Chapter 1
The uniqueness of human language

If you were asked to name the trait which most decisively distinguishes human beings from all other creatures on the planet, what would you choose? Love? Warfare? Art and music? Technology? Perhaps. But most people who have considered this question at length have come up with a single answer: **language.**

As I shall try to demonstrate, human language is arguably the single most remarkable characteristic that we have, the one that most truly sets our species apart. Our faculty of language, which we usually take for granted, exhibits a number of properties which are remarkable, even astonishing. Without language, we could hardly have created the human world we know. Our development of everything from music to warfare could never have come about in the absence of language. More than any other single characteristic, then, language is what makes us human. And human language is unique.

At first glance, this uniqueness may be far from obvious. After all, nearly every creature on the planet seems to have some kind of signalling system, some way of communicating with other members of the same species and occasionally even with members of other species. Crickets chirp, birds sing, monkeys squawk, fireflies flash, and even ants leave smelly trails for their co-workers to follow. And no doubt you are convinced that Rover or Tiddles has a special sort of ‘woof’ or ‘meow’ that means ‘I’m hungry’ or ‘I want to go out’. Moreover, recent work by ethologists (people who study animal behaviour) has revealed that many animal signalling systems are far more interesting than was once thought. You may be aware, for example, that certain species of whales are now known to sing songs, or that honeybees perform elaborate dances to announce the location of nectar to the hive.

Fascinating as these discoveries are, however, and however much they may remind us not to take our fellow creatures for granted, the fact is that human language is so utterly different from all these other signalling systems that we are obliged to treat it as a thing apart: a truly unique phenomenon.

In this book, I shall try to explain some of the fascinating and astonishing things we have discovered about language. I begin with some of the fundamental properties which are often collectively known as the **design features** of language. One of these design features is absolutely crucial to the very existence of language.

Duality of patterning

For most people, most of the time, the ordinary **medium** of language is speech. How do we speak? Easy: we allow air from the lungs to pass out through our mouths, and at the same time we move our mouths in various ways to produce **speech sounds**—consonants and vowels. Every utterance we make consists of a sequence of speech sounds, one after the other.

But here's an interesting question: how many *different* speech sounds can you produce? Different enough, that is, that the person you're talking to will have no trouble in telling them apart.

Well, there is no cut-and-dried answer to this question: it depends on just how much difference you want to insist on. But the number is certainly not large. Unless you've had specialist training in **phonetics** (the study of speech sounds), you will probably find it very difficult to produce even a hundred different individual sounds. (Remember, we're talking about *individual* sounds here, not sequences of sounds.) In fact, every human language operates with a much smaller set of speech sounds than this. Let's take a look at English.

Consider the word *cat.* How many speech sounds does it contain? Well, the English spelling system is not very trustworthy on questions like this, but here the spelling does suggest the right answer: three. They are the '*k*-sound', the 'flat *a*', and the '*t*-sound'. For convenience, let us introduce special symbols for these speech sounds: /k/, /æ/ and /t/, respectively. We use the slashes to indicate that we are talking about the distinctive speech sounds of a particular language—in this case, English. These distinctive speech sounds are called the **phonemes** of the language. Thus, in terms of the phonemes of English, the word *cat* can be represented as /kæt/.

Now, if someone asks you what the English word /kæt/ means, you will have no trouble in answering. But suppose someone asks you instead what the English phoneme /k/ means? This time it is impossible to answer, for the phoneme /k/ in fact has *no* meaning in English. Nor does any other phoneme: /æ/ and /t/ are just as meaningless as /k/.

But now notice something else: these same meaningless phonemes can be rearranged to produce different words with different meanings. Thus, the order /tæk/ produces the word *tack,* while /ækt/ gives *act,* /æt/ gives *at,* and /tækt/ gives *tact* or *tacked.* (Note that *tact* and *tacked,* in spite of their different spellings and different structures, are pronounced identically by most speakers of English.)

Let's add one more phoneme to our set: the '*p*-sound', or /p/. Now we can form the word /pæt/ *pat,* as well as /tæp/ *tap,* /pæk/ *pack,* /kæp/ *cap,* /pækt/ *pact* or *packed,* /tæpt/ *tapped,* /æpt/ *apt,* /kæpt/ *capped,* and quite a few others. You can see what's going on: by combining a very small set of meaningless speech sounds in various ways, we can produce a very large number of different meaningful items: words. All human languages are constructed in this way, and this type of structure is called **duality of patterning,** or **duality** for short. Duality is the use of a small number of meaningless elements in

combination to produce a large number of meaningful elements.

Why is this type of structure so significant? Well, just imagine what the alternative would be. Suppose we had no meaningless sound units to work with—suppose instead that every individual sound we could produce had its own meaning. What would be the consequence of such an arrangement? It's obvious: *the number of different meanings we could express would be no greater than the number of different sounds we could produce.* And, since we have already seen that we can't produce more than about a hundred different speech sounds, the result would be that a language could only contain about a hundred 'words'. And this would be catastrophic: imagine an 'English' consisting of no more than a hundred words. It is not remotely possible that, with such a drastically limited vocabulary, we could do most of the things we do with English: we couldn't explain to the mechanic what's wrong with our car, we couldn't tell our children stories about rabbits or elves, we couldn' t organize elections or negotiate treaties, we couldn' t charm our way into another person's heart with seductive conversation, and we certainly couldn't write books about language.

'So what?' you may be asking at this stage. Why am I making such a song and dance about duality? Isn't it the obvious way to go about things? Maybe so, but here's the crux: *no other species on earth has a slgnalling system based on duality.* Duality is unique to human language. (In fact, bird songs and whale songs arguably contain an element of duality, but these are not exactly signalling systems.)

What do other creatures do, then? They do what we have just declared unthinkable for human language: their signalling systems are based on the principle of 'one sound, one meaning'. That is, a typical non-human animal will have one sound meaning, perhaps, 'This is my territory', and another meaning 'Look out—danger in the air', and perhaps a few more. But that's it—the total number of different things such a creature can 'say' is no larger than the number of different sounds available. In practice, the number of different signals, or *calls,* used by any given species is usually between three and six—though vervet monkeys have the remarkable total of twenty or so. And this, it should be obvious by now, is a stupendous difference. Some of the other important characteristics of language that we will be discussing are only made possible by this fundamental property of duality.

