Writing systems: methods for recording language

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The study of writing systems as a branch of linguistics

Until recently, the study of writing systems was something of a Cinderella subject within the discipline of linguistics. For a long time there was only one standard monograph, I.J. Gelb's 1952 book *A Study of Writing*, which was valuable but was little influenced by the insights of modern structural linguistics. Many linguists saw human language as a window onto biologically-determined structures and processes of cognition; writing, as a technology evolved only within the past few thousand years and hence clearly a cultural rather than biological endowment, seemed accordingly less interesting than spoken language.

Large misunderstandings of the nature of non-European scripts were rife. As recently as 1963 the distinguished anthropologist Jack Goody claimed that the non-alphabetic Chinese script (the vehicle of one of the world's greatest civilizations for three thousand years) was a limited system, which was incapable of expressing a complete range of ideas and hindered the adoption of standards of logic usual in "literate" societies (by which Goody meant societies using an alphabet). The Maya script of Central America has been recognized since its decipherment as the clearest case anywhere of a writing system which developed entirely independently of the ultimate Middle Eastern ancestors of European writing; until his death in 1975 the influential Mayanist Eric Thompson continued to insist against the decipherers that the system was not writing at all, but consisted only of stylized illustrations of Maya mythology.

Happily, in recent decades things have changed. The study of writing is acknowledged now as a valid branch of linguistics alongside its other branches. Globalization has led Westerners to be less credulous about absurd misrepresentations of alien systems. The claim that different human languages all reflect an innate universal grammar looks less plausible to linguists today than it once did, and if languages are products of culture rather than biology then there is no reason to ignore written languages merely because they are newer cultural developments than their spoken counterparts. Writing may be a newish form of language, but in the circumstances of modern life it is a very important one.

The main difficulty in placing the study of writing systems on a scientific footing, arguably, is not nowadays lack of good information about non-European scripts, but the fewness of independent examples. There are thousands of spoken languages in the world, falling into dozens, perhaps hundreds, of apparently unrelated families,

but writing appears to have been independently invented only a few times in world history. Very many of the quite different-looking scripts used for various languages of the Old World all ultimately trace their ancestry to the second-millennium-BC Phoenician alphabet from which our own Roman alphabet descends, and it is likely that the forerunners of the Phoenician alphabet were themselves influenced in their creation by some of the older non-alphabetic scripts of the Middle East. Probably Chinese script was a purely indigenous creation (as Maya script certainly must have been), but there is little extant evidence for the earliest stages of Chinese writing and some have argued for cultural links with Middle Eastern writing through Central Asia. It can be difficult to arrive at reliable generalizations, in a field where there are limited possibilities of checking them against independent evidence.

Types of script

The most straightforward way to bring order into the diversity of present-day and past scripts is to classify them by type. (The term *script* will be used for a set of written marks together with conventions for using them to record a particular language; thus e.g. English and Finnish use the same alphabet, but their "scripts" are rather different – English spelling being highly irregular and Finnish extremely regular.) As in the case of typology of spoken languages, in classifying scripts it is necessary to define a range of ideal types, and to bear in mind that real examples rarely or never perfectly exemplify the type under which they are categorized.

In the first place, we can ask of a script whether it represents a spoken language at all. We usually think of "writing" as a means of visually recording spoken utterances, even if the utterances are only potentially spoken (probably most 21st-century written documents are never read aloud, and there are cases like Latin where a written language continues to be used for some purposes but the colloquial spoken language it originally represented is long dead). In principle, though, there is no reason why a system of communication by visible marks could not be developed independently of any spoken language. Within certain limited domains, such systems have become widespread over the past century: two examples are the international system of road signs, and the symbols for garment care. These symbols form conventional systems that have to be learned (one could not guess without instruction that, say, a triangle crossed by parallel diagonals means "use non-chlorine bleach", or that a red-bordered white disc means "closed to vehicles"). But at the same time they do not represent particular sequences of words of English or any other language – they are international, and the road sign mentioned could equally well be translated into English as "no wheeled traffic allowed", or as "vehicular access forbidden".

These two systems are very limited in their spheres of application. Many primitive cultures, for instance in the Americas and in Siberia, have used conventional systems of graphic marks to indicate ideas independently of words, but those systems too have been quite limited relative to any spoken language – often they seem to have served more as mnemonics to remind users of details of a message or story, rather than as devices to communicate information to people having no prior knowledge of it. But more comprehensive systems of speech-independent graphic communication have been created. Probably the most fully worked out system is

Blissymbolics, developed by Charles Bliss, a chemical engineer who escaped Nazi Europe for Australia, which is intended to be comparable in expressive power with spoken languages, containing thousands of symbols. (An example is shown in Figure 1.) Blissymbolics is claimed to be particularly helpful to people with cerebral palsy and other disabilities which interfere with reading and speaking, and has been used with disabled children particularly in Canada.

Figure 1 about here

Systems such as these are called *semasiographic*, as opposed to *glottographic* writing systems which express ideas by representing the elements of a spoken language. Many scholars prefer to reserve the term "writing" for glottographic systems (so that for them Blissymbolics would not count as writing, however complete its communicative resources). That is clearly an issue about definitions only, rather than a disagreement about substance. However, the remainder of this chapter will focus exclusively on glottographic systems of various kinds.

