# AN EXPLORATION OF
WRITING

Peter T. Daniels

With a Foreword by David L. Share

Peter Daniels has thought more and more deeply about writing than any-one else around. This very engaging book incorporates the taxonomy of types of writing systems that he pioneered and is organized very nicely around the various ways in which a writing system reflects its (spoken) language. The book presupposes little linguistic knowledge and is clearly written.

Professor Mark Aronoff, Stony Brook University

No student of linguistics, nor educator, psychologist, or social scientist concerned with literacy, can afford to remain ignorant of the fundamen-tals of writing systems. It is a great honor to commend to the reader a work of such exceptional scholarship.

*Professor David L. Share, University of Haifa (from the Foreword)*

An Exploration of Writing is a book about our alphabets, our syllabaries, and all the other kinds of writing that people use and have used for 5000 years. It introduces a topic that hardly anyone has heard about, so it clarifies basic linguistic terms as they occur. For linguists exploring the growing field of graphonomy—the study of writing systems—in which the author has long been a pioneer, it weaves together the many threads of theory into a tapestry showing a fuller picture of what all our scripts are seen to share.

An Exploration of Writing begins with more familiar kinds of writing considered in unfamiliar ways—starting with English viewed syllabically—and leads the reader across the Old World and the New to less familiar kinds of writing, showing how all writings share a fundamental essence, however diverse they appear to be, because all writing represents lan-guage. The more familiar (Hebrew, Chinese, Korean) leads on to the less familiar (Udi, Pahlavi, Javanese). Featured are some of the world's most recently elucidated scripts, and some that are long known but long neglected, such as those for Central Asian languages, and some of the most recent interpretations of long-mysterious scripts, such as Sumerian and Mesoamerican.

An Exploration of Writing is in the tradition of and, in part, a response to *A Study of Writing*, by I.J. Gelb. It encapsulates more than thirty years of the author's work and his dozens of articles on writing systems, ranging from investigating the physical process of writing, to bringing to light the achievements of those who deciphered forgotten scripts, to developing a theoretical approach to the origins of writing which leads to insights into the nature of writing itself.

Peter T. Daniels, the world's leading expert on writing systems, holds degrees in Linguistics from Cornell University and the University of Chicago. His first interests were in Comparative Semitic linguistics, which built to the study of writing and decipherment. His challenge to his teacher I.J. Gelb's influential theories of the evolution of scripts has led to a persistent search for legitimate principles of the nature and development of writing. He is co-ed-itor (with William Bright) of and principal contributor to *The World's Writing Systems* (1996).

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You've overruled my typewriter tonight.

Throughout this book, I've been using certain terms and avoiding certain others, and I've inserted definitions here and there. Now it's time to bring them together with strict definitions and show how they fit into a comprehensive understanding of what writing is and how it works.

12.1 Some definitions

Some terms carry theoretical weight, but in at least some cases, that burden may have been dropped because of their use in ordinary language as well; I deal with them in separate subsections below. Here are some basic, hopefully uncontroversial terms.

(1)   orthography   conventional spelling of texts, and the principles therefor
(2)   script   a particular collection of characters (or signs), used to avoid specifying abjad, alphabet, etc.
(3)   writing system   a script together with an associated orthography

A number of terms are used for the characters or signs that make up a writing system.

(4)   pictogram   a stylized representation of an object
(5)   ideogram   a symbol (often a pictogram) representing an idea rather than a linguistic expression of that idea
(6)   logogram   a symbol (often a pictogram) denoting the meaning but not the pronunciation of a word or morpheme [cf. (20), (22)]
(7)   phonogram   a symbol used to represent a unit of speech (typically a syllable or a segment)
(8)   syllabogram   a symbol used to represent a syllable
(9)   letter   a symbol used to represent a speech segment (a vowel or consonant)

The first three, (4)–(6), are often confused but need to be kept strictly apart. *Any* (quasi)representational component of a graphic communication system is a pictogram, whether it is an ideogram with no particular connection to the name of the

item depicted, such as ☺ and ♥, or whether it is a logogram, such as Chinese 口 *kǒu* 'mouth' and 上 *shàng* 'above' (compare 下 *xià* 'below'), or a letter, such as ⟨M⟩, in which the ripples of the ancestral Phoenician letter 𐤌 which depicted *mēm 'water' can still be discerned.

The five basic types of writing system can be summed up thus.

(10) logography — a writing system comprising logograms
(11) syllabary — a writing system whose characters denote syllables with no deliberate graphic similarity between phonetically similar syllables
(12) abjad — a writing system denoting consonants only
(13) alphabet — a writing system denoting all consonants and vowels
(14) abugida — a writing system in which the basic shapes denote a consonant plus /a/ and the other vowels are designated by attachments to the basic shape

"Morphography" would actually be preferable to "logography" (cf. §8.2, p. 113), and historically two subtypes are known: *morphosyllabaries*, such as Chinese, and the *morphoconsonantary* of Egyptian.

And then there's the most important of all.

(15) writing — a system of more or less permanent marks used to represent an utterance in such a way that it can be recovered more or less exactly without the intervention of the utterer.

Details

12.1 My new typology and nomenclature were first published in Peter T. Daniels, "Fundamentals of Grammatology" (1990), where I gathered from the literature quite a few labels for what I call the *abugida*; the main remaining competition is Bill Bright's *alphasyllabary* (unsatisfactory because it suggests it is a hybrid rather than a distinct type), and in William Bright, "A Matter of Typology" (2000), he makes it clear that the two terms differ slightly: *alphasyllabary* refers to *formal* properties of scripts, and *abugida* to *functional* properties: the test case is 'Phags pa (§5.8), which is an abugida but not an alphasyllabary. The typology and nomenclature were first used in accounting for the origins of writing in the 1988 talk published as Peter T. Daniels, "The Syllabic Origin of Writing" (1992b).

The first group of 15 definitions is adapted from the glossary of P. T. Daniels and W. Bright, eds., *The World's Writing Systems* (1996), xxxix–xlv. On what is not writing, see John DeFrancis, *The Chinese Language* (1984) and *Visible Speech* (1989).

Other typologies of writing systems have been offered over the years, and I discussed them in Peter T. Daniels, "The Study of Writing Systems" (1996b). Geoffrey Sampson, *Writing Systems* (2015), proposed in the 1985 original a sixth basic type, "featural," to account for Korean *han'gul*, shorthand systems like Pitman and Gregg, and Alexander Melville Bell, *Visible Speech* (1867), in which features of characters correspond to phonetic features (Table 8.1). However, neither *han'gul* nor shorthand is taught or learned with reference to the phonetic

The crucial point of this definition is that writing represents *language*; that is, the "pre-writing" or "forerunners of writing" that were glanced at in Chapter 10 are not writing. And, as stressed by John DeFrancis, the crucial feature of writing is that it represents the *sounds* of language. Any writing system *is* or *includes* a means of representing the vocal expression of speech. However,

> Spelling ... only needs to provide enough cues to pronunciation to enable a reader with the necessary linguistic knowledge to combine converging contextual and lexical information to achieve the desired match.

12.1.1 Word and morpheme

A second group of terms concerns the units of language that are relevant to the discussion of reading and writing. Surprisingly difficult is *word*. One linguist writes, "Before I start, you may expect a definition of 'word'. There are actually strong theoretical reasons for avoiding definitions"—such as his long lists of "properties of a typical word": *meaning, realization, word-class, valency, language, frequency, speaker, addressee, time,* and *place* and of "other properties available to some words": *style-level, speaker type, social relation, emotion, etymology, lexical relations, cognates,* and *translation equivalents.*

Quite aside from all those complications, the intuitive "string of letters between spaces" is quite obviously problematic. There is no reasonable reason to claim that, in English, *ice cream* is any less a single word than *bookcase* is. In Thai, and in the languages of India using scripts with a top bar (Devanagari, Bengali)—before British printers changed the conventions—, entire clauses are written without spaces, even though native speakers easily identify words within such stretches. One mid-century descriptive linguist raised eyebrows when he transcribed French verb phrases as, e.g., /vumdɔne/ *you give me* (cf. ⟨vous me donnez⟩), /kɔ̃dɥizelezi/ *take them there* (cf. ⟨conduisez-les-y⟩), and /nunlɥiɑ̃parlərɔ̃pɑ/ *we won't speak to him about it* (cf. ⟨nous ne lui en parlerons pas⟩); as mentioned in the Introduction, a grammatical description was based solely in the spoken language, and in principle that remains true to this day.

Details *(continued)*

correspondences (and Bell's proposal for use in speech sciences found little acceptance); nor is Canadian Syllabics, according to Suzanne McCarthy, "The Cree Syllabary" (1995), 64. It's thus not clear what's gained by the additional category. A little-known catalog of putative universals of writing merits close attention: John S. Justeson, "Universals of Language and Universals of Writing" (1976).

The quotation at the end of the section is from Share *apud* Peter T. Daniels and David L. Share, "Writing System Variation" (2017).