Incidentally, perhaps you are wondering just how many pho nemes there are in English all together. The answer: forty-odd. Why such a vague answer? Because not all English speakers use exactly the same set of speech sounds. For example, do you pronounce the words *buck* and *book* differently or identically? People who pronounce them differently have one more vowel than those who pronounce them identically. How about *hair* and *air*? People who pronounce these differently have one more consonant than those who pronounce them identically. The same goes for *cot* and *caught, three* and *free, pull* and *pool, fur* and *fair,* and *poor* and *pour.* Similarly, people for whom *singer and finger* do not rhyme have one more consonant than those for whom they do rhyme. (You may be a little surprised to learn that some people make a distinction you don' t make, or fail to make one you do make, but that's the way things are.) However, very few English-speakers have fewer than about forty phonemes, or more than about forty-five.

Other languages differ in the number of phonemes they use. At one extreme, the

Brazilian language Pirahã has only ten (seven consonants and three vowels), while, at the other, some languages of Africa have over a hundred (most of them consonants). The average number seems to be around twenty-five, so that English, with its forty-odd, is a little above average. But, regardless of the number of speech sounds used, every human language is built on the principle of duality of patterning, a principle which is absolutely unique to us in the natural world, and a principle without which language as we know it could not exist.

Displacement and open-endedness

Displacement is the use of language to talk about things other than the here and now. We have not the slightest difficulty in talking about last night's football game, or our own childhood, or the behaviour of dinosaurs which lived over 100 million years ago, or the ultimate fate of the universe; with equal ease, we can discuss political events in Peru or the surface of the planet Neptune.

O**pen-endedness** is our ability to use language to say anything at all, including lots of things we've never said or heard before. Here are a few English sentences:

(1.1) I find that polythene banjo strings give a most unsatisfactory twang.
(1.2) Luxembourg has invaded New Zealand.
(1.3) A large pink spider wearing sunglasses and wielding a feather duster boogied across the floor.
(1.4) Shakespeare wrote his plays in Swahili, and they were translated into English by his African bodyguards.

It is most unlikely that you have ever encountered any of these sentences before, and yet you have not the slightest difficulty in understanding them—even if you don't believe all of them. Nor do you have any more difficulty in producing totally new English sentences whenever you need them. In fact, most of the things you say and hear every day are completely new to you, and may never before have been uttered by anyone.

Both of these phenomena, our ability to talk about places and things far away in space and time, and our ability to produce and understand new utterances virtually without limit, are so familiar to us that we never give them a moment' s thought. And yet they are truly remarkable. Remarkable—and absolutely vital. Can you imagine being able to talk about nothing but the present moment and about nothing but what you can see as you speak? Equally, can you imagine speaking a language that consisted only of a fixed list of possible utterances, so that, every time you opened your mouth, you could do no more than choose one utterance from that list? Such a 'language' would be inconceivably far away from what we understand languages to be.

And yet this unthinkable state of affairs is exactly the way animal signalling systems appear to be. With one striking and famous exception, discussed below, non-human animals do not exhibit displacement. So far as we can tell, mice do not swap stories about their close encounters with cats, nor do bears soberly discuss the severity of the coming winter. Rabbits do not engage in heated arguments about what might lie on the far side of

the hill, nor do geese draw up plans for their next migration. Virtually all ‘utterances’ by non-human animals appear to relate directly, and exclusively, to the time and place of uttering.

Furthermore, these creatures exhibit nothing we could call open-endedness. Instead, it appears to be genuinely the case that each species’ signalling system contains only a small number of possible utterances, and that nothing can be expressed beyond the limited range of possibilities available. A monkey may be able to say ‘Look out—eagle’ if that message is available in the system, but that same monkey cannot introduce any novelties: he cannot, for example, come up with an unprecedented ‘Look out—two hunters with rifles’, or, still less, on spotting his first Land Rover, ‘Hey, everybody—what do you suppose that is?’

Of course, given the absence of duality, it could hardly be otherwise: we have already seen that duality is essential in a system that can express more than a small number of different meanings. Lacking duality, non-human creatures appear to be locked into a world of expression which we can barely conceive of: a system of communication lacking both a past and a future, bounded by the horizon, and devoid of novelties, consisting only of the endless repetition of a few familiar messages about what’s going on at the moment.

There is, however, one striking exception to this bleak picture: we know of one creature whose signalling system conspicuously exhibits displacement, apparently uniquely in the non-human world. What is this remarkable creature? Not the chimpanzee, or the dolphin, as you might have guessed: it’s the common honeybee.

In the 1950s and 1960s, the Austrian ethologist Karl von Frisch carried out a series of studies which revealed something unexpected about the behaviour of European honeybees. When a honeybee scout discovers a useful source of nectar, it flies back to its hive and then performs an astonishing little dance inside, watched by the other bees. The details of the dance vary depending both on the distance to the nectar and on the particular species and variety of bee (honeybees have ‘dialects'!). In the most famous case, though, the dancing bee performs a ‘tail-wagging dance’ in the form of a squashed figure eight with a straight middle section. Von Frisch was able to decode this dance, as follows. The time the dancing bee takes to complete a circuit of the figure eight indicates the distance to the nectar source: a longer time represents a longer flight. The level of excitement

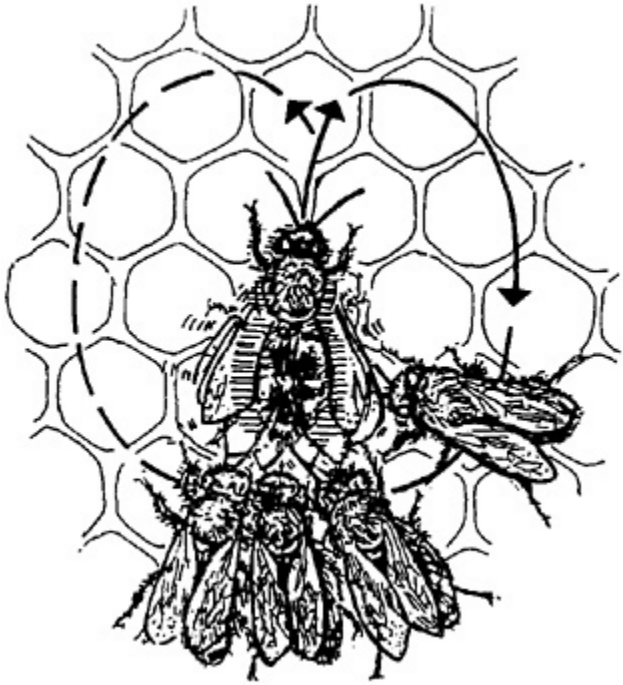

FIGURE 1.1 The tail-wagging dance
Source: Reprinted with permission from A. Akmajian, R.A. Demers and R.M. Harmish (1979) *Linguistics: An Introduction to Language and Communication*, Cambridge, MA: MIT Press, p. 12.

