulls. Alongside such evidence we
have tools and other artefacts, as well as traces of human habitation such as discarded animal
bones; but, again, what is available to us is skewed by the fact that stone survives better than
bone and much better than materials such as wood or hide. In view of this, the only relatively
Origins of Language

firm dates which anthropology can provide are two terminuses, one after which we can be sure that language in its fully modern form did exist and one before which we can be sure that it did not. For the long period in between, the anthropological evidence is tantalizing but frustratingly equivocal; there are no uncontroversial counterparts in the fossil record for specific stages in linguistic evolution.

We can be reasonably confident that modern-style spoken language evolved only once. This is not logically necessary. It is conceivable that something with the communicative and cognitive functions of language, and using speech as its medium, could have evolved independently more than once, just as the eye has evolved independently more than once in the animal kingdom. However, if that had happened we would expect to find evidence of it today. We would expect to find two or more different kinds of language, differing in structure in such a way that people biologically disposed to learn one kind would never be able to acquire another kind natively. These would be differences as fundamental as those between the eyes of octopuses, mammals, and insects. Yet no such evidence exists. For all their diversity, all existing languages display certain fundamental common properties of grammar, meaning, and sound. For this reason Chomsky feel justified in claiming that, to a visitor from another planet, it might seem that there really is only one human language. Moreover, a child who is removed from her parents’ speech community at a young age can acquire natively any language whatsoever, irrespective of what her parents speak. There is no evidence that any child is born with a biological bias in favor of one language or type of language. This means that language of a fully modern kind must have evolved before any contemporary human group became geographically separated from the rest of the human race (separated, that is, until the invention of modern means of transport). The first such cleargcut separation seems to have occurred with the earliest settlement of Australia by Homo sapiens. Archeological evidence suggests that that event took place at least 40,000 years and perhaps as long as 60,000 or more years ago. We can therefore take this as a firm terminus ante quem for the evolution of a form of language which is fully modern in a biological sense.

As for a terminus post quem, it is clear that spoken language with more or less modern articulatory and acoustic characteristics presupposes something like a modern vocal tract. But how are we to interpret “more or less” and “something like”? One thing is clear: the acoustic properties of many human speech sounds, particularly vowels, depend on the characteristically human L-shaped vocal tract, with an oral cavity at right angles to the pharynx (see Chapter 9) and with the larynx relatively low in the neck. This shape is characteristically human because in nearly all other mammals, and even in human babies during the first few months of life, the larynx is high enough for the epiglottis to engage with the soft palate so as to form a self-contained airway from the nose to the lungs, smoothly curved rather than L-shaped, and quite separate from the tube which leads from the mouth to the stomach. Having these two distinct tubes enables nearly all other mammals, as well as newborn human babies, to breathe while swallowing. The adult human pharynx, on the other hand, through which both air and food must pass, contributes importantly to the acoustic characteristics of speech sounds. So when did this L-shaped vocal tract develop? Lieberman (1984; cf. Lieberman and Crelin 1971) has claimed that even in Neanderthals, who did not become extinct until about 35,000 years ago, the larynx was positioned so high in the neck as to prevent the production of the full modern range of vowel sounds. He suggests that this linguistic disadvantage may have been a factor in the Neanderthals’ demise. But his argument rests on an interpretation of fossil cranial anatomy which has generally been rejected by anthropologists (Trinkaus and Shipman 1993; Aiello and Dean 1990). An alternative view is that the L-shaped vocal tract is a byproduct of bipedalism, which favored a reorientation of the head in relation to the spine and hence a shortening of the base of the skull, so that the larynx had to be squeezed downward into the neck (DuBrul 1958; Aiello 1996b). The question then arises: when did our ancestors become bipedal? The general consensus among anthropologists is: very early. Evidence includes fossil footprints at Laetoli in Tanzania, from about 3.5 million years ago, and the skeleton of Australopithecus afarensis nicknamed “Lucy,” dating from over three million years
ago. So, if bipedalism was an important factor contributing to the lowering of the larynx, the L-shaped vocal tract probably emerged relatively early too.