12.1.1 The list of properties of "words" is from Richard Hudson, *An Introduction to Word Grammar* (2010), 114. The French examples are from Robert A. Hall, Jr., *French* (1948), 49.

The most useful definition of "word" goes back a long way—ironically, to the very linguist who, a few years later, would articulate the famous words that relegated writing to, at best, second-class status in linguistics, Leonard Bloomfield (1887–1949). In the second volume of the journal of the newly founded Linguistic Society of America, he carefully worked up to the definition we are seeking.

(16)	utterance	an act of speech (§1 of his article)
(17)	form	a recurrent vocal feature which has meaning (§6)
(18)	meaning	a recurrent stimulus–reaction feature which corresponds to a form (§6)
(19)	minimum X	an X which does not consist entirely of lesser X's (§8)
(20)	morpheme	a minimum form (§9)
(21)	free form	a form which may be an utterance (§10)
(22)	word	a minimum free form (§11)

A word is thus the shortest thing someone can say in a language. In English, *be* and *-ing* are morphemes, *be* and *being* are words, but *-ing* isn't a word.

12.1.2 Syllable and segment

Throughout this book, syllables have kept popping up: in the origins of writing, whether ancient or recent; and in the types of writing systems, whether syllabaries, abjads, abugidas, or hybrids. Why should syllables be so prominent in scripts?

As I was pondering that question, I began finding other places where syllables seemed to be important. Here are a couple of the cases I found in the 1980s. James D. McCawley (1938–1999) told me of watching a doting aunt interact with a toddler: the aunt read out the title of *The Important Book* and tried to get the child to associate the words of the title with their representations. First the child said the three words, pointing to the letters T, H, E. The aunt read the title again, tracing across the words with a finger; then the child said the words, pointing to the letters T, H, E, I, M with the five successive syllables. (A Gelbian might interpret this as logography preceding syllabography!)

The psychologist José Morais with his colleagues, taking up a suggestion by Isabelle Liberman and her colleagues, investigating in Portugal, found that illiterate

adults—mentioned in §1.1—were unable to manipulate phonemes, while comparable people with even rudimentary reading instruction could do so. They also cited a study that directly compared phoneme and syllable segmentation by the same population: [veʃa] could be reversed to [ʃave] much more easily than [aʃ] to [ʃa]; That article of Liberman's showed that English-speaking children of ages 5–7 could segment words into syllables more readily than into phonemes, and that both abilities improve with age and schooling. But the authors assumed that the ability to segment into phonemes ought to arise eventually, suggesting that

> the possibility that changes with age are relatively independent of instruction could be tested by a developmental study in a language community such as the Chinese, where the orthographic unit is the word and where reading instruction does not demand the kind of phonemic analysis needed in an alphabetic system.

As it happens, the first steps in Chinese education now involve training in sub-syllabic scripts—*pinyin* in the People's Republic, another system in Taiwan—so no "purely" logosyllabic-learning community is available to observe any longer, even though those scripts are soon abandoned and usually turn out to be unusably forgotten by literate Chinese adults. But not long after the study of Portuguese fisherfolk, a team in China was able to study members of the last generation of literate Chinese-readers not started off with *pinyin* and found the same result as in Portugal.

In recent years, happily, the attention of reading specialists has finally been turning away from almost complete fixation on English literacy, and even from Roman-alphabet literacy, focusing especially on the achievement of abugidic and abjadic reading by Indian and Israeli children (Hindi, Kannada, Hebrew, and Arabic have been the objects of the most research). David Share digests a number of these studies, which tend to show that children learning only a non-alphabetic writing system are not necessarily aware of sub-syllabic stretches of speech. For example, one study reported that among fifth-graders in schools using only Oriya, syllable

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from p. 210). The article from which I first learned of such studies is Alvin M. Liberman, Franklin S. Cooper, Donald P. Shankweiler, and Michael Studdert-Kennedy, "Perception of the Speech Code" (1967). The Chinese study is described by Charles Read, Zhang Yun-fei, Nie Hong-yin, and Ding Bao-qing, "The Ability to Manipulate Speech Sounds Depends on Knowing Alphabetic Writing" (1986). The concentration on English by scholars of reading was decried by David L. Share, "On the Anglocentricities of Current Reading Research and Practice" (2008): both the atypicality of its orthography and its alphabetic type suggest that conclusions drawn from the study of the achievement of literacy in English might not transfer well to other literacies. The digest of studies appears in David L. Share and Peter T. Daniels, "Aksharas, Alphasyllabaries, Abugidas, Alphabets, and Orthographic Depth" (2015); the Oriya and Eritrean studies are, respectively, R. Mishra and R. Stainthorp, "The Relationship between Phonological Awareness and Word Reading Accuracy in Oriya and English" (2007), and Yonas Mesfun Asfaha, Jeanne Kurvers, and Sjaak Kroon, "Grain Size in Script and Teaching" (2009).
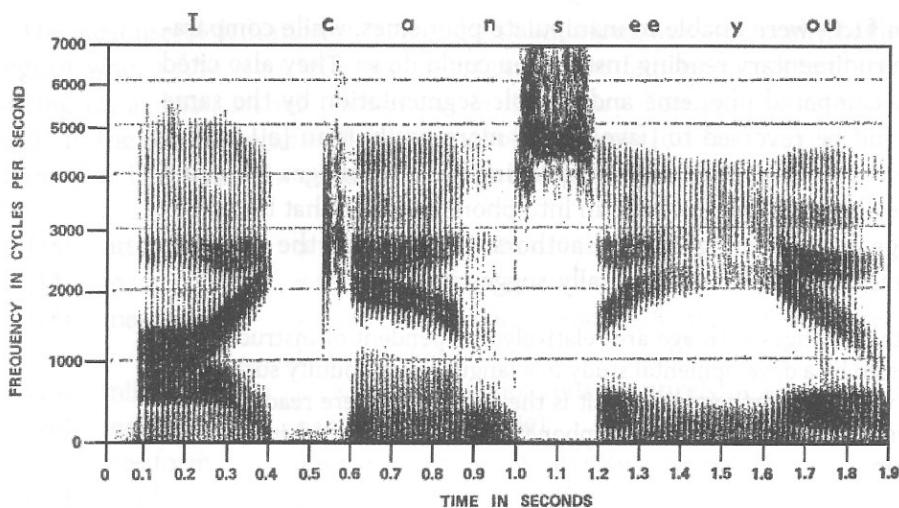
Figure 12.1. Spectrogram of "I can see you."

awareness but not phoneme awareness correlated with reading Oriya; but in a comparable school that taught in English, only phoneme awareness correlated with reading Oriya. ("Awareness" is psychologists' jargon for the ability to recognize and manipulate syllables and phonemes respectively.) An especially significant study indicates that it is not necessarily true that even an alphabet is best taught and learned alphabetically: according to a comparative study of grade-one reading instruction in four languages of Eritrea—Tigre and Tigrinya using the Ethiopic abugida (§5.9); Saho and Kunama using the Roman alphabet—, for languages with simple syllable structures, learning a true alphabetic script may be easier if it is taught as a syllabary: the Saho primer begins by introducing *ka, ku, ki, ke, ko* (compare §1.1), while the Kunama primer teaches letter–sound correlations of the letters individually. Results for Saho were far better than for Kunama.

What, then, are these "syllables" and "segments" that are so important in the nature and history of writing?

This is a question of *phonetics*, the science of speech sounds. There are two kinds of phonetics, corresponding to the two people involved in an occasion of talking: the speaker and the hearer. *Articulatory phonetics* investigates how people "articulate" language—that is, perform the various activities that result in speech sounds coming out of their mouths. These activities include the lungs pumping air, the vocal cords vibrating, and the lips and tongue changing shape and making contacts in the mouth. *Acoustic phonetics* deals with what it is that people hear: the nature of the speech sound waves that reach the ear and that the brain interprets as language.

Let's admit up front that articulatory phoneticians do not yet actually know what a "syllable" is, physiologically. (A pulse of air from the lungs? A resting-point for the muscles of the vocal tract? Each time a phonetician offers a suggestion, other
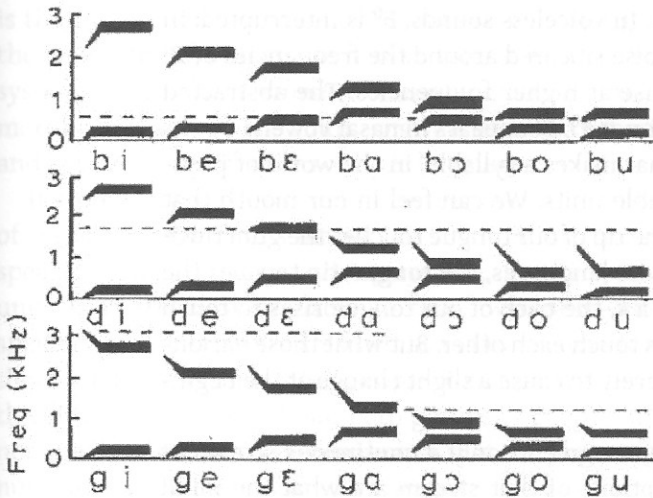
Figure 12.2. Idealized CV formants

http://home.cc.umanitoba.ca/~krussll/phonetics/acoustic/spectrogram-sounds.html

phoneticians show why the proposed definition doesn't work.) But, by and large, we know syllables when we say them or hear them. We can almost always say how many a word contains. We can usually agree on how to divide a word into syllables.