demonstrated by the bee represents the quantity of nectar, and hence the number of bees needed to harvest it: greater excitement, more nectar, and hence more bees needed. Finally, and most stunningly, the orientation of the straight part of the figure eight represents the direction of the source with respect to the position of the sun: for example, if the straight section is oriented at 80° to the left of straight up, the bees will fly toward a point 80° to the left of the sun. (See Figures 1.1 and 1.2.)

Now this is displacement. The dancing bee is passing on information about a nectar source which it visited some time ago, which is now perhaps miles away, and which it therefore cannot see. Moreover, the watching bees clearly understand that they are being informed about a task which they should perform in the (near) future. And the system is extremely effective: von Frisch found that his bees could regularly locate nectar sources up to about seven miles away

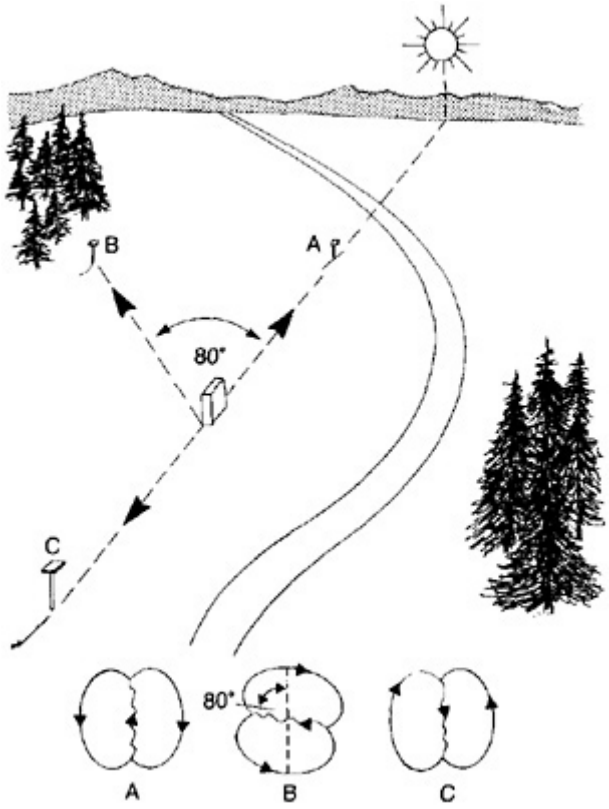

FIGURE 1.2 The dances which send worker bees to three feeding stations A, B and C

Source: Reprinted with permission from A. Akmajian, R.A. Demers and R.M. Harmish (1979) *Linguistics: An Introduction to Language and Communication,* Cambridge, MA: MIT Press, p. 13.

(about eleven kilometres). This is impressive. How successful do you think you'd be at finding a particular cluster of bushes seven miles away after being given only oral directions?

Wonderful as the bee dance is, it is none the less, as von Frisch was able to show, severely limited in important respects. In a famous experiment, he allowed some scouts to find an artificial nectar source, a bowl of sugar and water, placed on top of a pole twenty feet high, much higher than the bees were accustomed to finding nectar. The scouts returned to the hive and danced as usual. The result? A swarm of bees soon arrived at the pole, buzzed around it in seeming confusion for a while, and then went home. The dancing scouts had been utterly unable to include in their dance the novel bit of information about the height—or, as von Frisch put it, there is no word in honeybee for

'up'.

The honeybee dance is astounding, and we are forced to admit that at least one creature besides human beings can exhibit displacement in communication. But we must not let our amazement obscure some hard facts. The honeybee dance is unique in the animal world; no other creature has anything similar, not even other insects. And that dance is severely restricted in its communicative power: it cannot cope with the slightest novelty. Apart from its undoubted displacement, the bee dance is just as limited in its expressive power as any other animal signalling system. Bees have nothing that we would recognize as language.

Stimulus-freedom

Related to some of the preceding design features, but none the less partially distinct, is the property of **stimulus-freedom,** which is the ability to say anything you like in any context. Suppose someone says to you 'What do you think of my skirt?' You are free to make any response you like, including none at all. You might reply 'It's too short', or 'It doesn't go with your pink blouse', or 'Sorry—I have no taste in clothes'. You can even decline to answer, and change the subject.

Of course, this doesn't mean that human conversation is utterly random. There are all sorts of social pressures that make some responses more likely than others. If you value the friendship of the woman in the skirt, you are most unlikely to reply 'God, Julia, my dog's blanket would look better—you have the worst taste in clothes in the Northern Hemisphere'. Even if you're thinking that, you probably wouldn't say it. But you *could* say it if you wanted to: there's nothing about English that prevents you, but merely social conventions and the desire to maintain good relationships.

The absence of stimulus-freedom would once again reduce human language to something unrecognizable. Just try to imagine a world in which your every remark was completely determined by the context, so that, like a character in a play, you never had the slightest choice of what to say. There are, of course, certain formal and especially ceremonial contexts in which something like this actually does happen—church services, Passover meals, the taking of oaths but such contexts are not the norm, and even there you could, in principle, say something unexpected, if at the cost of ruining your position in society.

By now you are probably expecting to hear that stimulusfreedom too is unique to human language, and I shall not disappoint you. Non-human signals are not stimulus-free, but rather **stimulusbound.** That is, a non-human creature produces a particular signal always and only when the appropriate stimulus is present. If Fred the monkey is up a tree, and he sees a dangerous eagle approaching, he automatically produces the cry that means 'Look out—eagle!', and he never does this at any other time. He doesn't, on spotting the eagle, think to himself 'Maybe if I keep quiet the eagle will grab old Charlie down there, and I'll be safe'. Nor does a bored Fred suddenly come out with an eagle warning and then guffaw 'Haw, haw, Charlie gotcha that time!'