This conflicts with an opinion widespread among language origin researchers, namely that the lowering of the larynx (with its concomitant increased risk of choking) was a consequence of the evolution of more sophisticated language, not a precursor of it. This “brain-first” view was inevitably popular so long as Piltdown Man, with its human-like skull and ape-like jaw, was believed to be genuine. More recent evidence, showing how small australopithecine and early human skulls were, seems to count against the “brain-first” view. On the other hand, in yet more recent work, Fitch (2002) and others have shown that the lowered larynx is not so unusual among nonhuman mammals as was once thought. This in turn suggests that, whatever the reasons are why language is uniquely human, the vocal apparatus may not after all be centrally important.

Mention of skulls raises the possibility of drawing conclusions about language from hominid brains. (I use the term “hominid” to mean “(belonging to) a creature of the genus *Australopithecus* or the genus *Homo*.”) Brain size tells us nothing specific. But what of brain structure? If it could be shown that an area of the modern human brain uniquely associated with language was present in the brains of hominids at a particular date, it would seem reasonable to conclude that those hominids possessed language. But this line of reasoning encounters three problems. Firstly, since brains themselves do not fossilize, determining their structure depends on the interpretation of ridges and grooves on the inside of skulls, or rather of their counterparts on “endocasts” made from skulls. The region generally regarded as most closely associated with grammar and with speech articulation in modern humans is Broca’s area; but identifying an area corresponding to Broca’s area in hominid fossils has turned out to be highly controversial (Falk 1992). Secondly, no area of the human brain, even Broca’s area, seems to be associated with language and nothing else. Thirdly, Broca’s area seems to have little or nothing to do with vocalization in monkeys, so even if it can be established that a counterpart of Broca’s area exists in a certain hominid, its function in that hominid may not be linguistic. We will discuss Broca’s area again in Section 5. For the time being, though, the details of “brain-language coevolution,” as Deacon (1997) calls it, remain frustratingly indeterminate.

Some scholars have connected language with the evolution of “handedness,” which is much more strongly developed in humans than in other animals (Bradshaw and Rogers 1992; Corballis 2002). In most people the right hand is the dominant hand, controlled from the left side of the brain where the language areas are usually located. It is tempting to see this shared location as more than mere coincidence. If so, linguistic conclusions might perhaps be drawn from ingenious tests that have been carried out on fossil stone tools, to determine whether the people who made them were or were not predominantly right-handed. However, the correlation between language and handedness is far from strong: left-handedness neither entails nor is entailed by right-brain dominance for language. Also, even if evidence of a strong preponderance of right-handers in some group of hominids is taken as firm evidence of linguistic capacity, it furnishes no details about the nature of that linguistic capacity.

Let us turn from biology to culture. Common sense would suggest that a relatively sudden jump in the complexity of human linguistic behavior, if it occurred, should leave immediate traces in the archeological record in the shape of a sudden jump in the complexity of preserved artefacts (tools, ornaments, and artwork). So does any such jump in complexity occur, and if so, when? There is indeed a big increase in the variety and quality of tools found in Europe and Africa around 40,000 years ago, followed by the famous cave paintings of Lascaux and elsewhere from about 30,000 years ago. But this is inconveniently late as a date for the emergence of fully modern language, in that it is contemporary with or even more recent than the latest plausible date for the settlement of Australia. That has not discouraged some scholars from using this kind of evidence to argue that language evolved “late”; but on examination it generally turns out that what these scholars mean by “language” is not what linguists mean by it, but rather the self-conscious use of symbols (Noble and Davidson 1996). Moreover, there is scattered but intriguing
evidence of “cultural” behavior thousands of years earlier, such as burial pits, incised bones, and the use of red ocher pigment for body decoration. The linguistic implications of this for language are unclear, but it may be significant that some of the dates involved are not far removed from a milestone indicated by genetic evidence, to which we now turn.

