The Writing Revolution

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The Writing Revolution

Cuneiform to the Internet

Amalia E. Gnanadesikan

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Preface

One day during my sophomore year of college I returned to my dorm excited by a piece of information I had encountered.

"Is it true," I asked my neighbor, Joan Kim, "that Korean uses an alphabet you can learn in a single day?" Naïve Westerner that I was, I thought all East Asian languages, including hers, had very complicated scripts.

"Faster than that," she replied. "Here, I'll show you." And she did.

So began a love affair with writing systems which has culminated many years later in this book. It is written for people who, like my college-age self, are curious to know what the apparently meaningless squiggles of written symbols actually stand for, where they came from, and how they have adapted to and shaped the cultures that have used them through the centuries.

All of the world's major scripts are here, though the inclusion of important extinct ones means that not every modern script is discussed in the detail its present cultural prominence would merit. Also given pride of place are some minor scripts whose stories I could not resist telling, while many other of the world's smaller written traditions are at least mentioned. Enthusiasts may be disappointed, however, at the absence of Easter Island's rongo-rongo, the virtual absence of Anatolian hieroglyphs, the scanty treatment of runes, or other slights and omissions. Scholars may equally find that their field of specialty is touched on too quickly, with a lack of the nuance they rightly see as its due. To them I offer my apologies, pleading the constraints of length. To other readers I offer this book as an invitation to a fascinating topic of global importance.

I would like to acknowledge here a number of people who have helped my work along the way. Of foundational importance was

John McCarthy, whose inspired teaching and mentorship helped me become a phonologist, giving me the tools to understand many of the linguistic aspects of writing systems. I was also fortunate to receive his introduction to the editors at Wiley-Blackwell. My thanks also go to people who have taught me or helped me practice their scripts over the years: Joan Kim, Sandeepa Malik, Sheela Jeyaraj, and Lydia Peters. Thanks to Bill Poser for writing-system discussion, to the folks in the tablet room of the UPenn museum for showing me their work, and to Gillett Griffin for sharing with me Princeton's Mayan collection (and his own). Thanks to Yukiyo Yoshihara and Keith Rodgers for the Japanese proverb quoted in chapter 7. Some of the ancient scripts included in the figures and occasionally in the text are in the Alphabetum Unicode font, designed by Juan-José Marcos and used here with my thanks.

At Wiley-Blackwell I would like to thank Ada Brunstein for enthusiastically supporting the book in its early days, and Danielle Descoteaux and Kelly Basner for seeing it through to the end. My gratitude also goes to the members of the production team, especially to Fiona Sewell for her expert copyediting. Thanks also to David Crystal and three anonymous reviewers who made a number of useful suggestions and corrections. Remaining errors – and stances taken on controversial topics – are entirely mine. Thanks to Susan Hines, Patricia Athay, John Kilgore, and especially Lisa Fishman Kim for their comments on chapter drafts.

The paradox of the writing life is that it is both essentially communicative and essentially solitary. My heartfelt thanks, therefore, to John Hawthorn for being there in those moments when I emerged from my cave. Finally, my love and everlasting gratitude go to my dear ones, Anand and Gitanjali, who gracefully combined constant support and love with the role of literary critics and (in Gita's case) Chinese tutor.

1

The First IT Revolution

This sentence is a time machine. I wrote it a long time before you opened this book and read it. Yet here are my words after all this time, pristinely preserved, as good as new. The marvelous technology that allows the past to speak directly to the future in this way is by now so pervasive that we take it for granted: it is writing.

Imagine a world without writing. Obviously there would be no books: no novels, no encyclopedias, no cookbooks, no textbooks, no telephone books, no scriptures, no diaries, no travel guides. There would be no ball-points, no typewriters, no word processors, no Internet, no magazines, no movie credits, no shopping lists, no newspapers, no tax returns. But such lists of objects almost miss the point. The world we live in has been indelibly marked by the written word, shaped by the technology of writing over thousands of years. Ancient kings proclaimed their authority and promulgated their laws in writing. Scribes administered great empires by writing, their knowledge of recording and retrieving information essential to governing complex societies. Religious traditions were passed on through the generations, and spread to others, in writing. Scientific and technological progress was achieved and disseminated through writing. Accounts in trade and commerce could be kept because of writing. Nearly every step of civilization has been mediated through writing. A world without writing would bear scant resemblance to the one we now live in.

Writing is a virtual necessity to the societies anthropologists call *civilizations*. A civilization is distinguished from other societies by the complexity of its social organization, by its construction of cities and large public buildings, and by the economic specialization of its members, many of whom are not directly involved in food procurement or production. A civilization, with its taxation and tribute systems, its

trade, and its public works, requires a sophisticated system of record keeping. And so the early civilizations of Mesopotamia, Egypt, China, Mesoamerica, and (probably) India all developed a system of writing. Only the Peruvian civilization of the Incas and their predecessors did not use writing but instead invented a system of keeping records on knotted color-coded strings known as *quipu*.