It is acoustic phonetics that we turn to for insight into the prominence of syllables. Toward the end of the nineteenth century, when it became possible to view representations on paper of the energy patterns—the pitch and loudness—of speech sounds, it was discovered that the various simple vowel sounds are the result of changes in shape of two parts of the vocal tract, the pharynx (above the vocal cords) and the oral cavity (the mouth). The noise made by the vibration of the vocal cords resonates in those two chambers—just as any sound is altered by the space it's issued in: a closet, an echoey room, a concert hall. Sometimes a third resonator, the nose, is involved as well.

The resonances show up as *formants* on the paper record of the sound, a *spectrogram*: bands of energy at discrete frequencies and increased intensity, representing pitch and loudness respectively. They aren't tied to specific pitches and volumes; the pitches vary with the pitch of the speaker's voice. But for all speakers, the relationship between the two formants is the same, and it is this relationship that's processed by the brain as representing the various vowels. The "first formant," F^1, is the resonance of the pharynx. The "second formant," F^2, is the resonance of the mouth. The "fundamental frequency," the pitch of the voice that is perceived—the pitch that figures in lexical tone, intonation, and singing—is labeled "F^0."

If we take a spectrogram of a stop consonant (*p t k, b d g*) before or after a vowel, we make the surprising (to someone used to an alphabet!) discovery that the consonants don't have formants of their own: what we hear as a consonant is nothing but the deformation of a vowel's formants. As seen in Figure 12.1, the formants are

altered to "point toward" specific pitches. In voiceless sounds, F^0 is interrupted; in aspirated stops, there's a short burst of noise smeared around the frequencies of F^1 and F^2. In fricatives, there's sustained noise at higher frequencies. The abstracted diagram in Figure 12.2 shows F^1 and F^2 but not F^0. F^3 appears in nasal vowels.

In other words, whatever it is we do that makes a syllable, in the world of physical, acoustic reality, syllables are indivisible units. We can feel in our mouth that whenever we English-speakers make a *t*, the tip of our tongue touches the gum ridge just above our front teeth. (Though for most languages, the tongue-tip touches the backs of the front teeth.) When we make a *k*, the back of our tongue rises to touch the soft palate. When we make a *p*, our lips touch each other. But what those various "gestures" do to the stream of sound is merely to cause a slight change at the beginning or end of the adjacent vowel.

Acoustically, there is no such thing as a segment, only a continuous stream of speech, and the constrictions or interruptions of that stream are what the mind interprets as syllables. One characterization is: "loosely, acoustic energy bounded by minima of amplitude." Without awareness of articulatory procedures, nothing smaller enters the consciousness.

12.1.3 Phoneme

What, then, is it that the letters of an alphabet represent? *Phonemes.* "Phoneme" is one of the earliest and most basic concepts in modern linguistics, and once again we can do no better than return to one of its founding documents, Bloomfield's 1926 "Postulates."

(23)		Different morphemes may be alike or partly alike as to vocal features. (§15)
(24)	phoneme	A minimum same of vocal feature (§16)
(25)		The number of different phonemes is a small sub-multiple* of the number of forms. (§17)
(26)		Every form is made up wholly of phonemes. (§18)

In the discussion of these four items, Bloomfield notes, "The morphemes of a language can thus be analyzed into a small number of meaningless phonemes." This

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* "Sub-multiple" is an old-fashioned term for a factor of a number.

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The closing characterization of the syllable is from Robert J. Scholes, "Orthography, Vision, and Phonemic Awareness" (1995).

is the essence of the notion of "duality of patterning," which C. F. Hockett lists as the only defining property of human language shared by no animal communication system; succinctly, "Phonemes do nothing but keep morphemes (and sequences of morphemes) apart." The suffix -*eme* marks units that enter into such a relationship and applies in many realms outside language.

It's precisely this function of distinguishing morphemes that causes stretches of speech smaller than a morpheme to enter into the awareness of speakers. Once speakers have learned a writing system, it's the speech-stretches denoted by its units that are most available to that awareness—most salient—while stretches smaller than those units are hard to notice. People from Chicago call the state to their north "Wis-consin," but people from that state call it "Wi-sconsin," and when the difference is pointed out, both groups of people can recognize it. But probably not one person in ten thousand knows that the physical difference between the pronunciations is that English stops are unaspirated after /s/, aspirated at the start of a syllable. If we were writing the two pronunciations in Devanagari, they would be विस्खोन्सिन् (viskhonsin) and विस्कोन्सिन् (viskonsin) respectively—because aspiration was and is phonemic in the languages for which the Indic scripts are used.

Two historical phenomena further make the point. We know of only two alphabets that attempted to record sub-phonemic information, Avestan (Table 2.12) and vocalized Hebrew (Tables 3.8 and 3.9), and in both cases, there's perpetual argument over what some of the symbols stand for. Similarly, it's said that the Roman emperor Claudius tried to introduce into the Latin alphabet a letter, a reversed digamma ⟨Ⅎ⟩, to write the labial glide [w]. However, [w]—the equivalent [u̯] is another transcription—is simply an allophone of /u/ in Latin, and no one saw a use for the letter.

To be sure, the notion of *phoneme* is to some extent obsolete in contemporary linguistics. In Russian, certain phonetic features distinguish morphemes when they are part of some phonemes but not of some others. That is, /t/ and /d/ are separate phonemes, but [ts] and [dz] are merely allophones of a single phoneme /c/ (see Dimension II on p. 176; for allophones, §1.2). This led to the influential—albeit false—conclusion that the concept of phoneme served no purpose at all. You won't find modern phonological analyses making use of the notion—but in fact they *assume* a phonological analysis and start their accounts there. Bloomfield and his school of

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Details *(continued)*

12.1.3 The definitive presentation of the "design features of language" is the amplifed 1977 reprint of Charles F. Hockett, "Logical Considerations in the Study of Animal Communication" (1960) (the quotation from p. 154).

Sources for the anecdote about Claudius are given by Giovanna Marotta, *The Phonology of Latin* (in preparation), ch. 4, as Suetonius, *Claudius* 41; Quintilian, *Institutes* 1.7.26; and Tacitus, *Annals* 11.24.

Evidence against the usefulness of the phoneme as a tool in analysis began to be offered by Morris Halle, *The Sound Pattern of Russian* (1959).

Descriptive Linguistics were concerned with *describing* languages, not with explaining them.*

Sometimes, though, conclusions can be jumped to on the basis of phoneme theory: when psychologists showed that infants could distinguish between [pa] and [ba], they did not in fact show, as they claimed, that the infants could distinguish between [p] and [b] (or between /p/ and /b/), but only that they could distinguish between [pa] and [ba]. And perhaps it is the alphabet itself that leads the Western linguist to believe that speech is most fruitfully analyzed into segment-sized chunks. Martin Joos quotes W. Freeman Twaddell, whose *On Defining the Phoneme* (1935) was a key document in the development of classic phonemic theory:

> Guess what! Alfred[Senn] has just seen the light: Phonemes, he said to me yesterday, were what makes it possible to write a language alphabetically, and was that a fair statement? Nothing could be fairer, I said, and thanked him for the formulation.

An important concept in describing orthography is the *morphophoneme*, a device invented so that phonological systems could be described without "mixing levels," i.e. without taking into account *morphemic* information in a *phonemic* analysis. The forms *strife/strifes* and *dive/dives* show that the bases of the words end with /f/ and /v/ respectively. But this won't do for *wife/wives*; the base has to be represented as something like |wiFe|—where the capital letter acknowledges the alternation between /f/ and /v/ in the singular and plural forms. This proved to be an analytical conundrum—does the base change because the morpheme {PLURAL} is added?—but it acknowledges that the base of *houses* is spelled with ⟨s⟩ even though the sound it represents is /z/, so it's needed for describing writing systems.

12.1.4 "Grapheme"

If a phoneme is the basic linguistic unit that makes a difference between morphemes, and the morpheme is the basic meaning-bearing unit, shouldn't the *grapheme* be

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* Martin Joos famously wrote, "Children want explanations, and there is a child in each of us; descriptivism makes a virtue of not pampering that child." The statement (taken in its context) was praised by his contemporaries and (taken out of context) ridiculed by the subsequent generation.

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A summary of infant "phoneme" experiments is provided by Peter D. Eimas, "Speech Perception in Early Infancy" (1975).