Very occasionally, however, an animal has been observed to do something unusual.

For example, an Arctic fox was once spotted making a danger call in the absence of any danger, apparently just to distract her cubs from a meal she was trying to eat. But such incidents are, so far at least, very rare and strictly anecdotal: they do not represent normal behaviour, which is overwhelmingly stimulusbound.

Lacking *duality*, lacking displacement, lacking openendedness, lacking stimulus-freedom, animal signalling systems are almost unfathomably different from human languages. The communicative world in which other creatures live is as different from ours as anything we could imagine: from our point of view, bleak, featureless, closed in on every side. As I said at the beginning of this chapter, human language is unique on earth, and without it we could not count ourselves human at all.

Arbitrariness

In addition to the design features which set human language wellapart from animal signalling systems, there are others which are notunique at all, but none the less worthy of attention. Chief among theseis **arbitrariness,** which is the absence of any *necessary* connectionbetween a linguistic form and its meaning.

Note that word *necessary*. I am certainly not suggesting that there is no connection at all between the English word *pig* and the large snouted animal to which we commonly apply it. Of course there's a connection, but it's an *arbitrary* connection. There is no *a priori* reason why English speakers should apply the particular sound sequence *pig* to that particular animal: the connection is purely a matter of agreement, and the word can be successfully used only so long as English speakers agree to use it in this particular way. Speakers of other languages, of course, have reached different agreements, but no word is intrinsically better suited to naming this particular animal than any other, though each is perfectly adequate as long as speakers agree about it.

Such agreement need not be for all time. The animal was formerly called a *swine* in English, but this older word is now little used except as a light-hearted insult, and *pig* has replaced it as the name of the animal. The decision as to which words shall have which meanings is entirely a matter of convention. Different languages have different conventions (that's part of the reason they *are* different languages), and conventions can and do change.

Arbitrariness can be demonstrated the other way round. The English word *mean* has several different meanings—or, more accurately, there are several different English words sharing the form *mean*. The French word *mine* sounds almost exactly like English *mean*, but the French word means '(coal)mine'. Likewise, Welsh *min* means 'edge', Basque *min* means 'pain', and Arabic *min* means 'from'. There is nothing about this sequence of sounds that makes any one meaning more natural than another.

The overwhelming presence of arbitrariness in language is the chief reason it takes so

long to learn the vocabulary of a foreign language: it's generally impossible to guess the meaning of an unfamiliar word, and each new word just has to be learned individually. Even if I give you the big clue that all of the following Basque words are the names of living creatures, I very much doubt that you'll be able to guess any of them: *zaldi, igel, txori, oilo, behi, sagu.* In fact, they mean 'horse', 'frog', 'bird', 'hen', 'cow' and 'mouse', respectively.

This arbitrariness is the reason that the 'universal translator' beloved of science-fiction B movies is simply impossible. You know the scene: our intrepid space adventurers arrive on a new planet and find an alien race speaking a totally unfamiliar language, so they whip out their machine and twiddle a couple of dials, and—hey presto! the alien speech is at once rendered into perfect American English. Because of arbitrariness, even the most powerful computer can have no way of knowing whether the alien utterance *Kwarfnigli* means 'Welcome to our planet', or 'Prepare to be sacrificed to the Great God Kwarf', or 'You've parked your space ship in a tow-away zone', or perhaps even 'Hey, Edna—come and look at these weirdos'. On a more realistic scale, even if you learn a couple of thousand Basque words, if someone says to you 'Watch out—you might run into a *lupu* out there', where *lupu* is a word you don't know, you have no way of knowing whether a *lupu* might be a bear trap, a poisonous snake, an armed robber or a starving wolf. In fact, it' s a scorpion—though in a now extinct dialect of Basque, recorded in the sixteenth century, an identical word *lupu* meant 'wolf. So much for the universal translator.

Arbitrariness is in no way unique to human language: it is typical of animal signalling systems and of virtually every conceivable system of communication. But, occasionally, in language and elsewhere, we find elements which are not entirely arbitrary, but rather somewhat iconic. **Iconicity** is a direct correlation between form and meaning. We saw some iconic elements in the bee dance, in which a time represents a time and an angle represents an angle. But English, too, has some iconic elements.

The most familiar examples of iconicity in English are provided by instances of **onomatopoeia**—the representation of sounds by words of similar sound. Such words as *splash, clink, buzz, meow, moan, whoosh, thud, moo, ping, quack* and *boom* all represent attempts to reproduce real-world sounds with English phonemes. But even these onomatopoeic items still exhibit a great deal of arbitrariness in their forms. The easiest way to see this is to compare onomatopoeic items from several languages. The sound of a gunshot is represented in English as *bang,* in Spanish as *pum,* in French as *pan,* in German *as peng,* and in Basque as *dzast.*

In fact, onomatopoeic words are so strongly arbitrary that they have to be learned individually, just like ordinary words. Can you guess the meaning of Japanese *chirin-chirin?* It means 'tinkle'. How about Turkish *şip? It means* 'plop'. Turkish şak? It's 'clap' or 'crack'. Hebrew *yimyum?* It's 'meow' (!) Basque *kuhurruku?* Easy, this one: it's 'cock-a-doodle-do'. Japanese pyuu? It's 'whizz'.

There is another, much more subtle, type of iconicity in language. Suppose I tell you that the Basque word *tximeleta* (pronounced, roughly, chee-may-LAY-tah) is also the name of a creature. What sort of creature do you suppose a *tximeleta* might be? Large or small? Fast or slow? Pretty or ugly? Any thoughts? Now suppose I tell you further that

tximeleta means one of the following: ‘fox’, ‘bull’, ‘butterfly’, ‘snail’, ‘tortoise’. Which do you suppose it is?

Well, I was hoping you’d guessed it by now. Most people find that the word *tximeleta* seems to suggest, not something large or ponderous or slow, but rather something small and light and fluttery, and so they correctly pick out the only small, light, fluttery creature in the list.