Early writing had three essential functions. It was used in state administration and bureaucracy, in trade and commerce, and in religion. The ancient Sumerians invented writing for administration and trade. The ancient Chinese used it to record what questions they had asked of Heaven. The ancient Maya used it to establish the divine authority of kings, and the ancient Egyptians used it to gain eternal life. In the case of trade and adminstration, the advantage of keeping written records is clear. The natural affinity of writing with religion is less transparent, but may well stem from the relative permanence – immortality, almost – of the written word. From ancient Egypt to the modern world, writing has been used to mark burials (bestowing a form of immortality on the deceased), as well as to dedicate offerings and record the words of God. Literature, which we now tend to consider the essence of written language, was a much later development – and in the case of some writing systems, never developed at all.

Writing was invented from scratch at least three times: in Mesopotamia, in China, and in Mesoamerica. In Egypt and in the Indus Valley, writing may have been invented independently, or the basic idea may have been borrowed from Mesopotamia. When the first words were written down in what is now southern Iraq in the late fourth millennium BC, history was made in more senses than one, for it is writing that separates history from prehistory, the time that can be studied through written records from the time that can be studied only through archaeology. Thanks to the time-machine technology of writing, a selection of the thoughts and words of earlier peoples have come down to us.

Writing is one of the most important human inventions of all time. It is rivaled by agriculture, the wheel, and the controlled use of fire, but by little else. The goal of this book is to shed light on how this remarkable technology actually works, where it came from, what it has done for us, and why it looks so different in different parts of the world.

Writing was invented to solve a particular problem: information only existed if someone could remember it. Once it was gone from memory,

it was gone for good. As human societies became more complex, those attempting to control them found that their memories were overtaxed. What they needed was an external storage device. What they came up with is writing.

Let's say I owe you five dollars. If I say "I will repay you next April," the words are gone the instant I utter them. They exist only in my memory and in the memory of anyone who has heard me. And who is to say I will continue to remember them? You may well want more lasting evidence of my promise. Nowadays I could record my words electronically, but the inventors of writing lived more than five millennia before the invention of the phonograph, the tape recorder, or the digital voice recorder. Nor was capturing human speech their intention; they needed a way to record *information*. The memories of non-literate people are good, but they are far from infallible, and the human memory was not made for book-keeping.

So is there any way to keep my promise alive? How can we be sure exactly what has been said, or thought, or done? I could tell someone else, who would tell someone else, who would tell someone else . . . and, as in the party game "telephone," where each person whispers a message to the next person in a circle, the message would be very different by the end. But let's say I write down the words on a piece of paper and pass the paper around the circle. The words are just the same at the end as at the beginning. There is no amusing party game left, but in recording the words we have achieved reliable transmission of information.

This is the essence of writing. Writing represents language, but it outlasts the spoken word. The oldest examples of writing have lasted over five thousand years. Others will last only until I press my computer's delete key. But all have the potential to outlast the words I speak, or the words I put together in my head. A spoken (or mentally composed) message unfolds in *time*, one word replacing the previous one as it is uttered. Writing arranges the message in *space*, each word following the previous one in a line. Writing is therefore a process of translating time into space.

Being spatial, writing is visible. But being visible is not crucial to its definition. Braille, for example, is a writing system for the blind designed to be felt with the fingers. It represents letters as a series of raised bumps that can be read by touch. In both reading by touch and reading by sight, time has been translated into space. There are also

forms of language which are inherently visible and spatial, such as American Sign Language (ASL). But such languages are akin to spoken languages in their essential properties: they too unfold in time. Like spoken words, signed words are gone the moment they are produced. By contrast, writing is a transformation of language, a technology applied to language, not language itself.

Writing takes words and turns them into objects, visible or tangible. Written down, words remain on the page like butterflies stuck onto boards with pins. They can be examined, analyzed, and dissected. They can be pointed to and discussed. Spoken words, by contrast, are inherently ephemeral. So written language seems more real to us than spoken language. Nevertheless, writing is only a means of expressing language; it is not language itself. In a highly literate culture it is easy to confuse the two, since much communication is mediated by writing, and the standards of written language influence our sense of "proper" language. But writing is not language, nor is it necessary to language.

Humans everywhere use language. It is a natural and normal human behavior. Although babies are not born speaking a language, all children who are raised around other people, who can perceive the language spoken around them (they are not, say, deaf in an environment where no sign language is used), and who are within normal range in certain mental and physical facilities will inevitably learn at least one language. They pick up their mother tongue naturally over the first few years of life. Indeed they cannot really be taught it, and will resist instruction if parents try too hard to correct their baby talk. Reading and writing do not come so naturally and must be taught. By the time children learn to read and write the vast majority of their language learning (other than further vocabulary growth) has already taken place.