A striking property of all spoken languages is what André Martinet called "double articulation". That is, any particular language chops reality up into discrete categories in some particular way – so, for instance, English divides the inherently continuous rainbow spectrum into *red*, *orange*, *yellow*, and so on, while other languages may divide the same spectrum into fewer colours, or more; and at the same time a language divides speech sound into discrete units – some languages divide the physically-continuous range of front vowel sounds into three contrasting phonemes, /i e a/, while other languages recognize only two front-vowel phonemes, and others again recognize four or more. A language works by making these two articulations, and linking units of the first articulation (words, or morphemes such as *re-*, *-ceive*, *-ing*) with groups of units of the second, phonetic articulation.[1]

Among glottographic writing systems, then, the next question is what type of spoken-language units are represented by individual units of the script. A script whose elements stand for elements of the first articulation, such as words, is *logographic*; a script in which they stand for elements of the phonetic articulation is *phonographic.*

Phonographic scripts can be further classified in terms of the size of phonetic units represented by the script elements. In the West, laymen tend to think of division of the continuous speech stream into consonants and vowels as the "natural", "obvious" form of segmentation. But it only seems so because the tradition of alphabetic writing has trained us to divide speech that way. (Chinese philologers, whose script was not phonographic, did not analyse speech-sounds into linear sequences of consonants and vowels before China's encounter with the West.) A more natural unit than the phoneme is the syllable. And an individual consonant or vowel can be analysed into a set of phonetic features: for instance the English

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[1] In this chapter, /solidi/ and [square brackets] will be used to enclose "broad" and "narrow" phonetic transcriptions, as is standard in linguistics; <angle brackets> will enclose romanizations of letters of non-Roman scripts, thus "the Hebrew letter <d>" will refer to the letter of the Hebrew alphabet which is pronounced as /d/ (and whose shape is ד).

phoneme /m/ may be treated as a name for the combination of bilabial closure, voice, and nasality.

Different phonographic scripts can be based on any of these levels of phonetic unit: a phonographic script can be *syllabic*, *alphabetic*, or *featural.*

The term "alphabetic" is used here in preference to "phonemic" or "segmental", because the latter terms carry irrelevant theoretical baggage. The word "phoneme" is commonly used in connexion with the fact that related but distinct sounds may "count as the same" within a particular language, as the distinct first and last consonants of the word *lull* count as the same in English – they are "allophones" of one "phoneme". This issue has little significance in the study of writing systems. In practice, whether a phonographic script writes allophones alike or differently usually has little to do with linguistic theory, and much more to do with the prior values associated with the script symbols when they were first adapted to write the language in question.

We see this if we look at how romanization systems have been devised in our own time for languages that were previously unwritten or written with other kinds of script. For instance, Chinese has a single mid vowel phoneme with three allophones: in neutral environments it is back spread [ɤ], but adjacent to labials or rounded vowels it is [o], and adjacent to front vowels it is [e]. In the now-standard *pinyin* romanization system for Chinese, [o] is spelled as *o*, but [ɤ] and [e] are both spelled *e*; it would not occur to anyone (other than an academic linguist!) that the three sounds "ought" all to be written the same way, or "ought" to be assigned three different spellings. What mattered in practice was that the Roman alphabet offered two and only two letters customarily standing for mid vowels, and had no letters standardly used for back spread vowels.

That is typical of the processes by which alphabetic scripts were evolved long ago for European languages which have never been written any other way. Sometimes novel sounds do force script devisers to innovate; when in the ninth century St Cyril adapted his Greek alphabet to write Slavonic languages, the latter contained so many sounds unknown to Greek that, for instance, Cyril borrowed the Hebrew letter *ש shin* to write the [ʃ] sound (ш in modern Russian printing), and even added an arbitrary hook to write the complex sound [çc] as щ. But cases like this are exceptions rather than the rule. In the main, tradition outweighs linguistic theory in shaping writing systems.

As for "segmental": linguists use the term "segment" specifically for consonant- or vowel-sized sound units, but to the layman a "segment" of speech sounds as though it could be of any length, so that a whole syllable might be a segment. To avoid misunderstandings, it is best to call the European type of script "alphabetic".

These typological distinctions will be made clearer by discussing examples.

Logographic script exemplified

Taking the logographic category first, the obvious example to cite is Chinese script. To explain how Chinese writing works, we need to look at its historical development.

The beginnings of the script are unknown. By the time of the oldest extant inscriptions, from the late second millennium BC, the script was already so elaborate that it must have emerged from a period of development that is lost to the record. But those oldest examples allow us to see how the script evolved.

Chinese, and particularly the Old Chinese of that period, was an "isolating" language in which each word was a single invariant morpheme (there was no inflexion), and was pronounced as a single syllable. To write the language adequately, what was needed was a recognizable graphic shape for each word. We shall use the term *graph* for the symbol used to write a Chinese word ("character" is used synonymously).