The footnote Joos quotation is from *Readings in Linguistics* [I] (1957), 96; the text quotation is from *Notes on the Development of the Linguistic Society of America* (1986), 134. The history of the morphophoneme is described by James Kilbury, *The Development of Morphophonemic Theory* (1976).

the basic unit of writing? Unfortunately, it isn't that simple.* Recall that the suffix *-eme* identifies units that enter into the "duality of patterning" relationship that is central to language and to so much else in human behavior [§12.1.2 at (23)–(26)]. But duality of patterning is a coping device of the human brain for making sense of the countless stimuli it encounters every day, every minute. Duality of patterning is imposed unconsciously by every human brain.[1]

Writing, however, as we have been seeing throughout this book, is *not* unconscious. Everyone learns to talk simply by being born into a speaking community (or several speech communities), automatically acquiring the language(s) around them. But no one learns to read or write simply by being among people who read and sometimes write. Reading and writing must be *taught*.

This is the first hint that "grapheme" might not be a particularly useful term. But it's far from the only one. The leading scholar of English orthography, Richard Venezky, made this observation:

> Orthography from the time of Alfred to the present day has been delimited by the letters and their powers.[2] So ingrained has this principle become that some contemporary linguists have attempted, by substituting *grapheme* for *letter*, to sanctify it with the countenance of linguistic science without examining how unsound it is.[3]

All too often, in grammars of a language the units of its writing system are called its "graphemes," without regard to what that term might or ought to mean.

12.1.4.1 Use of the term "grapheme"

What, then, might or ought to be meant by "grapheme"? It seems to follow naturally from such terms as *phoneme* and *morpheme*, but there's a big difference.[4] The morpheme *-eme* implicates duality of patterning, the strategy used—unconsciously—by the human brain in all sorts of situations. Writing, being a conscious human invention, need not and does not necessarily conform to it.

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* Because of the historical nature of this section, references are given in footnotes rather than in the Details portion of the chapter.

1 However, in anthropology "emic" and "etic" seem to be used in a sense inverse to their meaning in linguistics. The opposition was elaborated by Kenneth L. Pike, *Language in Relation to a Unified Theory of the Structure of Human Behavior* (1954–59), the anthropological interpretation was created by Marvin Harris, "History and Significance of the Emic/Etic Distinction" (1976), and their differences are debated in T. M. Headland, K. L. Pike, and M. Harris, eds., *Emics and Etics* (1990).

2 Venezky might as well have named the ancients as Alfred—see David Abercrombie, "What Is a 'letter'?" (1949), esp. 81–83, and William Haas, *Phono-Graphic Translation* (1970), 27f. n. 1, on the Late Classical establishment of *figura*, *potestas*, and *nomen* (shape, sound, and name) as the properties of *litterae*.

3 Richard L. Venezky, "The Basis of English Orthography" (1966), 145. Nonetheless, this didn't stop him from subsequently writing "English orthography contains ... the classes of letters (graphemes)," in "English Orthography" (1967), 77.

4 I began to investigate these matters in Peter T. Daniels, "Is a Structural Graphemics Possible?" (1991b). This subsection largely treats aspects not discussed there.

The term has been "fuzzy" since it began to be used (as opposed to simply being included in a schema of linguistic terminology, §12.1.4.3). The psychologist Leslie Henderson attempted to bring some order to the concept. He had felt constrained to add a footnote in his introduction to a chapter by Max Coltheart registering his objection to Coltheart's usage:

> I employ the term 'grapheme' in the manner of many commentators on writing systems, to denote the minimal functional distinctive unit of any writing system and not in the phoneme-representing sense adopted by Coltheart.[5]

In a subsequent article, he quoted that passage and surveyed "the psychological literature" and found "at least three distinct and conflicting senses":

"a jargon word for the more homely 'letter'";
"the minimal contrastive unit in a writing system" (*Sense 1*); and
"a letter or letters that refer to or correspond to a single phoneme in speech" (*Sense 2*).[6]

Like Venezky, he rightly dismisses the first of these—but does not explain how *Sense 1* differs from it. He claims that no one but Coltheart uses *Sense 2*, which, however, seems to me [see (27) below] the only sensible interpretation the term could have.[7]

Nonetheless, *Sense 1* is what is found in works either by theoreticians who wish to exploit the "phoneme" parallel or by analysts whose familiarity extends primarily to segmental (alphabetic or abjadic) scripts where a one-to-one correspondence of "grapheme" (letter) to phoneme is possible. I know of one major and a few minor attempts to put *Sense 1* to work in analyses of a writing system,[8] and of none devoted to more elaborate ones.

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5 L. Henderson, ed., *Orthographies and Reading* (1984), 15.

6 Leslie Henderson, "On the Use of the Term 'grapheme'" (1985).

7 It is also the approach found in Eleanor M. Higginbottom, "Representation of English Vowel Phonemes" (1962), a pioneering but premature attempt at devising rules for text-to-speech synthesis that would have benefited greatly from Venezky's concept of the "marker" (§2.1.1). C. E. Bazell, "The Grapheme" (1966 [1956]), appears to attempt to reconcile *Sense 1* and *Sense 2* and assigns the grapheme level to the components of letters: the stem and the bowl of ⟨b⟩ are two graphemes that recur in ⟨d⟩.

8 Earl M. Herrick, *A Linguistic Description of Roman Alphabets* (1966), uses this approach in his "graphemic analysis" of a Roman-alphabet font; see Peter T. Daniels, "Is a Structural Graphemics Possible?" (1991b), 532 n. 2. (Herrick's two rejoinders, "Of Course a Structural Graphemics Is Possible!" [1994a] and "Reply to Daniels's Reply" [1994b], seem to miss the point.) Similar analyses have been carried out by Murray Eden, "On the Formalization of Handwriting" (1963); Giovanna Marotta, "The Features of the Roman Alphabet" (2000); and Beatrice Primus, "A Featural Analysis of the Modern Roman Alphabet" (2004). Herrick ([1994a], 416) introduces the term *graphemic grapheme* for that sort of analysis and *phonological-fit grapheme* for the kind discussed in §12.1.4.2 but immediately replaces the latter with *graphic image of a phoneme* (the symbol that represents speech-sounds) and *phonic image of a grapheme* (the sounds represented by a symbol). David G. Lockwood, "Phoneme and Grapheme"

General dictionaries have had to try to deal with the term. Henderson rightly lights into[9] the *OED*'s

> The class of letters and other visual symbols that represent a phoneme, as e.g. the grapheme ⟨f⟩ consists of the allographs *f, ff, F, Ff, gh, ph,* and *Ph* which represent the phoneme /f/ in *fun, huffy, ...*

(it first appeared in the 1972 Supplement), rightly observing that it's not supported by any of the quotations cited. Henderson didn't note that it seems to have been based on

> the sum of all written letters and letter combinations that represent one phoneme <the *p* of *pin,* the *pp* of *hopping,* and the *gh* of *hiccough* are members of one ~>

in the Merriam-Webster *Third International Dictionary* of 1961,[10] which doesn't provide evidence for its definitions, but he wrongly claimed that it conforms to *Sense 2*! I'm not aware of any scholar of writing systems who has subscribed to such a definition. A *Sense 2* user would consider *each* of the correspondences listed to be a separate grapheme—on the model of Pike's (e.g. n. 1 above) definition of "tagmeme," his unit of syntactic analysis, as a 'slot/class correlation', a correlation of form and function.

12.1.4.2 Why shouldn't "grapheme" be used?

If "grapheme" is to parallel "phoneme," we might expect that a grapheme is "a minimum same of written feature" [cf (24)]. But since this definition is identical to the definition of "phoneme" (differing only in modality), it would seem to imply an exact equivalence of the terms. It is clear, however, that the smallest units of writing do not necessarily correspond to the smallest units of speech that make a difference in meaning: English *cease* /siys/ and *case* /keys/ differ by only one letter, but by two phonemes.

Or, if phonemes are the components of the spoken aspect of morphemes, then what are graphemes the components of? To maintain the parallel, they should be the written components of minimal written units of meaning. But some units of writing *are* minimal units of meaning, namely, logograms. Does this mean that logographic writing systems do not include a graphemic level? If we admit this possibility, for even some writing systems, it's a clear difference between graphemics and phonemics.

(2000), 307, revives the terminology introduced by Manfred Kohrt, "The Term 'Grapheme'" (1986): "The *analogical view* ... makes the grapheme–allograph relation parallel to that between phoneme and allophone. The alternative is called the *referential view,* because it is based on the phonological reference of the various graphemes." Lockwood endorses the analogical view—and then shows that it is inadequate for analyzing, at least, Chinese writing.

9 Leslie Henderson, "On the Use of the Term 'grapheme'" (1985), 140.

10 Followed also by Merriam-Webster's principal American competitors, the *American Heritage Dictionary* and the *Random House Dictionary.* All the dictionaries also provide for the 'letter'/'minimal unit of a writing system' senses.