As far as we can tell, language has been with us since the human race began. By contrast, writing is not a fundamental aspect of human life despite the profound impact it has had on human history. All human societies have had language, but many have had no writing. The organization SIL (originally the Summer Institute of Linguistics) has counted 6,912 languages spoken in the world today. Thousands more were once spoken but are now dead. The exact tally of languages is open to dispute, as it is often difficult to determine what forms of speech are dialects of a single language and which are different languages; also, languages change constantly, and two dialects may grow into distinct

languages (especially in the absence of a common written form); languages may also die out, and are now doing so at increasing rates. Thousands of the world's languages use no writing system; no more than a hundred languages have produced a significant literary tradition.

Although writing is secondary to language, it often enjoys higher prestige. Writing is generally done more deliberately than speaking, so finished written pieces are much more carefully crafted than a typical spoken sentence. Written texts can thus convey their message more precisely, adding to the sense that writing is worth more than speech. Until the development of modern recording and broadcasting techniques, writing could reach a larger audience than the spoken word, and continue to communicate to people over a long period of time. Writing is associated with education, and education with wealth and power. The small percentage of languages that have a well-established written tradition include all the languages of national and international influence. Most of the unwritten languages are spoken by small minority groups, and many of these languages are not expected to survive the twenty-first century. Language conservation efforts must therefore include the development of writing systems and literacy programs.

Nowadays individuals faced with the task of designing a writing system for a language can draw on a wealth of literacy experience and linguistic theory. The original inventors had no such luxury. Later pioneers had the benefit of knowing that writing was possible, but still had to make most of it up as they went along.

Take King Njoya, for instance. King Ibrahim Njoya ruled the Bamum people of Cameroon from 1880 to 1931, the seventeenth king to rule from the ancient capital of Foumban. Njoya lived in a changing world, as strange people with strange new technologies encroached on traditional lands. To the north were invading Arabs, and they gave credit for their victories to a small book. Impressed, Njoya became a Muslim. Then Europeans came along with superior fire power. When asked where their strength came from, they also pointed to a book. Their book was larger, and their power the greater. Njoya therefore considered adopting Christianity, but could not accept its requirement of monogamy.

One thing was clear, however: writing was a powerful technology, and his people needed it. So in 1896 Njoya set out to invent a writing system for his language, Shü-mom, gathering together his best thinkers and best artists to help him.

The job he faced was not an easy one. His advisors were bright, but none of them had any prior experience with writing, and so none knew how the technology worked. What should Njoya write? What aspects of the Shü-mom language should be recorded?

Could he perhaps bypass the words of language and just record the thoughts he wanted to convey? When European scholars first encountered Egyptian hieroglyphs they thought the elaborate drawings represented pure thought. They believed that the hieroglyphic signs were *ideograms* – symbols that stood for *ideas*, not specific words. This misunderstanding set the decipherment of Egyptian hieroglyphs back considerably. The ideogram hypothesis was more than just a bad guess for Egyptian, however. As it turns out, a full writing system that bypasses the encryption process of language is not possible. In other words, *information* separate from *language* is not the place to begin writing.

Rudimentary systems of such a type do exist. A road sign that shows a car skidding will convey its meaning whether you say to yourself, "Slippery when wet," or, "Watch out, you might skid," as you "read" it. Similarly, mathematical symbols and equations convey a meaning that can be expressed in any one of many languages, or even several ways within a language. What is essential in an expression such as $\int dx/(a + bx^2)^2$ is not what it sounds like in English words, but what mathematical operation it refers to.

The graphical systems of road signs and mathematics work because they apply to a very limited part of human communication. By contrast, one of the essential properties of human language is the infinite range of what can be communicated using only a finite number of basic words. If we could distill human thoughts into a finite number of concepts that could be written down, could we resist giving them names – *words*? No. We would "read" the symbols by pronouncing them as words. Written symbols cannot systematically bypass language.

So King Njoya's writing system had to encode language. But this did not make the problem much easier. The system of encoding and communicating information that we call *language* has many layers. Which layer or layers should Njoya make symbols for?