This is not onomatopoeia, because the form of the word *tximeleta* is not in any way related to the sound of anything butterflies don’t even make any sound. Rather, the sound of the word seems somehow to correlate with the *appearance* of the insect: the word sounds light and fluttery, and the butterfly looks light and fluttery. This type of iconicity is sometimes called **phonaesthesia,** and both phonaesthesia and onomatopoeia are varieties of what is more generally called **sound symbolism.** All types of sound symbolism are partial exceptions to the more usual arbitrariness of language, but sound symbolism is a special case, and arbitrariness is the norm.

The vocal tract

As I mentioned above, the primary medium of language is speechthat is, the production of sequences of speech sounds. Speech is performed by allowing air from the lungs to pass up and out through the mouth and nose. Of course, speech is not the only possible medium for language. If you’re reading this book, you’ll be aware that language can be transferred, with a high degree of success, into the medium of **writing**—though this transfer is a recent development in the history of human language. The oldest known written texts are less than 6,000 years old, while speech, as we shall see later, is very considerably older than that, and even now the great majority of the world’s 6,000 or so languages are not normally written down. Of uncertain antiquity is the invention of **sign language,** in which language is transferred to the medium of gestures made chiefly with the hands; this too we shall be discussing below.

But speech is the primary medium, and human beings have evolved in such a way as to make efficient speech possible. The passageway through which air flows as we speak is called the **vocal tract,** and the human vocal tract is highly unusual, even unique, among mammals. Even our closest relatives, the apes, have vocal tracts which are quite different from ours and which are not very different from the vocal tracts of, say, horses or mice. Take a look at Figures 1.3 and 1.4, showing cross-sections of the vocal tracts of a person and of a chimpanzee.

There are several significant differences. For one thing, the human vocal tract is much larger and differently shaped: it extends well down behind the back of the tongue. Further, there is a big difference in the connection between the trachea, or windpipe, which leads through a complex structure called the **larynx** to the lungs, and the oesophagus, or gullet, which leads to the stomach. In the chimp, as in most mammals, a large cartilage called the epiglottis serves as a kind of valve between the two. When the epiglottis is raised (as shown), the trachea is connected to the nose and the mouth is sealed off. When the epiglottis is lowered, the mouth is connected to the oesophagus, and

the trachea is sealed off. This useful arrangement makes it virtually impossible for a chimp to choke on its food.

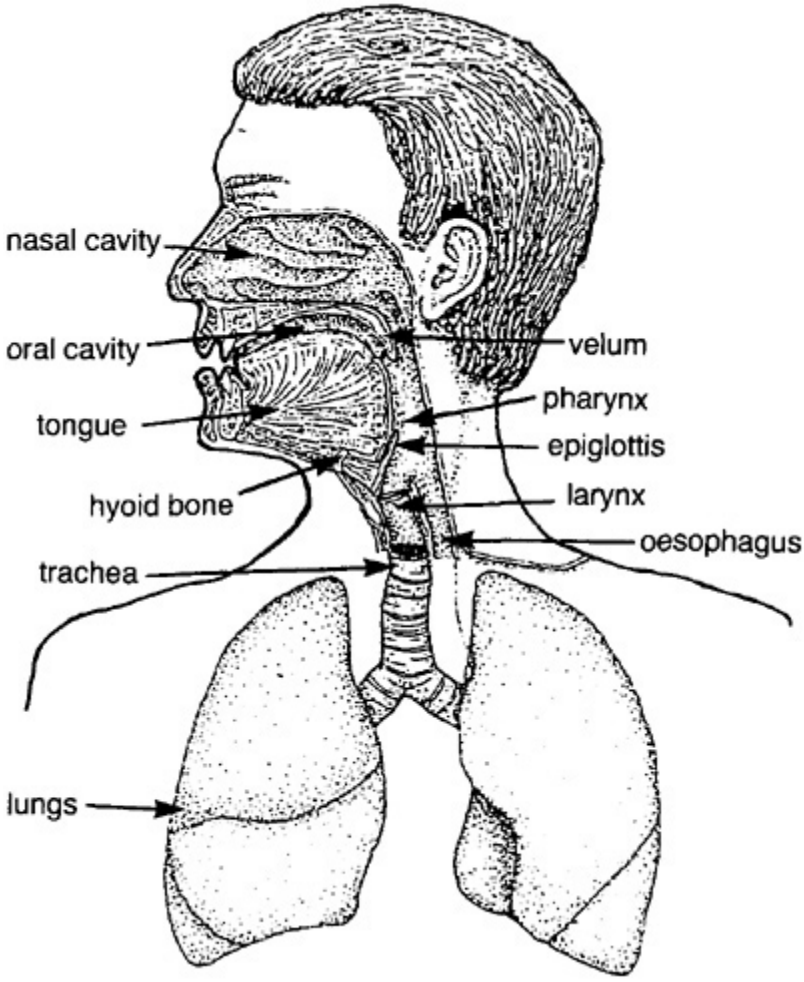

FIGURE 1.3 The human vocal tract
Source: Reprinted and adapted with permission from P. Lieberman (1991) *Uniquely Human: The Evolution of Speech, Thought and Selfless Behavior*, Cambridge, MA: Harvard University Press, p. 40.

The human being, however, is not so fortunate. The long part of the vocal tract called the **pharynx** is common to both the flow of air and the passage of food, and the small human epiglottis is not very effective at sealing off the trachea during swallowing. As a result, it is very easy for us to choke on our food, and dozens of people die this way every year in