More concretely, take Chinese. In §12.1 we saw three characters, 口 上 下, which happen to be pictographic, ideographic, and logographic all at once; but this sort of character is fairly uncommon in the full inventory of Chinese characters—fewer than one in five. More than 80% of the 8,075 characters in a popular dictionary are composite,[11] comprising a semantic (or radical) and a phonetic (§6.1). By using both parts, any native-reader of a Chinese text (who by definition already speaks the language perfectly) encountering an unfamiliar character can assign a reading to it on the basis of the two clues and the context in the passage. The question for graphemics is, Which are the graphemes: the thousands of characters, or the hundreds of components? One scholar appears to endorse the view that it's the components that should be the graphemes.[12] But then there would be two entirely different kinds of grapheme in the writing system, the semantic ones and the phonetic ones, and they would only achieve specific reference in combination. This also leaves the residue of non-composed characters to get some sort of separate description.

And again: if the characters are considered the graphemes, there is the dilemma that they constitute ultimately an open class (there isn't a limited number of them)—not only are tens of thousands of characters catalogued that were innovated perhaps once, never to be used again; but there is nothing to stop someone from creating still more new characters. A phonemic system is a small, fixed class—not a closed class; in §2.1.2 we saw that the voiced fricatives went from allophones to phonemes in Middle English—typically numbering around 30–40 phonemes. But if Chinese writing is to be analyzed as graphemes, then the number will be nearly 1000 if the components are counted, and in the tens of thousands if the characters are counted—in both cases open to increase. Open-endedness is a characteristic of lexicons, not of grammatical inventories.

Futhermore: if characters are taken to be graphemes, then the "graphemic" level exhibits no duality of patterning, the very essence of the emic concept.

There is one unsatisfactory solution to the "Chinese character problem": let the canonical eight brushstrokes, which all appear in the character 永 *yŏng*—with its auspicious meaning 'eternal'[13]—plus the order in which they are written to create each character, be the graphemes! The strokes have no inherent meaning, save their differentiation function; their class is closed; they exhaustively constitute the components or characters; their order of writing in each character is fixed.[14] But there is then no connection between the graphemic level of individual strokes and the morphological level of complicated characters which it is supposed to analyze—no stroke contributes some definable essence to the identification of the characters it

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11 Victor H. Mair, "Modern Chinese Writing" (1996), 201

12 Eric Scott Albright, "Design of an Electronic Method for Describing Writing Systems" (2001).

13 Peter Charles Sturman, *Mi Fu* (1997), 15.

14 The order information might not be found in major reference dictionaries, but it is included in learners' dictionaries such as Yu S., Sheng P., Yin P., Ding F., Yu R., and Chen Y., eds., *Quaille's Practical Chinese–English Dictionary* (1999).

appears in—so this *Sense 1* approach seems less than useful in studies of reading or of writing systems.

And what of multiple components of a single writing system? Brahmi-derived abugidas have distinct forms for independent and dependent forms of characters. Most alphabets have majuscule (capital) and minuscule (lowercase) forms for each letter, and many use italics (or an equivalent), with both of those features used for varying purposes across languages—in eighteenth-century English, nouns were capitalized (as in modern German) and proper names were italicized. Russian novels, such as Tolstoy's *War and Peace*, that contain passages in French naturally use Cyrillic for Russian and Roman for French. But in past times, German used Fraktur for ordinary German text but "Antiqua" (Roman type) for foreign words that happened to occur—Fraktur was seen not (as it is today) as a variety of Roman, but as a distinct script not suited for Latin, French, or English. In contemporary English, it's useful to consider the orthography of French-, Classical-, and native Germanic-origin vocabulary separately. There are no parallels in emic systems for these features, except for the last, where borrowed words in English sometimes follow different stress patterns from native words. Many alphabets use diacritics or optional ligatures (⟨æ œ⟩ etc.). Do these correspond to anything in language?

And even more so: the anomalies noted in the last paragraph can be ignored and all alphabetic text can be presented in plain minuscules. But this isn't an option in Japanese (§§ 4.1 and 7.1). Not only are there both *kana* and *kanji*, but there are two different kinds of *kana*. Where are the graphemes? The relationship between *hiragana* and *katakana* is like the relationship between upright and italic type in English, but unlike in English, it is obligatory. And more: is there one kind of relation between *kana* representing the same mora that happen to derive from the same *kanji* and another for those that derive from different *kanji* (Table 4.2)? Japanese raises problems for "grapheme" with a vengeance!

In still other cases, the notion of "grapheme" is simply redundant. Czech and Finnish are frequently cited as examples of (nearly) "perfect" orthographies in the spelling reformers' sense: letters correspond to phonemes and vice versa, so there is no need for any term beyond "letter" for describing them.

It is questions like these that lead me to suggest that the term "grapheme" should not be used in the study of writing systems.[15]

The one piece of grapheme theory that remains useful is the term *allograph*, which designates variants of a character that are conditioned by its surroundings: the word-final variants of one letter in Greek and five in Hebrew; the syllable-final variant ⟨s⟩ of the normal ⟨ʃ⟩ in German and earlier English; the shapes of Syriac and Arabic letters when connected to their neighbors in a word. In the Indic scripts, the vowel *matra*s are post-consonantal allographs, but even here there are

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15 David G. Lockwood, "Phoneme and Grapheme" (2000), suggests ways of rescuing the term, in particular as regards non-alphabetic writing systems.

complications: the reduced consonant shapes for the most part represent C and not C*a*, so they're not simply positional variants.

It is only for describing orthographies like those of English, French, Thai,[16] Tibetan, and a few other languages with long written traditions where spelling is preserved while language changes, that "phoneme–grapheme correspondences" tend to drift apart. Only then do principles need to be discovered for the historically modulated relationships between spelling and sound. Only then would something like (27) find some use:

(27)   grapheme   a correlation between a phoneme and a spelling

Thus in English, ⟨ee⟩:/iy/, ⟨ea⟩:/iy/, and ⟨e-e⟩:/iy/ (etc.), as in ⟨meet meat mete⟩ (etc.), would each be a grapheme, and so would ⟨eo⟩:/iy/, ⟨eo⟩:/e/, ⟨eo⟩:/ow/, and ⟨eo⟩:/i/, as in ⟨people leopard yeoman luncheon⟩.

One little-known approach, that of Nina Catach,[17] takes the notion of (27) further, because in French there are complications even beyond those of English.

Catach brings the concept back to Ferdinand de Saussure's notion of the *sign*— Saussure had spoken of *graphies* ('writings'), not of *graph(è)mes*—comprising the *signifiant* and the *signifié* (the *signifier* and the *signified*); and to André Martinet's notion of *double articulation*, the equivalent of Bloomfield's/Hockett's "duality of patterning." For Catach, morphemes are *signs*, but graphemes, like phonemes, are only *figures*. The phoneme is not the signified of the grapheme;[18] graphemes can be one or more letters (the French examples include *e, o, an, in, eau*); and, most noteworthily, the grapheme does not always represent the phoneme: some graphemes—she calls them *morphograms*—carry morphological information only. Among her examples are the consonant doubling in *immaculé* 'spotless' vs. *imaginer* 'imagine' with their homophonous initial sequences, and the many silent final consonant letters in French [§2.2.1 end]).[19] Her definition, then, is:

(28)   grapheme   the smallest unit of the written channel having a phonic and/or semantic correspondence susceptible to linguistic analysis[20]

16 There is a comprehensive treatment of the development, or lack thereof, of the relation of Thai orthography and phonology in J. Marvin Brown, *From Ancient Thai to Modern Dialects* (1985).

17 Nina Catach, "Le graphème" (1979).

18 Catach thus diverges from the frequently cited Angus McIntosh, "'Graphology' and Meaning" (1961), which holds the phoneme to be the "meaning" of the grapheme. McIntosh's position is justly criticized in great detail by William Haas, (1970), 9–16. Noam Chomsky, review of *Verbal Behavior* by B. F. Skinner (1959), 50, long ago defended "the important difference between reference and meaning."

19 Catach also invokes some terms and concepts from Louis Hjelmslev's *glossematic* approach to linguistics, filtered through William Haas, *Phono-Graphic Translation* (1970) and "Writing: The Basic Options" (1976). The latter, often cited but largely impenetrable, is vitiated by its insistence on including nonlinguistic graphic communication as "writing."

20 Nina Catach, "Le graphème" (1979), 27 (my translation).

In a subsequent programmatic article, she applies her views to writing systems more generally, but with little detail.[21] It seems to me that hers is the most generally applicable account of "graphemics," making the concept appropriate for all sorts of writing systems, but it is unlikely to find many adherents among modern practitioners.

12.1.4.3 Where did "grapheme" come from?

Current research indicates, not unreasonably because writing isn't inborn, that it piggybacks, rather consistently across speaking populations, not on brain structures devoted to language, but on structures that had evolved primarily for visual functions.[22]

But this neurolinguistic perspective hasn't been around for long, and it's not surprising that the few people who had thought seriously about writing wanted to see in it patterns like those they saw in speech and language.