The most obvious layer of language is its words. However, to make a truly different symbol for each word of a language would result in far too many symbols. To take an example from English, the 160,000 entries of the second edition of *Webster's New World College Dictionary*

would require 160,000 different symbols. But the number of entries in a dictionary actually underestimates the number of words in a language. For example, the entry for *girlish* also mentions *girlishly* and *girlishness* – both words of English, but not given their own entries. It would be silly, though, to try to create a writing system that had one symbol for *girl*, an entirely different one for *girlish*, and another completely different one for *girlishness*. The words *girl*, *girlish*, and *girlishness* have pieces in common. They all contain the piece *girl*, while *girlish* and *girlishness* share *-ish* as well. The *-ness* of *girlishness* is also a piece that recurs over and over in English. These pieces of words are called *morphemes*. There are far fewer morphemes in a language than words, and the morphemes can be combined and recombined in so many ways that it is hard to say how many words a language actually has. It is not surprising, therefore, that no one has ever managed to create a usable writing system that uses full words rather than morphemes as its level of encoding.

A morpheme has two aspects, its *meaning* and its *pronunciation*. Writing systems that concentrate on representing morphemes – as complete meaning–pronunciation complexes – are called *logographic* (the name, meaning "word-writing," is traditional, though it ignores the difference between morphemes and words), and the individual symbols are called *logograms*, as shown in figure 1.1 Although those of us who have been trained to use an alphabet find it natural to divide words up into individual vowels and consonants (in other words, separating meaning from its pronunciation and representing only pronunciation), the first inventors of scripts did not. For them it was more natural to consider the morphemes as a whole. Core morphemes at least (those like *girl*, rather than *-ish* or *-ness*) can be uttered on their own in many languages and thus are natural units in which to think of language.

The first version of King Njoya's writing system was therefore logographic. He compiled a list of little schematized pictures that could stand for individual morphemes. After a while he had 465 of them. A symbol for every morpheme in the language was clearly going to take a lot more than that. And so he was forced to a decision that all complete writing systems have had to make in some form or another: he was obliged to begin using symbols to represent *pronunciation*.

The pronunciation (or *phonology*) of language also has several layers. Words are made of one or more morphemes, but they are also made of one or more *syllables* in the way they are pronounced. A word

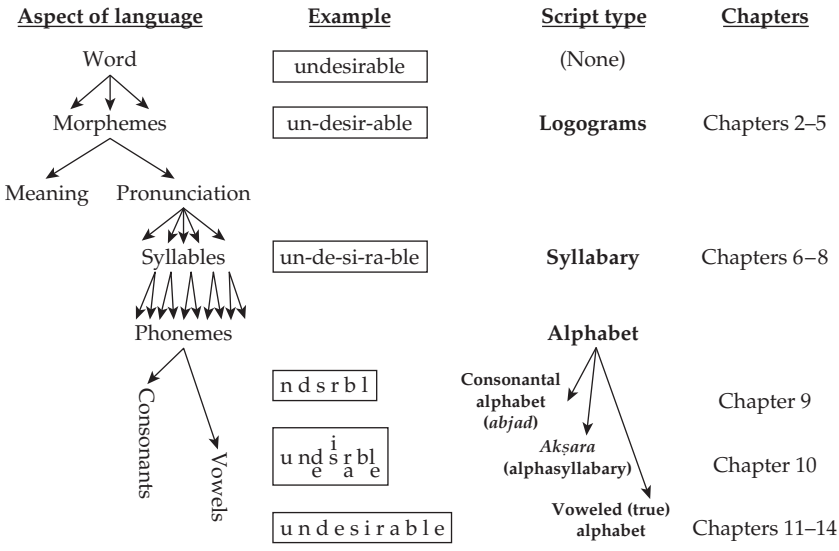

Figure 1.1 How different writing systems represent language. Logograms represent morphemes, both their meaning and pronunciation, while syllabaries and alphabets represent only pronunciation. In the column of examples, the word *undesirable* is used to illustrate how the various writing systems would divide up such a word. A morphemic (logographic) system would use three symbols, a syllabary five, and so forth. In an akṣara system, the vowels are written as appendages to the consonants.

like *cat* has a single morpheme and a single syllable, but a word like *undesirable* contains three morphemes and five syllables. Thus a logographic writing system would give *cat* one symbol and *undesirable* three, while a *syllabary* would give *cat* one and *undesirable* five. That lengthens the spelling of *undesirable*, but lessens the number of symbols needed in all, as there are fewer distinct syllables in a language than there are distinct morphemes.

So King Njoya converted a number of his symbols into *syllabograms*, standing for syllables – just a pronunciation, unconnected to any meaning. The meaning would come only when the syllabograms were put together to make up words. He worked on his script over a period of many years, ending with a syllabary of 73 signs, plus 10 numerals. He put the writing system to good use, compiling a law code, designing a calendar, and founding schools.

Other ways of writing were theoretically open to him. Syllabaries come in different kinds. Most represent only *core* syllables (a single consonant + short vowel sequence) and find a variety of workarounds to represent other kinds of syllables. A few include symbols for *closed* syllables (those that contain a final consonant), and a few writing systems of the world split the syllable in two, representing the consonant(s) at the beginning (the *onset*) with one symbol and the rest (the *rhyme*) with another.