3 Genetic Evidence

Within the last three decades, molecular genetics has opened up entirely new techniques for assessing the relationship of humans to each other and to other primates. (Genetic evidence tells us that we are separated by only about five million years from the ancestor which we share with the chimpanzees.) Since the 1950s it has been known that the information which differentiates an individual genetically from all other individuals (except a possible identical twin) is carried by DNA (deoxyribonucleic acid) in chromosomes located in every cell in the body. Geneticists can now compare individuals and groups in terms of how much of their DNA is shared. Moreover, they can do this not only with respect to the DNA in the cell’s nucleus, which is inherited from both parents, but also with respect to the DNA in the cell’s mitochondria – some of the so-called “organelles” which the cell contains in addition to its nucleus. What is important about mitochondrial DNA is that it is inherited from the mother alone. It follows that the only reason that there can be for any difference between two people’s mitochondrial DNA is inaccurate inheritance due to mutation; for, without this inaccuracy, both of them would have exactly the same mitochondrial DNA as their most recent shared ancestor in the female line. So, assuming that mutation in DNA occurs at a constant rate, the extent of difference between two people’s DNA is an indication of the number of generations which separate them from the most recent woman from whom both are descended through her daughters, her daughters’ daughters, and so on.

Cann, Stoneking, and Wilson (1987) used this technique to try to locate in time and space the most recent woman from whom all living humans are descended in the female line. With the help of elaborate statistical techniques, they argued that this woman lived roughly 200,000 years ago in Africa, hence the nickname “African Eve.” Both the African location and the date corresponded quite closely to the “out-of-Africa” scenario for early Homo sapiens proposed on independent grounds by some archeologists, so the two theories provided mutual support. The nickname “Eve” is convenient but unfortunate, because it suggests that, apart from Eve’s male partner or partners, none of her contemporaries has any descendants alive today. That is a fallacy; all one can say is that anyone alive today who is descended from a female contemporary of Eve must be linked to that woman through at least one male ancestor. However, the argument of Cann and her colleagues does suggest that there was a population bottleneck relatively recently in human prehistory, such that most of the humans alive around 200,000 years ago, scattered over large areas of Africa, Europe, and Asia, have indeed left no surviving descendants. Why should this be?

Many scholars have been tempted to suggest that what was special about Eve’s community – the characteristic which enabled their descendants to outperform other humans and which discouraged interbreeding with them – must have been superior linguistic abilities, presumably newly acquired. This is only a guess, however. Cann herself has more recently mentioned one of many alternative possibilities: infectious disease (Cann, Rickards, and Koji-Lum 1994). But the possible link with language evolution has been popularized by Cavalli-Sforza (1995) and by Ruhlen (1994), whose supposed reconstructions of Proto-World vocabulary might, if genuine, be roughly contemporary with Eve. An equivocation on “mother tongue” underlies this view, however. Even supposing it were possible to reconstruct the most recent language from which all contemporary languages are descended, it would be a remarkable coincidence if that ancestral language (the “mother tongue” in a historical linguistic sense) were also the first linguistic variety with fully modern characteristics (the “mother tongue” in a biological sense). So, once again, we are faced with evidence which, though tantalizing, does not point to any firm conclusion.
Another recent discovery has been evidence for a relationship between inherited language impairment and a specific gene: the so-called FOXP2 gene (Lai et al. 2001). So is FOXP2 “the language gene”? No serious scholar now makes that claim. For one thing, it is found also in the DNA of many other species. Its role in language is at best indirect, and many other genes are relevant to the normal maturation of language in humans. However, it seems possible that a specifically human change in the FOXP2 gene around 200,000 years ago may turn out to be an important piece in the jigsaw, because that is a plausible date for the beginning of the territorial expansion of Homo sapiens beyond southern Africa.

4 Primatological Evidence

No living primate apart from man is equipped to speak. However, three areas of current research on primates may shed light on language evolution. These involve primate vocal call systems, primate cognitive abilities (particularly their knowledge of social relationships), and the results of experiments involving teaching sign language and artificial signaling systems to apes.

4.1 Vocal call systems

Until a couple of decades ago, it was generally thought that the calls uttered by all animals, including monkeys and apes, were exclusively reflections of physical or emotional states such as pain, fear, hunger or lust. In this respect, the portion of the human vocal repertoire which primate call systems seemed to resemble most closely was the portion consisting of involuntary sounds such as cries of pain, laughter or sobbing. No linguists have been reluctant to contemplate an evolutionary link between these cries and primate vocalizations. But primate “vocabularies” were thought to lack a central element of human vocabularies: referential calls identifiable with specific objects or classes of objects in the external world. Given that assumption, it was easy to dismiss animal call systems as irrelevant to human language. However, students of animal behavior were becoming increasingly uncomfortable with this assumption, and Cheney and Seyfarth (1990) developed a particularly elegant and convincing way of testing it systematically. (On animal communication generally, see Hauser 1996; on the calls of chimpanzees in the wild, see Goodall 1986.)