Accordingly, the word "grapheme" was devised independently at least four times:[23] by Jan Baudouin de Courtenay in 1901; by Benjamin Lee Whorf in 1932; by W. Freeman Twaddell in 1935; and by R. H. Stetson in 1937. Only Stetson generally gets the credit in the literature on writing systems. Until recently, his was the earliest usage registered in the *OED*.

Baudouin de Courtenay (1845–1929) is celebrated for having introduced the concept "phoneme" to the West; it was developed by his student Mikołai Kruszewski in Kazan' around 1880.[24] As part of Baudouin's general program to rejuvenate linguistic terminology, he included "grapheme" in 1901. The first occurrence has been rendered as follows:

> The connection of language enunciation and writing reduces to the associations of phonetic representations with graphic representations, i.e. of phonemes as well as their parts and combinations with graphemes as well as their parts and combinations.[25]

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21 Nina Catach, "The Grapheme" (1986).

22 Stanislas Dehaene, *Reading in the Brain* (2009). A less parochial view (see §12.4) is taken in Stanislas Dehaene, Laurent Cohen, José Morais, and Régine Kolinsky, "Illiterate to Literate" (2015).

23 A fifth inventor, Aarni Penttilä, used the term quite idionsyncratically and is dismissed by Manfred Kohrt, "The Term 'Grapheme' in the History and Theory of Linguistics" (1986), 82f.

24 See Roman Jakobson, "The Kazan' School of Polish Linguistics" (1971), for as much of the development as can be reconstructed. The term "phoneme" was a few years older but had not been defined in a modern sense or used rigorously, as shown by Joachim Mugdan, "On the Origins of the Term *Phoneme*" (2011).

25 Jan Baudouin de Courtenay, "Wskazówki dla zapisujących materiały gwarowe na obszarze językowym polskim" (1901), 116, translated by Piotr Ruszkiewicz, "Jan Baudouin de Courtenay's Theory of the Grapheme" (1978), 118—who shows that Baudouin had been concerned with the topic for at least 35 years.

In 1908:

> The discourse peculiar to Russian school grammars of "soft vowels" is due to
> the confusion of letters with sounds, of graphemes with phonemes. Russian
> writing has vowel graphemes, i.e. representations of vocalic letters, which are
> associated with the representation of the "softness" of preceding consonants;
> as a result, this label "soft" is transferred to the vowels corresponding to these
> graphemes by the so-familiar path of psychological misattribution and con-
> fusion, so that the consonants preceding these vowels are not understood at
> all as "soft."

> We have for the most part divested ourselves of the commingling of letters
> with sounds, of graphemes with phonemes. But next within the realm of pho-
> netics itself comes the distinction of the acoustic from the physiological, the
> centripetal from the centrifugal. Accordingly, our scientific jargon must also
> undergo a thorough revision. [26]

In 1910:

> The *confusion* of letters with sounds, of *graphemes* (representations of letters)
> with *phonemes* (representations of sounds), is responsible for:

> 1) conclusions about the difference and identity of sounds based on the dif-
> ference or identity of letters;
> 2) the transfer of the notion of homogeneity and indivisibility from graph-
> emes to phonemes.[27]

This passage continues with a characterization of the phoneme showing that
Baudouin extended the use of *-eme* in a way that would not be perpetuated, and
grapheme may at that time have gone the way of his *kineme* and *acousmeme*.

Much later, he anticipated many of the observations to be made by scholars of
writing and written language in succeeding decades. Most importantly, "In order to
pronounce correctly a written word …, one must first understand the word. To the
speaker of a given language this presents no special problem."[28]

The use by Whorf (1892–1941) of the term "grapheme" likely went unnoticed[29]
because it appeared in an article in the context of his attempted decipherment of
Maya glyphs, not a topic of compelling interest to the linguists of his day (§9.3)—
astonishingly, the article has long been readily available in the well-known collec-
tion *Language, Thought, and Reality*:

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26 Jan Baudouin de Courtenay, "Zur Frage über die 'Weichheit' und 'Härte' der Sprachlaute" (1908),
586f., 590 (my translations).

27 Jan Baudouin de Courtenay, "Phonetic Laws" (1910 [1972]), 271.

28 Jan Baudouin de Courtenay, "The Influence of Language on World-View and Mood" (1929 [1972]),
287f.

29 The OED reported Stetson's as the first use of the term in English, as does the literature on writing
systems and on reading. The 1932 antedating was uncovered by Fred R. Shapiro, "Contributions
to the History of Linguistic Terminology" (1995), 26, to which I was directed by Joanne Despres of
Merriam-Webster, Inc., whose dictionaries carry the earlier date. Meanwhile, Ross Clark reports
(Usenet newsgroup sci.lang, January 6, 2017) that the *OED* now contains Twaddell's 1935 use.

> Grapheme is a word formed on the analogy of morpheme, semanteme, to denote any written symbol, especially as a linguistic factor, in place of "ideogram," "pictograph," or the ambiguous "character." In discussing hieroglyphs it is desirable to have a term that does not presuppose anything about the nature of the denotative process employed.[30]

Twaddell's (1906–1982) coinage seems jocular, intended to mock certain linguists he disagreed with:

> For many linguists, it appears, the phoneme functions as a unit to be represented by a symbol in so-called phonetic transcriptions. It appears that the unit these linguists require cannot sufficiently take into account either phonological or phonetic facts; it would clarify the issue if these units might be called 'graphemes', 'transcribemes', or even 'letters'.[31]

R. H. Stetson (1872–1950) was a phonetician. He was interested in movement and had devised the field of "motor phonetics":[32]

> [The phoneme] is an articulation ... essentially a movement pattern.
> There are many movement patterns like it and a comparison may help in understanding the phoneme. The unit of writing may be called the grapheme; although often used to represent phonemes, it is not a mere parallel to speech. Much is written that is not pronounced, in music, in the formulae of mathematics and of the physical sciences .... In English the same character may represent several different phonemes and a well defined phoneme may be represented by two graphemes as in the case of "th" and "ph."
> The grapheme proves to be the standardized character of writing, with certain conventions as to its meaning in combinations which is extremely varied through the range of music, mathematics, symbolic logic, physical sciences, and language.[33]

It is perhaps not surprising to find him veering into matters of handwriting—and the pattern of a symphony conductor's baton marking time, and "the podeme derived from the step or stride in locomotion." These applications of emic theory were perhaps a step too far for language scholars of his time.

12.2 Orthographic depth

Despite all the—mostly unacknowledged—difficulties with the notion of "grapheme," the associated notion of "phoneme–grapheme correspondence" has exercised

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30 Benjamin Lee Whorf, "A Central American Inscription Combining Mexican and Maya Day Signs" (1932 [1956]), 45 n. 5.
31 W. Freeman Twaddell, *On Defining the Phoneme* (1935), 54 (= 1957: 76b).
32 R. H. Stetson, *Motor Phonetics* (1928).
33 R. H. Stetson, "The Phoneme and the Grapheme" (1937), 353.

a powerful hold on psychologists of reading. While they may not endorse the "one-for-one" obsession of spelling reformers, they seem to have been convinced that there's just one way of teaching reading: to be specific, the way that has been developed for English.

Well, actually, two ways, which often go by the names "phonics" and "whole-word," and for decades these were seen as mutually exclusive. *Phonics*, broadly, follows the premise that the learner must first master the correlations between spellings and sounds; *whole-word* believes that since words aren't read by sounding them out letter by letter (or "grapheme" by "grapheme"), they should simply be taught as wholes of sound and meaning without special attention to the letters they're made up of. Cooler heads seem to have prevailed and recognize that aspects of both techniques are necessary for a language like English.

But in order to teach all writing systems using methods developed for English, it's necessary to fit them all to a Procrustean English bed. When the few other languages mentioned by reading researchers were those like Spanish, Finnish, and Czech, which come close to the one-letter-one-phoneme "ideal," it was easy to say that they were at the easy end of a continuum, English was at the hard end, and French was somewhere in the middle. But then it was suggested that Hebrew fitted alongside English at the hard end—or should we say the deep end.

The term "orthographic depth" was developed in the context of European alphabets and referred to the fact that English orthography does not reflect the *surface* phonemics (or phonetics) of the English language particularly well, but rather a *deep* layer (playing on the by then already superseded Chomskyan notions of "deep" and "surface" structure in syntax), whereas the orthography of Serbo-Croatian (as it then was)* does reflect the surface structure. English was labeled a "deep" orthography

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* Before the dissolution of Yugoslavia, a single literary language that had been created early in the nineteenth century served both Serbs and Croats. The former (Eastern Orthodox) used a Cyrillic alphabet, the latter (Roman Catholic) a Roman alphabet (but all children were taught both, and interesting inquiries into biscriptalism were made). Nowadays four languages are recognized, not only Serbian and Croatian, but Bosnian and Montenegrin as well—for identifying "languages" is a political, not a linguistic, endeavor.