More familiar to Westerners is the kind of writing system that ignores syllables entirely and looks at the individual sounds out of which syllables are made. This requires knowing what counts as an "individual sound." Consider for a moment the words *feel* and *leaf*. They appear to contain the same sounds, in reverse order. However, if you say the two words slowly, and pay close attention to your tongue as you say the *l*s, you may notice that the *l* in *feel* has the back of the tongue pulled back and upward compared to the *l* in *leaf*. Chances are, however, that you have never noticed it before. Similarly, the *p* in *spoof* is pronounced quite differently from the *p* in *poof* – you can blow out a candle by pronouncing the latter but not the former.

There are many such variations in sound that native speakers of a language disregard and typically have lost the ability to hear unless they have had training in phonetics. Native speakers of a given language will consider an entire range of sounds to be the "same." That "same sound" that native speakers perceive is called by linguists a *phoneme* of that language. The actual sounds of language are infinitely varied, as they are uttered by different people in different circumstances. It would be pointless to try to capture this variation in writing. But most languages have between 20 and 37 phonemes, and phonemes can be written down. An alphabet that is strictly phonemic would have the same number of letters as phonemes (though English does not).

Technicalities aside, an important point here about these abstract phonemes and syllables is that although writing represents information about how words are pronounced, it does not record the identifying details of any individual utterance of those words. It records *language*, but not actual *speech*. Even in cases of dictation or courtroom stenography, much information about the actual speech is lost, such as intonation and emotional content. As a result, reading is not at all the same as listening to a recording (and can therefore, fortunately, proceed much faster).

Writing systems that represent individual phonemes are called *alphabets*. It is therefore inaccurate to refer to the "Chinese alphabet" or the "Japanese alphabet," as these writing systems do not work at the phonemic level. A further level of distinction separates alphabets into those that represent only or primarily consonants (consonantal alphabets, also known as *abjads*), those that represent vowels as somehow dependent on the preceding consonant (*akṣara* systems or *alphasyllabaries*), and those that give vowels and consonants equal status ("true" or voweled *alphabets*).

All writing systems find themselves somewhere in the range from morphemic to phonemic (see figure 1.1). The more morphemic writing systems may also do a little to directly represent the semantic aspect of a morpheme in the form of clues to meaning known as *determinatives* (thus the symbol for "cat" might include a symbol showing that it is an animal). But no writing system is so completely morphemic that it pays no attention to the phonology (syllables and/or phonemes) of the language. Some scripts are fully phonological, representing either the phonemes or the syllables of the language. On the other hand, no written language is simply a record of uttered sounds: that is left up to a less significant invention, the phonograph, and its modern descendants.

The earliest writing systems were, like King Njoya's first efforts, all highly logographic. Later writing systems are typically more phonologically based and use far fewer logograms. This is not to say that logographically based scripts are primitive. Logograms have the advantage of using space very efficiently, needing only one sign per morpheme, where alphabets need several. They are also more convenient in contexts where pronunciation varies significantly, making phonologically based writing hard to standardize. Yet an alphabet, with its limited number of signs, is the more easily memorized and can therefore spread faster in a context of limited schooling. What kind of writing system a language uses is largely determined by the accidents of history and by the properties of the language itself.

King Njoya's labors had a sad ending. The French colonial forces burned his books and exiled him from Foumban in 1931. Today, despite Cameroon independence, his writing system is nearly forgotten. His grandson, the present king, sponsors classes in it at the royal palace in Foumban, but it sees very little actual use. Other scripts have been luckier. Born into more propitious time they have enjoyed a more extensive history. The following chapters tell their stories.

First, in chapters 2 through 5 are the stories of ancient logographic systems – Mesopotamian cuneiform, Egyptian hieroglyphs, Chinese characters, and Maya glyphs – along with their syllabic or consonantal compromises. Next, chapters 6 through 8 tell of syllabaries, from the Bronze-Age Linear B used for Greek, through the two Japanese syllabaries, to the modern invention of the Cherokee script. Phonemic scripts follow, with consonantal alphabets, akṣara systems, and voweled alphabets in turn. In the final chapter the effects of secondary writing technologies – printing, typing, word processing, and the Internet – are considered, along with the globalization of the Roman alphabet.

A book about writing systems faces one significant obstacle: transliteration. The phonemes, syllables, and morphemes recorded by the world's writing systems cannot all be recast into the Roman alphabet in a single, unambiguous way. The languages of the world contain some 600 distinct consonants and 200 different vowels. Not all of these have yet been converted into writing, but clearly there needs to be a way to translate the scripts we do not know into one we recognize, so that we know what they say. Many languages already have established ways of being transliterated into the Roman alphabet or use the Roman alphabet themselves. For many transliterated languages the general operative principle is "consonants as in English, vowels as in Italian." Such a system glosses over a lot, as there are only so many consonants in English and so many vowels in Italian. Furthermore, languages that already use the Roman alphabet do so in many different, mutually incompatible ways.