In the 1970s and 1980s, Cheney and Seyfarth spent years investigating the behavior of vervet monkeys in their native habitat, the Amboseli National Park of Kenya. These small monkeys utter distinct warning calls for different types of predator, notably leopards, snakes, and eagles, for which different types of evasive action are appropriate: they run up trees to escape leopards, peer at the ground around them to avoid snakes, and hide in bushes to evade eagles. This kind of apparent referentiality had been noticed before, not just among vervets; but such awareness had not shaken the general conviction among both zoologists and linguists that animal cries were basically emotional or affective in content rather than referential. In crude terms, a vervet’s eagle call would be interpreted as linked not to something in the outside world (“There’s an eagle!”) but rather to its internal state (“I am experiencing eagle-fear!” or “I feel an urge to hide in bushes!”). To be sure, if one vervet uttered the eagle call, others might take evasive action too; but this could only be because these others saw the eagle for themselves and hence experienced the same emotion (it was thought).

Cheney and Seyfarth showed this interpretation to be incorrect by way of a crucial experiment. They made recordings of predator warning calls and played them back from hidden loudspeakers in the absence of the relevant predators. If the traditional interpretation of the warning calls was correct, the vervets would be predicted to take no evasive action in response to these bogus calls. They might look for around for the relevant predator but, failing to see one, they would not experience the relevant fear reaction and so would do nothing. However, what Cheney
and Seyfarth found was that the vervets reacted to the bogus calls just as if they were genuine, by taking the appropriate evasive action. The call itself was the trigger to act, not the emotion or physical state engendered by the sight of a predator. Warning calls therefore really do contain referential information about the environment, on which vervets can act appropriately. To this admittedly limited extent, therefore, they resemble words of a human language.

A second respect in which human language differs from animal cries, it used to be thought, is that only human language can be unreliable. If an animal cry is an automatic response to an emotional or physical stimulus, its reliability is in some sense guaranteed. Humans, on the other hand, can tell lies or make mistakes. But Cheney and Seyfarth showed that in this respect too the gap between vervet monkeys’ calls and human language is less than was once thought. Vervets’ use of their warning calls is not entirely innately determined; for example, young vervets will sometimes utter the eagle call even when they have seen something in the sky which is not an eagle or even a bird at all, such as a falling leaf. And adult vervets react differently to young vervets’ calls too. Instead of taking immediate evasive action, as they would if they had heard an adult call, they first check for themselves whether the relevant predator is present and, if not, ignore the call. It seems to be through observing when its calls are acted upon and when they are ignored that a young vervet refines its innate repertoire of vocal reactions into accurate warnings deployed according to the conventions of the adult community.

These observations show that, for vervets, calls have a content which is independent of their own physical or emotional state. Cheney and Seyfarth were also able to show that, in judging the reliability of a call that it hears, a vervet goes beyond merely identifying the caller. It is clear that vervets can distinguish individual “voices,” because when a young vervet utters a cry of distress the adults in earshot will look toward that individual’s mother, as if expecting her to respond. Cheney and Seyfarth compared reactions to recordings of different voices uttering a variety of calls. In the absence of a genuine eagle danger, hearers will become habituated to and hence ignore recorded eagle alarms in the voice of vervet A, but will still react to alarms in the voice of vervet B. But, even when so habituated to vervet A, they will not ignore a recording of vervet A uttering a call of a different kind (say one of the repertoire of calls relating to individual or group interactions). Vervets can evidently distinguish, in respect of another vervet, those topics on which it is a reliable witness from those on which it is unreliable.

To be sure, the vervet call system has no grammatical organization remotely resembling that of human language, and the same is true of all other primate call systems. Nevertheless, the observations of Cheney, Seyfarth, and others tend to show that the differences between primate call systems and human language are not so great as was once thought, and hence weaken the case for denying any evolutionary connection between them.