Details *(continued)*

12.2 The notion of orthographic depth was developed by several scholars associated with the Haskins Laboratories for basic research on spoken and written language, in New Haven, notably Leonard Katz and Laurie B. Feldman, "Linguistic Coding in Word Recognition" (1981) and "Relation between Pronunciation and Recognition of Printed Words" (1983), but it was adumbrated in one of the first interdisciplinary conferences on the psychology and linguistics of reading, by Edward Klima, "How Alphabets Might Reflect Language" (1972), and Samuel E. Martin, "Nonalphabetic Writing Systems" (1972). It is associated most prominently with Ram Frost and found its fullest expression in his "Orthographic Systems and Skilled Word Recognition Processes in Reading" (2005). "Biscriptal" education in Yugoslavia provided a rare opportunity to investigate two alphabets that share a number of symbols—some representing

and Serbo-Croatian a "shallow" orthography. But does the concept of orthographic depth have value in the description of orthographies other than European alphabets? Casting a broader net across the sea of writing systems suggests that no, there isn't a single continuum on which all writing systems can be placed. The few examples under each of these ten "dimensions" represent only a small selection.

I. Retention of historical spellings despite pronunciation change

Words can be spelled the same but pronounced differently. Language change in English accounts for the many pronunciations of ⟨ough⟩ exemplified by the words *bough/cough/dough/through/tough*, which once all rhymed.

Conversely, words can be spelled differently but pronounced the same: In English, *meat/meet/mete*, *peak/peek/pique*, even *relieve/receive*, reflect dialect differences within the language, which are sometimes retained in local pronunciations; or borrowing both spellings and pronunciations from different sources. In Hebrew, ancient spellings with ע ה א, ת ט, ק כ, and ס שׂ (ʕ h ʔ, t ṭ, q k, ś s) are retained even though in the modern language those groups of letters have merged to ∅, /t/, /k/, and /s/ respectively. Many languages influenced by Sanskrit retain letters for three sibilants श ष स (ś ṣ s) for spelling loanwords from that language, even though in many of the modern languages they have merged to /s/.

II. Spelling constancy despite morphophonemic alternation

In English and Russian, depth is morphophonemic because the orthography does not change when either morphemes or phonemes undergo conditioned alternations: /haws/ ⟨house⟩ becomes /hawz/ when the plural suffix is added, but the spelling does not change: ⟨houses⟩. In Russian, /d/, /t/, and /c/ at the end of a morpheme take on the voicing of a following stop, but the spelling doesn't change: a suffix, водка /vód-ka/ [ˈvotkɐ] 'vodka'; a prefix, отблеск /ót-blʲesk/ [ˈodblʲɛsk] 'reflection, gleam'; or a compound—плацкарта /plac-kárta/ [plɐtsˈkartɐ] 'reserved seat ticket' versus плацдарм /plac-dárm/ [plɐdzˈdarm] 'bridgehead'.

III. Omission of phonological elements

In Hebrew and Arabic, most vowels are normally not written: Modern Hebrew orthography writes all the consonants and uses *matres lectionis* for some of the

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Details *(continued)*

the same sound, some representing different ones—although only capital letters, and not connected texts, were studied: Laurie B. Feldman and Michael T. Turvey, "Word Recognition in Serbo-Croatian Is Phonologically Analytic" (1983).

The first five dimensions of orthographic depth were identified in Peter T. Daniels, "Introduction to Graphonomy" (2012), and another five were contributed by the first author in David L. Share and Peter T. Daniels, "Aksharas, Alphasyllabaries, Abugidas, Alphabets, and Orthographic Depth" (2015), revised in Peter T. Daniels and David L. Share, "Writing System Variation" (2017).

vowels that in Biblical Hebrew were long. Many consonant strings can represent several words: ספר ⟨spr⟩ can be /séfer/ 'book', /safar/ 'count (v.)', /sfar/ 'enumeration', or /sapar/ 'barber'. In English, stress isn't marked: *contráct* (v.) / *cóntract* (n.). The four accent marks that designate the four tones of Mandarin Chinese in *pinyin* (see note * on p. 84) are hardly ever used. Just about every time in all these cases, it is the context that ensures that no problem arises in reading.

IV. Dual-purpose letters

The *matres lectionis* of the Aramaic-based writing systems usually retain their consonantal value as well as indicating, or even representing (as with Arabic ا و يـ ⟨ī ū ā⟩), vowels. The merging of the shapes of Middle Iranian letters does not reflect merging of their sounds (Table 7.2). In English, ⟨h⟩ doubles as a diacritic in the digraphs ⟨ch ph sh th wh⟩ and sometimes ⟨kh⟩, indicating a pronunciation similar to that of the bare consonant, rather than aspiration. Japanese *on* and *kun* readings of *kanji* (§7.1) are a spectacular example.

V. Diglossia

Diglossia is the name for the situation in which the language learned by all literate people differs considerably from the language they speak; those languages were referred to as the "High" and "Low" varieties respectively. This isn't a common occurrence; the four original examples were Standard German/Swiss German, Standard Arabic/vernacular Arabics, Standard French/Haitian Creole, and Katharevousa/Dhimotiki in Greece. The spoken language is normally not written, so learning to read is tantamount to learning a foreign language.

VI. Graphic considerations and allographs

In an inversion of Dimension I, orthographic depth can result from differentiation for solely graphic reasons. Recall the spelling of English [ʌ] with ⟨o⟩ as in *come, monk, won* because ⟨come monk won⟩ were considered easier to read than ⟨cume munk wun⟩ (§2.1.1). In Russian, most of the capital and small letters are the same shape, but in English mostly they differ: В в ⟨V v⟩ vs. B b, Д д ⟨D d⟩; here allography carries meaning. Final letters in Hebrew, ץ ף ן ם ך corresponding to צ פ נ מ כ ⟨ṣ p n m k⟩, and Greek, ς corresponding to σ ⟨s⟩, represent a different sort of allography, purely conditioned. The same holds for the remarkable differences between vowel *aksharas* and *matras* in Indic (§5.2) and between independent characters and their component forms in Chinese (Table 6.1).

Details *(continued)*

III The examples of Hebrew ambiguity are entries in E. Ben-Yehuda and D. Weinstein, eds., *Ben-Yehuda's Pocket Hebrew–English English–Hebrew Dictionary* (1961), 225a.
V The concept of diglossia was introduced by Charles Ferguson, "Diglossia" (1959). It is often extended to just about any sort of bidialectal or even bilingual situation, but this is an unfortunate distortion.

VII. Ligaturing

Sometimes a coalescence of characters is so trivial that it is never mentioned. In standard typography, ⟨f⟩⟨i⟩ combine into ⟨fi⟩, which, to a novice reader at least, might look very like ⟨h⟩, but the ⟨fi⟩ ligature seems never to be taught, and no resulting confusion is reported. The joining of letters in Arabic might be considered a source of difficulty in learning to read, though this may be more an illusion caused by the way the script is taught (Table 3.4). The considerable variety of techniques for conjunct formation in the Indic scripts (§5.5), on the other hand, may cause considerable difficulty in mastering the orthographies.

VIII. Visual uniformity or complexity

The shapes of scripts—their ductus—reflect the esthetic ambiance of the cultures they are used in. Some scripts seem to exhibit far more elaborate shapes than are needed to distinguish 40-odd characters from each other. Among the Indic scripts, compound *akshara*s (§5.5) sometimes bear little resemblance to their unattached components. The Cyrillic alphabet is harder to read than the Roman alphabet because its letters are more similar in shape (Table 2.13); Armenian (Table 2.11) presents even more of the same difficulty—it's been said to be unphotocopiable because the large preponderance of thin strokes tend to disappear in the reproducing—though in contemporary Armenian typography the letters have been considerably assimilated to the Roman ductus: compare traditional ա բ գ դ ե զ է ը թ ‹ ⟨a b g d e z ē ə tʰ h⟩ with a modern font, ա բ գ դ ե զ է ը h.

IX. Non-linearity

Diacritics add a non-linear dimension to many scripts. Among European alphabets they have a number of different functions, sometimes several in a single language (§2.2.1). In Indic scripts, the vowel *matras* can appear on all four sides of a consonant *akshara*; in Chinese characters, the radical usually appears to the left of the phonetic component but can also be to the right, above, below, or surrounding it.

Details *(continued)*

VII My re-presentation of Arabic ligaturing, Peter T. Daniels, "Arabic Letters Do Not Have Final Forms" (2013a), has not yet been given written form. Grammars and textbooks for Indian languages rarely include tables of all the possible aksharic combinations in their abugidas. A welcome exception is the pamphlet series typified by K. Srinivasachari, *Learn Sanskrit in 30 Days* (n.d.) (they're called "Learn [Language] Through English" on the spine); there are volumes for Arabic, Bengali, Gujarati, Kannada, Malayalam, Marathi, Oriya, Punjabi, Tamil, Telugu, and Urdu (but not Sinhala, which isn't a language of India). For Devanagari and its two closest relatives, Gujarati and Bengali, see H. M. Lambert, *Introduction to the Devanagari Script* (1953).