Initially, rather more than a thousand words were equipped with graphs by drawing pictures representing their meanings. The pictures were highly stylized (for instance, animals would commonly be shown with an eye representing their entire head), and sometimes we cannot now tell what the original form of a graph was intended to depict, but many early graph forms are recognizable as pictures today.

(This transparency did not last. Changes in writing materials caused the shapes to change, with curved lines replaced by straight lines and angles; by about 200 BC the elements of Chinese script had become arbitrary shapes with no pictorial value.)

Two methods were adopted to create writings for more words. First, a graph created for one word would be used also for other words pronounced the same or similarly. Then, the ambiguities thus created were resolved by adding, to a graph chosen for its phonetic value, a subsidiary graph indicating the broad semantic category into which the target word fell. In Chinese script as it exists today, most graphs have this bipartite structure, combining a *phonetic* with a *signific* element.

Take, as an example, the graph 昔. The original shape of this graph appears to have depicted strips of meat and the sun, making it a suitable writing for the word /sjak/ 'dried meat'. (Reconstructed Old Chinese pronunciations follow the system proposed by William Baxter.) 'Dried meat' had a homophone meaning 'formerly', and the same graph was borrowed to represent that word also. Then, 扌 'hand' was added to form a graph for 措 /tsʰaks/ 'to place'; the addition of 足 'foot' gave 踏 /tsʰjak/ 'walk reverently'; 口 'mouth' gave a graph 嗜 for /tsjaks/ 'sigh', and 亻 'human being' gave 借 for its homophone /tsjaks/ 'borrow'; and so on. Also, 'dried meat' came to be written with the addition of the 'flesh' graph, 腊, leaving the simple graph 昔 to be used only for 'formerly'. ('Dried meat' was the word corresponding to the original picture, but 'formerly' was the concept that was difficult to indicate via a signific element.)

The Old Chinese pronunciations of these words were not identical, but they were close enough to make the logic of the system apparent. If nothing had changed, one

might be inclined to see Chinese script as fundamentally a syllabic phonographic system, though with a logographic aspect in terms of the significs, and with considerable imprecision in the relationship between syllables and graphs. (Not only are the words sharing a phonetic element not perfect homophones, but other words pronounced similarly are written with different simple graphs – a word 'slipper, sole' was pronounced /sjak/ like 'dried meat' but was written with an unrelated graph, which in turn was used as phonetic in further phonetic/signific combinations.) Some scholars who maintain, as a linguistic universal, that all writing systems are based on sound have described Chinese script in that way.

However, over the more than three thousand years that have followed the creation of the graphs, Chinese pronunciation has changed hugely, and one consequence is that the phonetic elements of graphs offer far less reliable indications of pronunciation than they once did. 'Formerly', Old Chinese /sjak/, is pronounced in modern Mandarin *xī* (*x* represents a sound between English *s* and *sh*); and the other words listed as written with 昔 as phonetic are now: *cuò* 'to place'; *qì* 'walk reverently'; *zhà* 'sigh'; *jiè* 'borrow'. These spoken forms no longer share much family resemblance. With respect to the present-day language, one must describe Chinese script as a fundamentally logographic system, though one in which the graph for a word will often contain vague hints at its pronunciation and its meaning.

It may have been essentially a chance matter that Chinese script originally achieved precision by incorporating logographic elements, rather than finding ways to make its phonetic indications more exact. But as the spoken language has developed, logography has come to suit it very well. One consequence of the sound changes which led to modern Mandarin has been a vast increase in the incidence of homophony. Although the word for 'dried meat' is now pretty well obsolete, there are twenty or so morphemes of the modern spoken language which were pronounced differently from 'formerly' in the Old Chinese period but have now fallen together with that word as *xī*. Most other Mandarin syllables are similarly overloaded with alternative meanings. In the modern spoken language the resulting ambiguities have been mitigated through innovations in vocabulary structure, and in any case ambiguity can be negotiated away in face-to-face speech by people who share a common frame of reference. But for public writing, where far less shared knowledge can be assumed, a phonographic script for Mandarin Chinese would scarcely be usable.

And since, over about the past 1400 years, the Chinese language has fissioned into a number of regional dialects that are not mutually comprehensible, the script has the further large advantage of preserving the unity of the language. The dialects differ greatly in pronunciation but little in vocabulary or grammar, so written Chinese can be understood by speakers of any dialect.

Phonographic script-types exemplified

Turning to phonographic systems: readers of this book will not need an explanation of alphabetic writing, but we shall look at examples of syllabic and of featural scripts.

One modern language using a *syllabic* script is Japanese. The Japanese writing system is exceptionally complex, which is a consequence of the fact that the Japanese borrowed the notion of writing from China, but the Japanese language is quite different in type from Chinese (the two languages are not genetically related). Unlike Chinese, Japanese has an extensive system of grammatical inflexion. Roots of inflected words are written using Chinese logographs (we shall look at that aspect of Japanese script later), but the inflexional affixes, together with "grammar words" comparable to English *the*, *of*, are written syllabically.