### 4.2 Cognitive abilities

Longterm observations of primate groups in the wild, such as those of Goodall and Cheney and Seyfarth mentioned in Section 4.1, show that primates know many more details about themselves, their conspecifics, and their environment than was previously suspected. In particular, they can distinguish kin from nonkin, and by remembering who has done what to whom they can distinguish allies from enemies. This is relevant to language inasmuch as a fundamental characteristic of language is the ability to represent grammatically the roles of participants in a situation (Bickerton 1990, 2002). For example, the sentence John gave Mary a banana represents a situation in which John is the agent, Mary is the goal, and the banana is the patient or “theme” in relation to an act of giving. In the terminology of semantics, such a set of relationships between participants in a situation is called a “thematic structure” or “argument structure” (see Chapter 7). Higher primates do not produce sentences, but they certainly have mental representations of thematic structures of the kind which underlie sentences. To that extent they have evolved to a stage of cognitive readiness for language.
One of the rubicons which have been claimed to separate humans from other animals is that, whereas other animals may possess “procedural” knowledge (“knowledge-how”), only humans have access to “propositional” knowledge (“knowledge-that”). (In a similar vein, Donald (1991) distinguishes between “episodic,” “mimetic,” and “mythic” culture, among which only “episodic” culture is available to nonhumans.) If this is correct, it is tempting to see propositional knowledge as a prerequisite for language. In assessing whether this is correct, however, one immediately encounters a risk of circularity. If “propositional knowledge” means simply “knowledge of a kind which can only be represented in sentence form,” then it is not surprising that propositional knowledge should be restricted to sentence-users, that is, to humans; but then to say that animals lack it is to say no more than that animals lack language. On the other hand, if “propositional knowledge” is defined so as to make it logically independent of language, such as in terms of thematic structure, it is by no means so clear that this rubicon exists.

At least two considerations support the idea that primates have access to “knowledge-that.” One is the extent to which, in the admittedly artificial conditions of the laboratory, chimpanzees can acquire and display awareness of abstract concepts such as “same” and “different” and apply them by reference to a range of criteria such as color and size (Premack 1976). Even more striking is the ability of macaque monkeys to memorize long sequences of symbols and touch them rapidly on a screen in the right order, even when the arrangement of them changes each time, in order to get food rewards (Terrace 2002). (Imagine if, every time you withdrew money from an automatic teller machine, you found the numbers in a different configuration!) The other consideration is the fact that primates can apparently indulge in deception, or display what has been called “Machiavellian intelligence” (Byrne and Whiten 1988; Sommer 1992). In interpreting “Machiavellian” behavior it is of course necessary to guard against overenthusiastic ascription of human personality traits to animals. Nevertheless, this behavior suggests that primates are capable of conceiving of situations which do not exist, that is, to think in an abstract “propositional” fashion, and hence reinforces the worthwhileness of looking for precursors of language in other species.

Social relationships among primates are both more complex and less stereotyped than among other mammals, and it has been suggested that social factors may outweigh communicative ones in fostering language evolution. Dunbar (1996) and others have drawn attention to the relationship between group size, brain size, and social grooming in various primate species. Grooming is important in fostering group cohesion; on the other hand, time devoted to grooming increases exponentially as group sizes increase, thereby reducing the time available for other essential tasks such as food gathering. Dunbar suggests that language provided a way out of this dilemma: it is a form of vocal grooming, with the advantage that by means of language one can groom many other individuals at once. Traces of this original function can be observed in the extent to which, even today, language is used for gossip and for cementing social relationships rather than for the more abstract representational and information-conveying purposes which tend to interest grammatical theorists and philosophers.

### 4.3 Sign language experiments

Apes do not have vocal tracts suited for speech, but their arms and hands are physically quite capable of forming the signs of Deaf languages such as American Sign Language (ASL). In the 1970s great excitement was generated by experiments which purported to show that chimpanzees could learn ASL, so that language could no longer be regarded as a uniquely human attribute (Terrace 1979; Gardner, Gardner, and Van Cantfort 1989). Linguists in general denied hotly that the sign sequences produced by chimpanzees such as Washoe and Nim could be regarded as genuine syntactic combinations or complex words, pointing to the fact that the chimpanzees’ sign sequences never reached the variety and complexity of those of fluent human ASL signers.