Britain alone. Why have human beings, almost

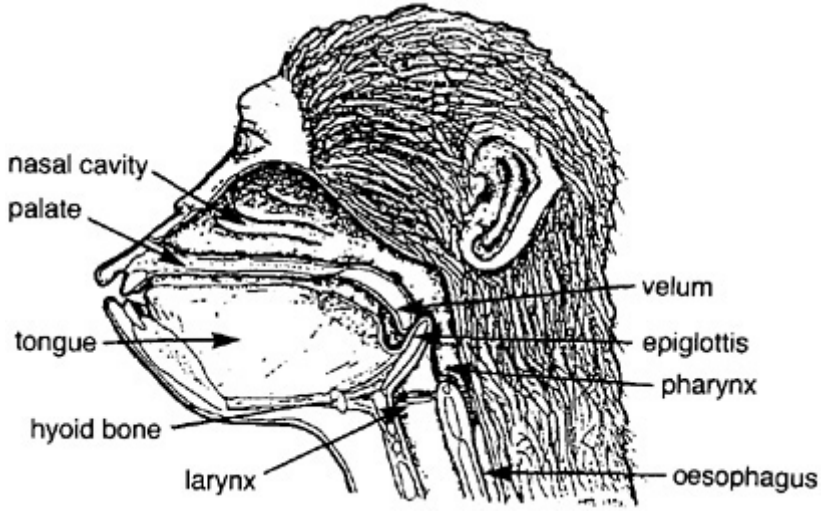

FIGURE 1.4 The vocal tract of the chimpanzee
Source: Reprinted and adapted with permission from P. Lieberman (1991) *Uniquely Human: The Evolution of Speech, Thought and Selfless Behavior*, Cambridge, MA: Harvard University Press, p. 55.

uniquely among mammals, evolved this dangerous arrangement? Why have we not retained the safer vocal tract of our ancestors?

Even more intriguing is the fact that newborn human babies have vocal tracts which resemble that of the chimpanzee, and young babies are therefore protected against choking to death. Only after about three months does the infant's growth begin to stretch its vocal tract into the dangerous adult shape. It looks as if evolution has really worked very hard at rearranging our vocal tract into its present curious shape. But why?

Dangerous or not, the human vocal tract has one great advantage: since it is so large and elongated, it allows us to produce a number of speech sounds—at least some dozens of distinct consonants and vowels, as you'll recall. But the chimpanzee vocal tract and the vocal tract of a newborn baby lack this ability. Investigation has shown that the chimp vocal tract can scarcely produce more than one vowel and a couple of consonants. And this is not nearly enough to allow speech and language. Recall that we need to have a range of speech sounds at our disposal in order to take advantage of the fundamental design feature of duality: no speech sounds, no duality, and no duality, no language.

Many investigators have therefore reached the conclusion that our vocal tracts have evolved very specifically to allow us to speak. The idea is that speech and language proved to be so beneficial to the species that we became specialized for it even at the cost of losing a number of our fellows to death by choking every year. Intimately related to the evolution of our distinctive vocal tract would have been the accompanying evolution

of our remarkably big brain. The use of language requires not only the ability to speak but also a very considerable capacity for rapid mental processing—and apes, we now know, also lack that part of the brain which performs the mental processing required for speaking.

There are several landmarks in the history of human evolution. Our upright posture (for which we have paid the price of frequent problems with our backs) and our hands, with our skilful fingers and especially our opposable thumbs, were of course vital developments - but these, as we now know, were evolved millions of years ago by ancestors who had not yet acquired large brains and probably not our distinctive vocal tract. More than any other development in our history, the development of speech and language set us apart from our ancestors and from our relatives, and put us, for better or for worse, on the path to our uniquely human behaviour. Indeed, several specialists have suggested that, rather than calling our species in Latin *Homo sapiens* 'the wise human', we might better call ourselves *Homo loquens* 'the speaking human'.

And just when did human language evolve? No one knows. Almost everyone agrees that language has been around for at least 100,000 years or so, which is when we find the first evidence of fully modern humans indistinguishable from ourselves. A minority of scholars would suggest a much earlier origin, going back perhaps to our immediate ancestor, *Homo erectus,* over a million years ago. The topic is controversial, of course, since we have practically nothing in the way of evidence.

One famous attempt at tackling the question has been made by the speech scientists Philip Lieberman and Edmund Crelin in a series of publications. Their work concerns the Neandertals (or Nean derthals), a somewhat distinctive stockily built people who inhabited western Europe until around 35,000 years ago, when they abruptly vanished, possibly under pressure from our own direct ancestors. Working with a fossilized Neandertal skull, Lieberman and Crelin have proposed a reconstruction of the Neandertal vocal tract, and their reconstruction shows a vocal tract very different from ours and more akin to that of a chimpanzee. Lieberman and Crelin therefore conclude that the Neandertals could not have produced an adequate range of speech sounds and hence could not have spoken.

Fascinating though this attempt is, Lieberman and Crelin's conclusions have been fiercely attacked on various grounds. For one thing, the (crushed) skull they used had been improperly reassembled by an earlier worker. For another, it appears that several different reconstructions are possible even after the skull is restored to its proper shape, including some which look much more like modern human vocal tracts, and some critics have argued that Lieberman and Crelin's reconstruction would not even have allowed the owner of the skull to open his mouth. The question, therefore, remains open. We do not know when language appeared, though most specialists would guess a date much less than a million years ago.

Language without speech: sign language

For most people, the primary medium of language is speech. But speech is not the only possible primary medium, and it is not even the only one that human beings use. Deaf people cannot hear sounds, and so speech is not a very convenient medium for them. But most deaf people have normal vision, and a visual medium would be quite suitable for language in their case. And such a medium exists. It is called **signing,** and a language whose primary medium is signing is a sign language.

Let me first clarify this term a little. A true sign language is not just a way of converting a spoken language into signs (though such systems exist), nor is it a crude auxiliary system of the 'You Tarzan, me Jane' variety. Instead, a true sign language is a genuine human language, complete with a large vocabulary and a rich and complex system of grammar. A true sign language can convey anything that can be expressed in a spoken language, and it even allows its users to make jokes and puns and to use obscenities. A true sign language is the mother tongue of a sizeable number of people, most of whom are deaf. In short, there is absolutely no difference that we can see between a spoken language and a sign language, except for the medium.

The signs of a sign language are gestures, made primarily with the hands, face and head, but sometimes also involving the arms, shoulders, chest and other parts of the body.

At present there are some dozens of sign languages in use in various parts of the world. In Britain, the most prominent sign language is **British Sign Language,** or **BSL.** In the USA, the counterpart is **American Sign Language,** or **ASL.** BSL and ASL are completely unrelated to each other, and British and American signers cannot understand each other any better than speakers of English and Hungarian. Moreover, neither BSL nor ASL has the slightest connection with English, and neither even resembles English. Indeed, both BSL and ASL have grammatical structures which are utterly different from that of English, but rather similar to the grammatical systems of certain North American languages, like Hopi and Navaho - though BSL and ASL are not related to these languages either.