The phonology of Japanese is simple, with almost all syllables consisting just of one consonant followed by one vowel, and the numbers of distinct consonants and vowels are not large by world standards. Consequently a system of 49 basic symbols, together with two diacritics marking consonant variations, is enough to write any Japanese syllable. (If a language like English, with syllables like *grand*, *squeeze*, were written syllabically, far more symbols would be needed.)[2]

The crucial point making this aspect of Japanese script truly "syllabic" rather than segmental is that the signs for various syllables sharing the same consonant, or sharing the same vowel, are not graphically related in any way. Thus, the syllables /na ne ni no nu/ are written な ね に の ぬ; /a ha ka ma na ra sa ta wa ya/ are written あ は か ま な ら さ た わ や. Any partial visual similarities that might appear to exist in these respective series would be purely coincidental.

At the other phonographic extreme, a *featural* script is one in which the various phonetic features which jointly go to make up a speech-sound are separately indicated in the script.

Japanese syllabic writing in fact has minor elements of this. Japanese has a voiced/voiceless contrast in stop consonants; rather than providing separate symbols for syllables with the two kinds of stop, the script writes a voiced-consonant syllable by adding a small double tick to the corresponding voiceless-consonant syllable: /ta da/ た だ, /ki gi/ き ぎ. And, historically, the /h/ phoneme originated as a fricative counterpart to the stop /p/; syllables in /p-/ are written by adding a small circle to the symbols for syllables in /h-/: /he pe/ へ ぺ.

It is possible, though, for a script to be more thoroughgoingly feature-based than this. A particularly clear case is Pitman's shorthand, devised in the nineteenth century by the teacher and educational publisher Isaac Pitman, which became the most widely-used shorthand system in Britain. In this system, consonants are written as extended lines, vowels as small marks adjacent to them. Among consonants, the voiced/voiceless contrast is represented by thick v. thin lines. Stops v. fricatives correspond to straight v. curved lines. Long vowels and diphthongs are distinguished from short vowels as heavy versus light vowel marks; and so on.

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[2] For completeness it should be mentioned that Japanese in fact uses two different syllabaries: any given syllable can be written in two ways, depending on the linguistic context. The examples shown below represent the "*hiragana*" syllabary.

Probably no script used as the standard writing system for any language takes the featural principle this far. But the Korean "alphabet" comes close. Korea, for many centuries, used Chinese as its written language, as mediaeval Europe used Latin, but in the fifteenth century a phonographic system was devised to enable Koreans to write their own language. This is now the normal script of North and South Korea.

Korean has a three-way "manner" contrast in stop consonants, between lax, tense, and aspirated stops. For a given place of articulation, a simple graphic form represents a continuant made at that place, and stops are written by adding one horizontal and two horizontals for the lax and aspirated stops, respectively, and by doubling the lax symbol for the tense counterpart. Thus (marking tense stops with asterisks): /n t tʰ t*/ are respectively ㄴ ㄷ ㅌ ㄸ; /s ts tsʰ ts*/ are ㅅ ㅈ ㅊ ㅉ. (The precise realization of the sibilants varies and would not always be transcribed narrowly with the [s] symbol, but the script ignores subphonemic detail.) Among the vowels, front vowels are written by combining the corresponding back vowel symbol with the symbol for /i/.

Admittedly, the scheme is not carried through with total consistency. Thus, /m/ is a square, ㅁ, but /p/ is written as ㅂ rather than with a horizontal above the square. On the other hand, in another respect one might see Korean script as *more* featural than Pitman's shorthand. The basic place-of-articulation shapes were originally chosen to depict the corresponding gestures of the vocal organs. Thus, ㄴ for the apical series shows the tongue-tip of a (left-facing) speaker raised to the hard palate; and the original shape for the sibilant series, thought of by Koreans as "tooth sounds", was a simple inverted V representing a tooth.

A cautionary remark is in order in connexion with featural scripts, though. We have seen that it takes training to learn to break syllables down into smaller phonetic elements, and the smaller the elements the less self-evident they are likely to be. There is a question about how real, for users of a featural script, the implicit analysis into phonetic features is. Surely, many British shorthand typists have become skilled users of Pitman's system without being consciously aware of concepts like voice, stop v. fricative, etc. One could simply learn that e.g. a thick straight vertical means /d/ without any awareness of the underlying rationale, and perhaps most Pitman's users have learned it that way. Likewise, a Korean might learn that ㅌ spells /tʰ/ without breaking this down into apical + aspiration. For a script to be "featural" may be a fact relating more to the process of its invention than to its use as an established system.

Completeness of representation

Apart from the type of units represented, another principle by which one can categorize scripts is *completeness*. A script may omit some meaningful components of speech, or record them in an ambiguous fashion which does not uniquely determine the spoken form intended. For instance, many languages written with the Roman alphabet have a contrast between long and short vowels, and some languages mark that contrast in their spelling: Finnish *kaatua* 'to fall' is different from *katua* 'to regret', Czech *chůdy* 'stilts' contrasts with *chudý* 'poor'. But the language for which the Roman alphabet was first used, Latin, never marked its own

length contrast; e.g. *mălus* 'bad' and *mālus* 'apple tree' were written identically (the lunette and macron used to show the difference here are a modern scholarly convention). Some scripts are much less complete than this.