Therefore I will use standard spellings and transliteration systems where their meaning is clear, but will supplement them where necessary with the International Phonetic Alphabet (IPA). The IPA is designed to represent all the phonemes of human languages. By transcribing an alphabet into the IPA we can tell what phonemes that alphabet encodes: it is a sort of decoder ring for alphabets.

The IPA is reprinted in the appendix (figure A.1). Examples of English phonemes transcribed into the IPA are given in figure A.2. When using IPA symbols to describe a pronunciation, I will write them between square brackets. This is to emphasize that what is being referred to is a *sound*, not a letter of the Roman alphabet. Thus **b** is a letter, but [b] is a sound. In many cases the IPA symbol represents the same sound that the Roman letter does in English, but this is not always

so, especially in the case of vowels, where the symbols taken from the Roman alphabet generally have the sound values that they do in most continental European languages (such as Italian).

Sounds that do not occur in English will be explained where relevant in later chapters. However, much can be learned about them from studying the IPA charts. The purpose of laying out the IPA vowel and consonant symbols in charts is that even if your language does not contain a particular sound, you can get a fairly good idea of what it sounds like from the description and its place on the chart. For instance, English does not have the [x] sound. However, the consonant chart describes it as a fricative, in the same row as [f], [v], [θ], [ð], [s], and [z], which do occur in English (as in ***f****ine*, ***v****ine*, ***th****in*, ***th****ine*, ***s****in*, and ***z****en*). A fricative is, like any of these sounds, a sound that you can keep on making (unlike a plosive, such as [b]), but that makes a turbulent sound of rushing air (unlike, say, [l]). The column [x] is in shows that it is a "velar" sound. This tells us that it is made in the same part of the mouth as [k] and [g], at the soft palate toward the back. It is therefore the "ch" sound of Scottish *loch* or German *ach*. Most English speakers find this sound impossible to pronounce correctly. However, with the IPA they can at least talk about it, even if they can't produce it.

The vowel chart also has many sounds that English does not possess, such as [y]. It is described by the chart as "close" and "front." Even if those terms do not mean anything to you, you can tell from the chart that it is similar to [i], the vowel in English *s****ee***. But unlike [i], it is "rounded." This means that it is made with pursed lips, like [u], the vowel in *f****oo****d*. If you say [i] and then try to say it with your lips pursed, you may manage the vowel [y]. Most English speakers have a great deal of trouble with it. It is the vowel sound in French *t****u***.

A full understanding of the IPA is not necessary to this book. However, if you find yourself wondering what sounds the symbols in a script actually refer, you can get a rough idea by using the IPA chart.

2

Cuneiform: Forgotten Legacy of a Forgotten People

Our story begins in the Middle East, in what is today southern Iraq. Nestled between the southern reaches of the Tigris and Euphrates rivers was a land whose earliest recorded name is Sumer (see map in the appendix, figure A.3). The land was rich and fertile, but dry. With irrigation, however, the land yielded enough and to spare; the extra food encouraged the growth of trade and the development of specialized professions and stratified social classes. Over time these developments led to the birth of a true civilization in the centuries between 3500 and 3000 BC.

It was a momentous period. Facing a drying climate, people living in northern Mesopotamia moved south to avail themselves of the benefits of irrigation. The necessity of feeding a larger population was the mother of a number of inventions: the plow, the grain sled, the potter's wheel, wheeled vehicles, and the sail. These technologies allowed people to plant more food and to store, transport, and trade it more easily. To keep pace, irrigation technology had to be improved, and larger-scale irrigation systems built. Such public works required concerted community effort, encouraging the rise of strong community leaders. With fertile land at a premium, scattered villages began to be replaced with more compact, centralized cities. As the cities grew in size and complexity of organization, so their leaders accumulated power and wealth.

The growth of civilization required yet another advance in technology. The complex society of a city-state requires administration, and administration requires record keeping. Early attempts to meet this need included the working out of a numerical tally system and perhaps the use of tokens, which stood for farm animals, quantities of grain, trade goods, or other objects that needed to be recorded. But these advances

were not enough to meet the culture's growing bureaucratic needs. The technology that emerged to meet those needs – writing – filled a prosaic but essential purpose: accounting. The impetus behind its invention was not a desire to faithfully record language, but to record trade transactions, crop yields, and taxes – to record and preserve *information*, not *language*. It was the first – and most important – information technology revolution. It succeeded in preserving information, however, by representing language – crudely at first, but with increasing precision. As the technology matured and spread, it came to be used for languages of five separate linguistic families and inspired the development of several other scripts; it shaped forever the world that came afterwards.