So far as we know, BSL and ASL arose among the deaf communities in their respective countries in the late eighteenth and nineteenth centuries. A version of BSL was carried to Australia, where it developed into **Australian Sign Language, or Auslan;** BSL and Auslan have since developed rather differently, but they can still perhaps be regarded as two dialects of a single language. Since those early days, the languages have become greatly elaborated in their vocabulary and grammatical structure. The modern versions are very different from the earliest ones, and they are true languages in every respect. Later in this book we will encounter another sign language which has arisen only very recently.

Above I mentioned that the words of spoken languages are overwhelmingly arbitrary in their form. Sign languages are a little different here, since the signs they use often exhibit a significant degree of iconicity. But only a very small proportion of signs are so strongly iconic that an outsider can guess what they mean at once. Most signs are still so

arbitrary that the iconicity is only obvious once you have learned the meaning. And many signs are totally arbitrary in form.

Figure 1.5 shows eight signs from BSL. In each case, an arrow represents movement; a double-headed arrow indicates two identical movements; and wiggle lines indicate a waggling movement. Perhaps you would like to try to guess their meanings. I have deliberately included some fairly iconic signs to give you a chance, but one or two are wholly arbitrary and cannot possibly be guessed. Have a try, if you like, but don't forget to look at the face: the expression on the face is often a critical part of the meaning of a sign. If you happen to know a different sign language that won't be of much help, since the signs will be different.

Any ideas? Not so easy, is it? These signs are still pretty arbitrary. But now I'll give you the meanings of the eight signs in a different order. See if you can now match up the meanings with the signs. The meanings are these: *book, coffee, depressed, drunk,joke, scream, should, two days ago.* Give it another try.

OK; here are the answers: (a) is *scream,* (b) is *depressed,* (c) is *two days ago,* (d) is *coffee,* (e) is *joke,* (f) is *drunk,* (g) is *book* and (h) is *should.* Very likely you got a number of these right, but you probably got *should* only by elimination, and you might not find the sign for *coffee* very iconic, either.

As the sign for *two days ago* suggests, BSL signs (and also ASL signs) do not always match up one for one with English words: a single sign may carry the meaning of a whole English phrase, or even of a complete sentence.

Particularly important is the modification of signs for grammatical purposes. Just as spoken languages modify the forms of words for grammatical purposes *(take, takes, taking, took),* sign languages modify the forms of signs. In ASL, for example, touching the tip of the index finger to the side of the forehead means 'sick, ill'. But this sign can be modified by altering the size, shape and speed of the movement and by repeating it, in order to express any of 'slightly ill', 'very ill', 'sickly', 'ill for a long time', 'always ill', and a number of other variations, all of which require other words in English. Such modification is a central feature of the grammars 7

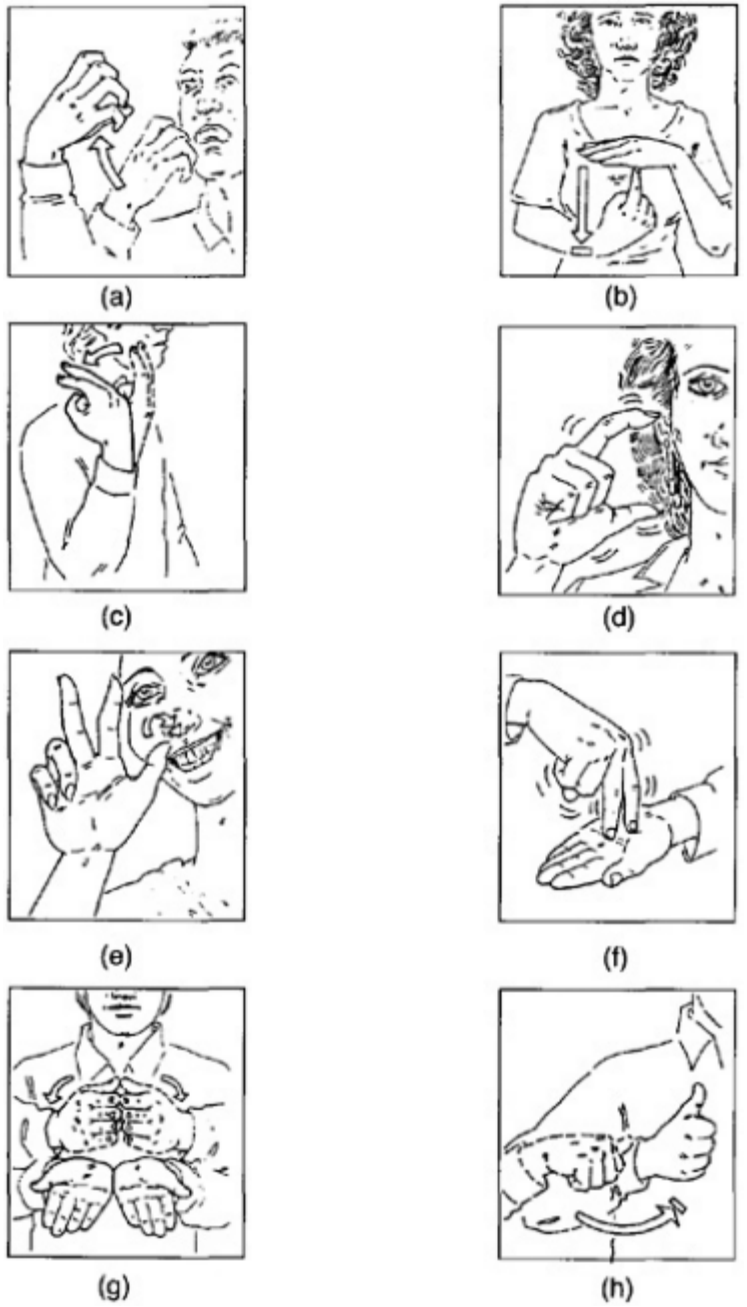

FIGURE 1.5 Eight BSL signs

of ASL and BSL, just as it is in the grammars of Hopi and Navaho - but not of English.