As an example of incomplete logographic writing, consider the Japanese use of Chinese writing. We have seen that the grammatical words and the inflexions of Japanese are written in a phonographic script, but the roots of the content words are written with Chinese graphs. In the Chinese language, most words are represented unambiguously with a unique graph (there are occasional cases analogous to English *lead*, which can represent either /lid/ 'conduct' or /lɛd/ as 'metal', but this type of ambiguity is not very salient). In Japanese the situation is different. Although the Japanese language is genetically unrelated to Chinese, for historical reasons it has borrowed a vast quantity of vocabulary from Chinese, and the borrowings occurred at different periods between which Chinese pronunciations changed considerably. A native Japanese root is written with the graph for some Chinese word with the same or similar meaning; but that Chinese word is likely itself to have been borrowed into Japanese, perhaps in different phonetic forms at different periods, and those borrowings are also written with the same Chinese graph.

As an extreme case, the Chinese word 行, meaning 'move, practise' and pronounced in Middle Chinese /hæŋ/, is used for the native Japanese root *ik-* 'to go', but it also has three different pronunciations as a Chinese loan: *gyō* in e.g. *shugyō* 'training'; *kō* in e.g. *ginkō* 'bank' (in the financial sense); and *an* in e.g. *angya* 'walking tour'. These pronunciations may look rather different, but each of them (other than *ik-*) developed historically by various routes from Chinese /hæŋ/. However, nothing in the writing of a particular instance of 行 in a Japanese text tells the reader whether to pronounce it *ik-*, *gyō*, *kō*, or *an*. That has to be inferred from context and knowledge of the language.

To offer an analogy: if English were written with a Japanese-style script, we would find a particular symbol standing either for a word of the native Germanic vocabulary, or alternatively for a root with the same meaning borrowed from Latin or from its descendant language Norman French. Writing *X* for such a symbol, if a reader were faced with examples like:

(i) *The Xs have escaped into the lane.*
(ii) *He has a Xine temperament.*
(iii) *We need to X up security.*

only knowledge of English, not the symbol itself, would tell him that *X* is to be read in (i) as native *cow*, in (ii) as the Latin root *bov-*, and in (iii) as *beef*, the Anglicized form of French *bœuf*. (And comparable ambiguities would also arise in the writings of *escape*, *lane*, *temperament*, etc.)

Incidentally, the use of Chinese graphs to write the roots of the native layer of Japanese vocabulary represents an unanswerable objection to those writers who urge that all scripts of the world are in some fundamental sense phonographic. The phonetic element of a Chinese compound graph was originally selected for its

sound, but the graph used to write a native Japanese root is chosen for its *semantic* similarity to the Chinese word originally written with that graph, and, since Chinese and Japanese belong to separate language families, there will be no relationship at all between Chinese and Japanese pronunciations. (The Japanese root *ik-* does not sound anything like /hæŋ/, and there is no reason to expect them to sound similar.) Hence the native Japanese pronunciations associated with a set of graphs sharing the same "phonetic" element will differ quite randomly.

In the case of phonographic scripts, there are many cases where significant elements of speech are omitted altogether. Arguably, this is true for all scripts with respect to intonation. English and other European languages have rich systems of contrasting intonation patterns that add considerably to the sense of an utterance, but no alphabetic or other script offers a serious attempt to represent these graphically. Intonation is a difficult case, though, since there is little agreement even among linguists about how to analyse it. For a clearer case, let us look at the treatment of vowels in Semitic languages.

The Phoenician alphabet originally used to write Semitic languages was a purely consonantal alphabet. When it was eventually adapted to write Greek and later other European languages, letters for consonants which do not occur in Greek were turned into vowel letters (e.g. the letter O originally stood for a pharyngeal approximant, /ʕ/, but Greek, like English, has no pharyngeal consonants). Semitic speakers, though, continued to use the letters with their original values. At an early period, vowels were entirely ignored in Semitic writing. Later, some of the consonant letters were assigned a secondary role to indicate related vowels, for instance in Hebrew <w> could be used for long /ō/ or /ū/: /ʔārōn/, 'chest, Ark', originally written <ʔrn>, came to be written <ʔrwn>. But this system never came close to providing full information about vowels. All short vowels continued to be ignored, long /ā/ was ignored unless word-final, <w> was ambiguous between /ō/, /ū/, and its original consonantal value, and so forth.