Commodities such as wood, stone, and metal had to be imported into Sumer, but thanks to the Euphrates and Tigris rivers the land was rich in mud. The right kind of mud produced clay. Almost everything in Sumer was made of clay: bricks for houses and temples, tools, and even writing surfaces. Clay left to dry of its own accord is fairly durable; baked clay is virtually indestructible. It is because of this property of clay that ancient Mesopotamian writing is preserved for us: early unbaked tablets have come down to the present rather crumbly but often still legible after five millennia, while tablets that experienced the sacking and burning of cities were merely strengthened by the process. Later tablets were sometimes intentionally baked to preserve them.

The earliest writing known to archaeologists is found on small clay tablets unearthed from the ancient city of Uruk. Uruk (biblical Erech, modern Arabic Warka) was once a thriving city on the banks of the Euphrates. It is now a large and desolate heap 12 miles from the Euphrates, the river bed having shifted over the course of the millennia. Arguably, the name has changed less with time than the geography.

Modern excavations began at Uruk in 1912. As is usual in archaeology, the periods of occupation have been named from the top (latest, but first to be unearthed) downward. Thus Uruk I is more recent than Uruk II, and so forth. It is during the period Uruk IV that writing is first attested, around 3400 or 3300 BC. In the Uruk III period (c.3200–3000 BC), a few other Sumerian cities also show evidence of writing. Either independently or by the inspiration of the Sumerians, writing also appears around this time east of Mesopotamia at Susa – recording the as yet undeciphered proto-Elamite language – and to the west in Egypt.

Though the earliest known writing comes from Uruk, we cannot be entirely certain that this is where writing was actually invented. However, later Sumerian legend also places the first writing there. The invention is ascribed to Enmerkar, said to have been king of Uruk after the Great Flood of Sumerian legend. Enmerkar was engaged in a contest of wills with the lord of far-off Aratta. He had sent three messages demanding tribute and had been denied three times. His final move was to send a written clay tablet. The written message reduced the lord of Aratta to submission, perhaps in recognition of the significance of the invention.

The first written tablets are in a script we call proto-cuneiform. About 85 percent of them are of an administrative or accounting nature, while the remaining 15 percent are lists of words. The latter were spelling lists, used by scribes practicing the signs for the various professions, agricultural produce, and commodities. The same word lists, written in the same order, were used for hundreds of years; conveniently, this fact allows modern Sumerologists to use the later lists to identify early proto-cuneiform signs.

Proto-cuneiform was scratched, or drawn, into damp clay tablets (see figure 2.1). Numerals figure prominently in the early business records: of the roughly 800 different signs that have been identified, 60 or so are numerals. This is a lot, compared to the 10 digits we use today. But the early Sumerians did not use numerals abstractly, without reference to what was being counted. Instead, different systems of numerals were used for counting different things: for discrete entities, for areas of land, for periods of time, for quantities of grain, and so forth. This was probably a holdover from the tally systems of the preliterate period, when numerals that told you something about what was being counted were an advantage rather than a cumbersome inconvenience.

Of the remaining signs, some were straightforwardly pictographic – stylized pictures of identifiable objects – like the sign for "head," *sag*, or the sign for "fish," *ku*, shown in the left-hand column of figure 2.2. In such cases the shape of the sign indicated fairly clearly what the meaning of the word was. In other cases the relationship between the appearance of the sign and its meaning was looser, and would only be apparent after one already knew what the meaning was. Still other signs were from the beginning entirely arbitrary or highly abstract, like the sign for "sheep," *udu*.