For a long time, we were rather slow to appreciate the nature and importance of sign languages, and serious research has mostly only been underway since the 1970s. Today, though, we understand the truth: ASL and BSL are real human languages, just like English and French. They are not crude auxiliary systems, and they are not derived from anything else. If we want to know what human languages are like, we must look equally at sign languages and spoken languages.

Signing chimps

In the last several decades, a number of researchers have attempted to look at the question of language origins from a very different direction. Even though, as I have stressed in this chapter, language is clearly unique to humans, we might still ask the following question: could a non-human animal learn a human language if it had the chance?

This question has inspired a great number of experiments, some of which have occasionally attracted headlines in the news. What many (not all) of the investigators have attempted is to bring a baby animal into a human household, to bring it up as far as possible like a human baby, to surround it with language, and to encourage it to use language itself. But this obvious approach presents some formidable difficulties. For one thing, not all baby animals can be fitted into a human household. Dolphins and killer whales are known to be highly intelligent, but it is scarcely possible to bring up a baby killer whale in your living room. For this reason, most experimenters have worked with baby apes, usually chimpanzees, occasionally gorillas. With their humanoid form, baby apes can be accommodated in human surroundings. Just as importantly, apes (especially chimps) are our closest living relatives, and hence we might expect that, if any other creatures could learn human language, it would be apes.

But apes, as we have seen, lack a human vocal tract, and hence there is no possibility of teaching them to speak. This blunt fact defeated the first experiments with the chimps Gua and Viki in the first half of the twentieth century. However, we have already noted that speech is not the only possible medium for human language, and it’s not even the only one that human beings use. The sign languages discussed in the last section are full-blown human languages, with all of the critical properties that we expect human languages to have. Sign languages make no use of the vocal tract, but rely instead on gestures made largely with the hands—and apes have hands closely resembling our own.

In the 1960s the psychologists Allen and Beatrice Gardner introduced a young chimpanzee called Washoe into a group of adult human signers; these signers made every effort to encourage Washoe to understand and use signs. The results seemed so encouraging that further chimps were added to the experiment, and other groups began similar experiments with chimpanzees or occasionally gorillas. Still other groups tried something similar, not with sign language, but with invented languages whose ‘words’ were coloured plastic magnets of varying shapes stuck on a board or geometric shapes displayed on a computer screen.

By the late 1960s and early 1970s most of these research groups were reporting

impressive achievements by their animals. The animals were said to be capable of understanding hundreds of signs or symbols, of understanding and responding appropriately to new sentences made up of novel combinations of signs or symbols, of producing spontaneous utterances of their own, of understanding high-level abstractions, of coining new 'words' by original combinations of existing signs or symbols, and even of teaching sign language to their own offspring. These reports attracted much publicity and also a great deal of criticism.

The sceptics found no shortage of weaknesses in the evidence supporting the claims of the chimpanzee experimenters. First, much of that evidence proved to be purely anecdotal: that is, it consisted of reports that some particular animal on some particular occasion had been observed to do something-or-other pretty damned impressive. But anecdotal evidence is almost devoid of value in science: any single event can have any of a large number of explanations, most of them not very interesting, and only well-documented reports of *consistent* behaviour by an animal can be counted as substantial evidence. Second, many of the experimenters were found to have applied very generous standards in testing their animals. For example, if a signing chimp was shown an apple and asked (in ASL) 'What is this?', the experimenters frequently counted as a correct response any sequence of signs including the sign for 'apple', including something like 'yellow banana hungry me apple banana apple', which is a far cry from the sort of response usually heard from a human child learning a first language. Third, we have in many cases nothing more than the experimenters' own word for it that the apes were making any signs at all. In one case in which a native human signer was called in to check the animals' behaviour, he protested that he couldn't see *any* recognizable signs, but only meaningless gestures which were none the less being enthusiastically recorded as signs by the other humans present. Finally, and most damningly, the critics discovered that the experimental procedures typically used to test the animals were so slipshod that an animal under test could often see its human handler unconsciously forming the required response with her or his own hands, so that it could see what to do—a well-known phenomenon in working with animals, and known as the 'Clever Hans effect', after a nineteenth-century performing horse which could apparently answer questions in arithmetic but which was actually just watching its owner for clues as to what to do. When the experimental technique was tightened up, the performance of the animals became very much worse, and was often no better than chance.

As a result of these criticisms, some experimenters became disillusioned with the whole project of teaching language to animals, while others decided simply to shift their attention to studying the ordinary cognitive abilities of their animals, without trying to teach them novel types of behaviour. A few, however, gritted their teeth, tightened up their procedures, and returned to their efforts. Work in this field still continues today, and experimenters still report that their animals can learn to understand two or three hundred signs, though the performance of the animals seems to tail off rapidly after about this much, just at the point at which a human child's progress begins to accelerate almost explosively. Because of this, many people have concluded that the most important result we have obtained from all these projects is a vivid demonstration of the vast gulf that separates the linguistic behaviour of human children from that of all other creatures.

Language, it seems, is still unique to human beings.

Further reading

The idea of design features was introduced by the American linguist Charles Hockett (Hockett 1960); both Hockett and others have occasionally proposed modifications to Hockett's original list of sixteen features, and several versions of the list can be found, but all include the important features discussed in this chapter. Lieberman and Crelin's work can be found in a number of places, of which Lieberman (1975 and 1984) are particularly convenient. The most recent work on the evolution of language is summarized in Aitchison (1996), while Leakey (1994) presents a popular account of human origins, including language origins, from the point of view of palaeoanthropology. Books on sign language are now numerous. For BSL, see Smith (1990) or Miles (1988), or ask your browser to search the Internet for 'British Sign Language'. Or you can e-mail the Forest Bookshop at *deafbooks@forestbk.demon.co.uk*, or contact the British Deaf Association at *http://www.bda.org.uk/*. For ASL, see Valli and Lucas (1995), Lane *et al.* (1996), Schein and Stewart (1995) or Padden and Humphries (1990); use your browser; or contact the American Sign Language Institute at *http://www.asli.com/* or Gallaudet University at *http://www.gallaudet.edu/*. For Auslan, see Schembri (1996). For the signing chimps, see Linden (1974) or Savage-Rumbaugh (1986) for a favourable account and Sebeok and Umiker-Sebeok (1980) or Wallman (1992) for a critical review.