The nature of spoken Semitic languages is such that inadequate recording of vowels is less troublesome to readers than it would be in a European language. Much of the vocabulary consists of verbs or words derived from verbs, and verbal roots comprise consonants only, with the vowels of a form contributing to the inflexion or derivation rather than determining the root. In Hebrew the root 'guard' is /ʃ-m-r/: /ʃāmar/ is 'he guarded', /ʃōmēr/ is 'guarding', /ʔeʃmōr/ is 'I shall guard', /məʃummār/ is 'guardroom', and so on. Context, together with the clues provided by affix consonants (such as the /ʔ-/ of 'I shall guard') and consonant letters used as vowels ('guarding' would commonly be spelled <ʃwmr>) are often enough for a skilled reader to know what all the vowels must be. Israelis feel no need for more. By the tenth century of our era, in order to preserve the language of the scriptures uncorrupted, Jewish scholars had devised a very complete and precise notation for specifying vowels and other pronunciation details by means of small dots and lines adjacent to the consonant letters; but although this notation is used in editions of the Bible and in language textbooks, everyday Israeli publications such as newspapers or novels make scarcely any use of it. Nevertheless, while vowel information is evidently less crucial for readers of a Semitic language than for readers of European languages, it remains true that Semitic scripts are relatively incomplete, and ambiguities arise. Hebrew <jwn> can be /jōn/ 'dove' (where <w>

represents the vowel), or it can be /jāwēn/ 'mud' or /jāwān/ 'Greece' (where <w> has its consonantal value).

Semitic scripts are probably the most incomplete phonographic scripts in common use today. In the past, there have been scripts which were less complete than they are. Linear B, the script used in the second millennium BC by the Mycenaeans, was a syllabic script which ignored not just vowel length but manner of articulation of most stops (Greek contrasted aspirated, unaspirated, and voiced stops, but a single Linear B symbol stood for each of e.g. the syllables /kʰa ka ga/), and it omitted syllable-final consonants altogether.

Shallow versus deep spelling

Another respect in which phonographic scripts differ from one another is in terms of the "depth" at which they reflect the phonology of the language in question. Many languages have *morphophonemic variation*: that is, the same root is pronounced differently in different circumstances, as in English the root *house* has a final /s/ in isolation but /z/ in e.g. *housing*, or the root *metr-*, from the Greek for 'measure', has the vowel /ɛ/ in *metric*, /i/ in *metre*, and /ə/ in *geometry*. In a "shallow" phonographic script, spellings vary to reflect varying pronunciations. In a "deeper" script, roots tend to retain a fixed graphic shape (as the above examples do in English spelling), at least when the phonetic variation is regular and predictable.

Regular morphophonemic variation in a language commonly results from the operation of historical sound changes that happen to affect a particular sound in one environment but not in another. Consequently deep spelling can easily be taken to reflect conservatism: forms which were written alike because originally they were pronounced alike have not adapted their spelling to keep up with changes in speech. Conservatism certainly is one significant factor in the evolution of writing systems. But there are cases where we can observe scripts developing from shallow to deep in circumstances where this represents innovation rather than stasis.

Consider, for instance, the case of Korean script, already described above. Korean as a spoken language has a rich system of regular morphophonemic alternation. The alternations are largely the outcome of historical sound changes; but most of the sound changes had already occurred by the fifteenth century, when the script was invented. When the Korean script was fairly new, it was used in a shallow way, but more recently it has been turned into a deep orthography. Thus, the name of the Yalu River (which divides Korea from China) derives, in both modern languages, from Middle Chinese /ʔæp ljokʷ kæŋʷ/ 'duck green river', but is pronounced in Korean /ʔamnok*aŋ/. By successive sound laws, /l/ became /n/ where not "protected" by a preceding vowel (so /p l/ > /p n/); oral stops became nasal before another nasal (/p n/ > /m n/); and (simplifying somewhat) pairs of lax stops coalesced to form single tense stops (/kʷ k/ > /k*/). In the early use of the Korean script, /ʔamnok*aŋ/ would have been written as it is pronounced. Nowadays it is spelled <qap lok kaq> (using <q> to represent a Korean letter that stands for both of the sounds /ʔ/ and /ŋ/, which are in complementary distribution). In this spelling, 'green' begins with an /l/ (as it does in speech, after a vowel); 'duck' ends in an oral

stop (as it does in speech when not followed by a nasal); and the single tense /k*/ sound is resolved into the separate lax stops from which it derives. Rather than the consistent relationship between letters and sounds which obtained earlier, what we now find is a consistent relationship between spellings and vocabulary items.

We see something akin to this (though less clearly) in the history of European punctuation. When first introduced, the hierarchy of punctuation marks seems to have been thought of as representing pauses of different lengths, that is as reflecting purely phonetic facts. Later the marks came to be used as they are today, to display the logical structure of a passage, independently of how it might be read aloud. M.B. Parkes compares the punctuation of an eighth-century and an eleventh-century copy of a text by Bede: in the latter, punctuation

> is no longer merely a guide to the oral performance of the written word but has already become an essential component of the written medium, which contributes directly to the reader's comprehension of the message of the text.

The common feature in both cases seems to be that when phonographic writing is novel for a society, script users feel a need to hug the phonetic ground closely, as children learning to read and write do today. Later, when literacy is well-established and widespread, people read for meaning rather than sound: they need the meaningful units of the language to be readily recognizable, and they are less concerned with superficial issues of pronunciation. The fact that English orthography largely ignores morphophonemic alternations may be an index less of conservatism than of the fact that England has had a high level of literacy for a long time.