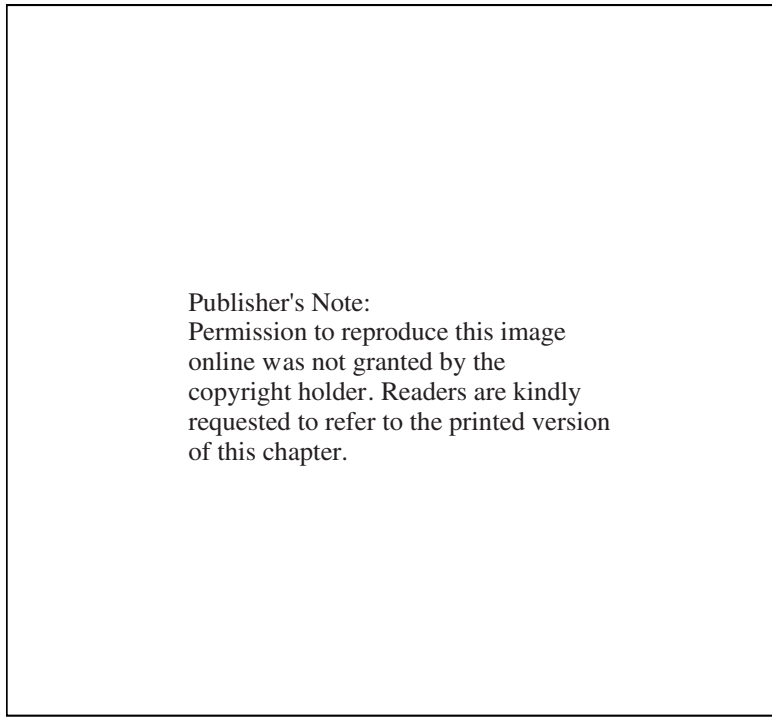

Figure 2.1 A proto-cuneiform tablet. Administrative tablet with cylinder seal impression of a male figure, hunting dogs, and boars. 3100–2900 BC. Jamdat Nasr, Uruk III style, southern region, Mesopotamia. Clay, H. 2 in. (5.3 cm). Purchase, Raymond and Beverly Sackler Gift, 1988 (1988.433.1). The Metropolitan Museum of Art, New York, NY, U.S.A. Image copyright © The Metropolitan Museum of Art/Art Resource, NY.

Yet to have a separate sign for each word (even just those consisting of a single morpheme, like *sheep*) requires a great many signs, and if one is relying on pictography there is the problem that not all words are easily drawn. Modern players of Pictionary can attest to this fact. The early Sumerians came up with a number of workarounds for this obstacle. Less easily pictured words often used the same sign as one that was more easily pictured but had a similar meaning. Thus the sign for "mouth," *ka*, which indicated the position of the mouth on a picture

Proto-cuneiform c.3000 BC	**Early cuneiform c.2400 BC**	**Late (Neo-Assyrian) cuneiform c.700 BC**	**Transcription and meaning**
			sag "head"
			ka "mouth"
			du/gin/gub "go/walk/stand"
			gud "ox"
			udu "sheep"
			ku "fish"
			dug "pot"
			gi "reed, to render"

Figure 2.2 The development from proto-cuneiform, through early Sumerian cuneiform, to later Akkadian cuneiform. Proto-cuneiform signs were often pictographic, though not always, as the sign for "sheep" shows. By late cuneiform the pictographic origins are hard to spot. At some point between the second and third columns the orientation of signs (and tablets) was rotated by 90 degrees.

of the head, could also mean "tooth" (*zu*), "word" (*inim*), "voice" (*gu*), or "speak" (*du*), depending on context. Another way to represent words was to combine or modify other, simpler signs. Thus a sign that showed a jar (*dug*) became, with the addition of stippling or cross-hatching, *kaʃ*, the beer that was kept inside such a jar.

Some signs were not meant to be read aloud, but functioned as determinatives – unpronounced signs that told the reader what class of thing was being referred to. Early determinatives marked divine

names, wooden objects, and male and female names. The use of determinatives is common in logographic writing systems, but they are not unknown elsewhere. In English, for example, we vary letters between upper and lower case. The words *frank* and *Frank* are pronounced the same and spelled with the same letters, but the capitalization of *Frank* informs us that it is a name, while *frank* is an adjective. The use of upper case thus serves as a determinative in English.

In contrast with determinatives, some signs were used precisely because of their pronunciation. For example, *gi* meant "reed." But the word that meant "to render" in Sumerian was pronounced precisely the same, so the reed symbol was also used to mean "render." Similarly, *ti* meant "arrow," but it could also mean "life," so a sign depicting an arrow could mean either one. This use of an easily pictured object to stand for its more abstract homonym is known as *rebus writing*. Proto-cuneiform used it sparingly, but enough to allow us to identify proto-cuneiform as the writing of language rather than merely concepts, and to convince some scholars that the language represented was indeed Sumerian. Without these homonym pairs we would know very little about the pronunciation of proto-cuneiform.

The written messages of proto-cuneiform tablets are all rather telegraphic. All grammatical information, such as verb tense or noun case, was omitted, and only the core morphemes of words were shown, without any prefixes or suffixes. The signs were arranged in boxes outlined on the tablets, one statement per box. The order of the signs within a box did not follow the order of spoken language, and some have even described it as random. Yet there do seem to be patterns: they tended to first record numerals, then the objects counted, and then other relevant information about them, such as "3 sheep temple," meaning, presumably, that three sheep had been given to the temple. Different types of transactions appear to have been organized differently. But there is much about the arrangement of proto-cuneiform signs that is not obvious to the modern reader; the ancient scribes would have been able to use a significant amount of contextual understanding that is lost to us.

The proto-cuneiform system was limited and full of ambiguities. However, for the purposes to which it was put it was quite adequate, and context provided the necessary disambiguation. As a technological and intellectual development, it was like nothing the world had seen before.