In this light, the issue of spelling reform (which has enthused numerous English-speakers, George Bernard Shaw being the most famous) looks like a movement to privilege the interests of literacy-learners over those of experienced readers. Since greater life expectancy means that the proportion of an average lifetime spent mastering the system has shrunk, it is not clear why this would be a rational direction for our societies to move in.

Scripts as badges of identify

Equipping a spoken language with a script might seem to be a purely technical issue, to be solved in terms of efficiency and economy. The nature of the shapes used as letterforms in a particular script tends to be largely determined by the physical materials available for writing. Sometimes these influences are less than obvious. The runic script used by pre-Christian Germanic peoples was formed from straight lines that were never horizontal, so that F, H, T took the forms ᚠ ᚺ ᛏ. This angularity doubtless contributes to the aura of magic and witchcraft which runes possess for present-day romantics, but the real reason was more prosaic. In a paperless society, runes were commonly carved on wooden staves. Horizontal cuts, that is cuts along the grain, would be hard to see against the grain and would risk splitting the wood.

However, few aspects of human culture are determined solely by pragmatic considerations. Anything that can be invested with emotional or political associations probably will be, and writing systems are no exception.

Consider, as a case study, the distinctive script used for Irish Gaelic until recent decades (see Figure 2). Before the Norman Conquest of England, these letterforms were common to Britain and Ireland and are known to epigraphists accordingly as "insular hand"; but they were originally developed in Dark Age Ireland, and after roman script became usual for writing English they were perceived as distinctively Irish. One of the strategies through which Elizabeth I of England attempted to win her Irish Catholic subjects over to her reformed church was to make the scriptures newly translated into their vernacular more acceptable to them by commissioning a fount of Irish type. The first book printed anywhere in the literary Gaelic common to Ireland and Scotland had been John Knox's prayer-book, published in Edinburgh in 1567 in roman type. As Mathew Staunton sees it, for Elizabeth this publication posed a threat of fostering allegiance among the Irish to what was then a foreign country and its more radical Presbyterian religion; using Irish script for Gaelic printing in Ireland was intended to ensure that Elizabeth's were the documents for which the Irish felt affinity.

Figure 2 about here

Once Elizabeth had begun using Irish script to promote Anglicanism, exiled Irish priests on the Continent adopted it for literature aiming to keep the Irish loyal to Catholicism. The distinctive script became an important icon of Irish nationalism, a visible token of the separateness of Irish culture. The population grew hostile to the idea of printing Irish in roman script, despite the severe practical difficulties of providing special founts of type for a small market, and of teaching children two scripts. One early nineteenth-century prison governor reported that if he presented his charges with an Irish Bible printed in roman, he had to promise to swap it for one in Irish type when available.

As pressure for independence from Britain grew in the late nineteenth century, nationalists "used the language and the letterforms to justify their claims for independence ... it can be argued that ... Irish nationalism was very much a conspiracy of printers" (quoting Staunton). Irish script started popping up in unexpected places like the side of delivery vans; "[s]cript became a form of resistance to British rule." Only a few twentieth-century Irish people could master the Irish language, but all could recognize the distinctive script.

Yet, once the Irish Republic was established in 1949, the heat went out of the issue. There were scarcely any objections when, in the early 1960s, the Irish government switched the language over to roman script.

Writers' versus readers' convenience

It is understandable that political considerations may sometimes outweigh simple efficiency in deciding what form of writing a society uses. One might suppose, though, that where politics does not impinge, functional considerations would constrain the ways in which a script could evolve. Functionally speaking, the only

important quality in an alphabetic letter is to look clearly different from all the other letters, so while letter-forms might evolve over the centuries (particularly before printing technology was available to "freeze" them) one might expect such evolution not to compromise their distinctiveness too much.

Perhaps surprisingly, this is not so. Visual distinctiveness is desirable for readers, but a writer wants to economize effort. These considerations can pull in different directions, and the outcome does not seem to be predictable.

Consider the divergent developments of the ancestral Phoenician alphabet, as used for later Semitic languages, and as used for European languages (the Greek and Roman alphabets). The Phoenician letters were distinctive in shape; some of the outlines were simplified in their Greek and Roman descendants (e.g. the letter ancestral to H had three crossbars rather than one), but they retained their distinctiveness. In cursive handwriting letters may of course be carelessly distorted, but Europeans never lost sight of the careful forms, and scribes used them in formal writing. For speakers of Semitic languages, on the other hand, hasty cursive forms became the only forms. The Greek and Roman letter O continues to be written as a circle, like the Phoenician letter <ʕ> from which it descends. In Hebrew and Aramaic writing the circle was formed as two semicircles touching at top and bottom, but the strokes were allowed to splay apart at the top and meet imprecisely at the bottom: by the time of Christ, <ʕ> was written as in modern Hebrew, ע. Because of this cursive simplification, visual contrasts between Hebrew letters are often minimal: compare for instance the letters ב כ נ ג (reading from right to left) with their Roman cognates B K N C, or ו ר ד with D R F.

With Arabic script this process went further. Arabic words are always written continuously (there is no concept of "block capitals"), and various sets of letters were reduced so far that they became indistinguishable.

In subsequent Arabic writing they have been made different again by adding dots in various patterns. For instance, word-internally the cognates of Roman B I N T are each written as an identical upward kink in the horizontal stroke joining them to the preceding and following letters, but with the addition respectively of one dot below, two dots below, one dot above, and two, or three, dots above. Consider Figure 3: the basic outline is the same for each word, but with the first (that is, rightmost) letter one versus two dots marks the difference between <f> and <q>, and with the middle letter (as we have seen) two dots above versus one below marks the difference between <t> and <b>. (The vowels are ignored.) But these dots do not derive from any features of the original Phoenician alphabet. They were added, some time after AD 700, purely in order to rescue the script from ambiguity.

Figure 3 about here

It is rather mysterious why the tension between economy of scribal effort, and readers' need for clarity, should have been resolved so differently in different societies.

The psychology of reading

Over the past forty years there has been a great deal of research by psychologists seeking to discover how the reading process works. Apart from being a scientifically interesting topic, this research area has received impetus through its links with issues of broader public significance. There was widespread interest in a claim published in 1968 that in Japan, with its complex but largely logographic script, the phenomenon of dyslexia is rare. And much of the psychological research appears to offer evidence potentially relevant to debates (which in Britain have become a national political issue) between alternative methods of teaching children to read.

For users of an alphabetic script, the most obvious question (perhaps at first sight the only question) is: how, exactly, does a reader move from a particular sequence of letters to identification of the meaningful word represented by those letters? For instance, how far in practice is it important that the word as a whole consists of a set of letter units arranged in linear sequence? Very different hypotheses are available. At one extreme, it could be that an experienced reader recognizes a word as a single distinctive shape, with the fact that the shape is formed from separate letter units having little practical relevance to the psychological process by which meaning is retrieved from graphic form. (That is, a phonographic script might be read as if it were a logographic script. An idea like this seems to underlie the "look and say" approach to the teaching of reading, which was fashionable at one time though currently out of favour.) At the other extreme, it might be that the process of reading a word reflects in reverse the process by which words are spoken: that is, letters would be identified one after another in sequence, and once the entire sequence has been identified the corresponding word with its meaning is somehow retrieved from memory.

By now, the experimental data have shown rather clearly that the truth lies between these extremes. Reading a word does involve identifying its component letters, but (at least for short words) the letters are processed simultaneously, rather than sequentially as the sounds of a word are pronounced. (With longer words, successive groups of letters are each processed in parallel.)

Furthermore, while it is clear that the process of reading a word always includes identifying its pronunciation (even if a skilled reader is not consciously aware of the sounds during silent reading), there are alternative hypotheses about how that happens. One possibility (called *addressed phonology*) would be that a letter-sequence acts as an arbitrary code leading to a particular storage location in long-term memory, and that location holds the pronunciation as well as the meaning of the relevant word. Alternatively (*assembled phonology*) letter-to-sound correspondences are used to construct a pronunciation from the letter-string, and the pronunciation is used as a key to identify the word with its meaning. The evidence suggests that neither of these mechanisms has a monopoly: even in the case of languages with much more regular spelling than English, readers appear to use both types of process, with addressed phonology perhaps playing a greater role for common words, and assembled phonology being more important for less common words.

The experiments which have yielded these conclusions involve doing things like measuring the speed and accuracy with which readers carry out tasks such as recognizing words whose spelling has been distorted in different ways. In case it may appear from what was said so far that the upshot of this experimentation is merely a set of rather bland, middle-of-the-road conclusions, it is worth pointing out that some of the findings are by no means intuitive. Thus, although we know that the consonants of a word are more important than the vowels in helping a reader to identify it (which is unsurprising, since there is a larger range of consonants, i.e. they carry more information), when readers try to identify words in which all letters are present but some are misplaced, swapping a pair of vowels creates greater difficulty than swapping a pair of consonants.

Furthermore, it also turns out, contrary to many people's first assumption, that identifying individual words is only one part of the total mental activity comprised in the reading process, and (for skilled readers) not the most demanding part of the total process. For instance, words, once identified, have to be fitted together into a meaningful grammatical structure (sequences of words must be *parsed*), and psychological experiments are shedding light on how that is achieved. But to date there is too little consensus about these higher-level reading processes to discuss them here, and in some respects they fall outside the purview of this chapter. (Parsing is not specifically a written-language phenomenon; spoken utterances must be parsed too, though their grammar tends to be simpler and more predictable.)

Conclusion

After Ferdinand de Saussure promulgated the notion of "synchronic linguistics" early in the twentieth century, there was a surprising delay before linguists began to recognize that written language is worthy of consideration within the discipline. In 1967 Jacques Derrida characterized writing as "the wandering outcast of linguistics". But we have come a long way in the past thirty to forty years. By now, we can say that the outcast has definitively been welcomed back into the fold.

Further reading

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Figure 1: 'I want to go to the cinema' in Blissymbols

Figure 2: The word *Gaelach* ('Irish') in Irish script

Figure 3: Arabic words distinguished by dots

qabila	qatala	fatala
he accepted	he killed	he plaited