IX The effect of non-linearity of Indic vowel *matras* on fluency of reading was investigated by Padmapriya Kandhadai and Richard Sproat, "Impact of Spatial Ordering" (2010).

X. Inventory size

A few alphabets have more than fifty signs. Most alphabets have both majuscules and minuscules. If compound *akshara*s are counted individually, they can number in the hundreds. Similarly, the few dozen Korean letters enter into more than a thousand syllable blocks. The several thousand Chinese characters reduce to a few hundred semantic and phonetic components, but there are no such clues to the meaning or sound of the 2000 or so Japanese *kanji*, which must be mastered holistically.

12.3 Creating orthographies

Almost all the adaptations of scripts to new languages we've looked at in this book have been devised by people seeking to record their own language. Oftentimes they've simply used the existing resources as best they can to handle the different sets of consonants and vowels that are found in their language. Sometimes there's a considerable mismatch between those sets—the most obvious example is that Latin had only a single sibilant, /s/ (in later times /z/ came in via Greek loanwords), but just about every European language that took over the Roman alphabet had at least three, adding /ʃ/, and quite a few, notably the Slavic languages, had quite a few more than two. The different languages came up with quite a variety of devices to spell their different sibilants; the prize probably goes to Polish:

[s]	[ɕ]	[ʃ]	[z]	[ʑ]	[ʒ]	[ts]	[tɕ]	[tʃ]	[dz]	[dʑ]	[dʒ]
s	ś	sz	z	ź	ż, rz	c	ć	cz	dz	dź	dż

12.3.1 A curious pattern

But in enough unrelated cases that it seems some sort of pattern might be involved, properties of segments are encoded not in the letters for the segments themselves, but in an adjacent letter. One of these examples figured in the earliest proposal of the term "grapheme": Baudouin de Courtenay's discussion of the vowel letters in Russian (§12.1.4.3), where a palatal segment is signaled by the following vowel letter: a ⟨a⟩ я ⟨ja⟩, э ⟨e⟩ e ⟨je⟩, o ⟨o⟩ ë ⟨jo⟩, y ⟨u⟩ ю ⟨ju⟩; the high non-back vowels и ⟨i⟩ and ы ⟨y⟩ [ɨj] can't be preceded by the glide. Palatalization of consonants or its absence can be signaled by the letters ь and ъ respectively.

The Turkish language has a fairly limited array of consonants but no fewer than eight vowels. The Arabic script used for Ottoman Turkish (until 1928) might seem particularly unsuited, with its 27 consonant letters and provision for just three vowels. But there's a special feature of Turkish, and many other languages of the world, that Ottoman orthography took advantage of: *vowel harmony*. The eight vowels are grouped on three dimensions: four vowels are *front* /i e ü ö/ and four are *back* /ɨ a u o/; four are *high* /i ɨ u ü/ and four are *low* /e a o ö/; and four are *rounded*

/ü ö u o/ and four aren't /i ɨ e a/. The Ottoman solution was to use the letters for "back" consonants for the back vowels, the "regular" consonants for the front vowels: صوص (ṣwṣ) *sus* 'be quiet', سوس (sws) *süs* 'ornamental'; طار لا (ṭārlā) *tarlá* 'field', تر له (trlh) *terlé* 'sweat'.

One word can usually include vowels from only one of those groups, and inflectional endings have to participate in the word's vowel harmony. The plural suffix, for instance, is |lVr|, which becomes -*ler* after front vowels and -*lar* after back vowels. Both allomorphs are spelled لر in Ottoman, but in modern orthography (§12.4) they're different. The five Roman vowels plus two with umlauts are supplemented by an innovation: dotless ⟨ı⟩ spells /ɨ/ and its capital is ⟨I⟩; the capital of ⟨i⟩ /i/ is dotted ⟨İ⟩. Some of the consonants can trip up readers familiar with older applications of the Roman alphabet: ⟨ğ⟩ marks a preceding vowel as long, ⟨c⟩ is /dʒ/, ⟨ş⟩ is /ʃ/, ⟨ç⟩ is /tʃ/.

12.3.2 Missionary scripts

Especially in §§ 2.1.4.2, 2.4, 3.2.3, and 5.6, we've seen examples of the creation of scripts and orthographies in olden times by proselytizers and missionaries for major world religions. The principal exceptions appear in Chapter 8, with missionaries inventing new scripts for their converts. In recent centuries, missionaries and their analogues have been responsible for much, or most, of the creation of new orthographies, and for the most part they've adapted their own alphabet—since most mission activity is Christian, based in Europe and North America, most new orthographies are in the Roman alphabet. During and in the wake of the Age of Exploration, when Europeans set out around the world and discovered people whose souls they believed they needed to save, missionaries were not far behind. The sixteenth century saw the creation of many grammars of indigenous languages, mainly in Latin America, so that clergy could learn to preach and minister to their charges; but there was little or no interest in writing those languages, since only the Latin Scriptures and catechisms were deemed worthy of study.

One of the first languages for which a Roman-alphabet orthography was devised by missionaries was Vietnamese. Portuguese missionaries laid the groundwork, and the French scholar Alexandre de Rhodes (1591–1660) finalized their work. The familiar story of language change and orthographic inertia is responsible for what appear to be some oddities in the use of letters: ⟨đ⟩ is used for [d] and ⟨d⟩ for [z] not out of some desire to confound the Europeans, but because the modern sounds are the result of centuries of changes. Similarly, ⟨ph⟩ is [f] and ⟨kh⟩ is [x], as might be expected—but ⟨th⟩ is [tʰ], not [θ]. The most unusual feature of Vietnamese orthography is the obligatory notation of no fewer than six different tones using five distinct

Table 12.1 Vietnamese vowels and tones

A. VOWELS				B. TONES			
				Symbol	Description	Phonetics	Meaning
i [i]		ư [ɯ]	u [u]	ma	level	[mā]	'ghost'
				má (acute)	high rising	[má]	'cheek'
ê [e]	â [ə]	ơ [ɤ]	ô [o]	mà (grave)	low (falling)	[mà]	'but'
				mả (hook)	dipping-rising	[mǎ]	'tomb'
e [ɛ]	ă [a]	a [ɑ]	o [ɔ]	mã (tilde)	high rising glottalized	[máʔ]	'horse'
				mạ (dot)	low glottalized	[màʔ]	'rice seedling'

diacritics (Table 12.1B). It is often said that the eleven distinct vowel letters (Table 12.1A) also consist of a base plus a diacritic, but it's better not to consider the differentiations between similar letters to be diacritics because the specific marks used (horns, circumflexes, breve) aren't associated with consistent distinctions between the corresponding vowels, ⟨Cộng hòa Xã hội chủ nghĩa Việt Nam⟩ 'Socialist Republic of Vietnam'.

A different story emerges from missionaries at work on Pacific islands, attending to Polynesian languages. The first Roman alphabets were created in the 1820s, initially for Samoan and Fijian. The Polynesian languages are well known for having very few consonants—Tahitian has /t/ but not /k/, Hawai'ian has /k/ but not /t/, and the early explorers couldn't always decide which letter to use in spelling the names of islands they put on their first maps.

An interesting property of Samoan and Tongan, and Polynesian languages generally, is that they don't have voiced stops /b d g/, which freed up the letter ⟨g⟩ for the third nasal alongside /m n/, namely /ŋ/. The capital of American Samoa

1886	1897	1950
King George I	King George II	Queen Salote
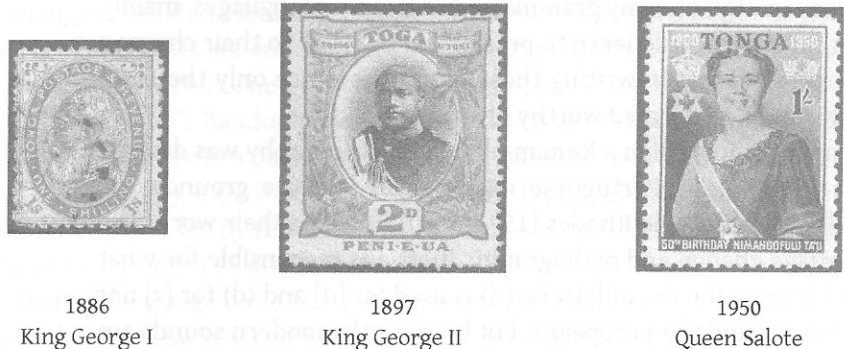
From the author's collection.

Figure 12.3. Stamps of Tonga showing orthographic change

Details *(continued)* ────────────────────────────────

12.3.2 The complicated history of Polynesian orthographies was untangled somewhat for me by Albert J. Schütz (University of Hawai'i).

seems always to have been spelled Pago Pago, and the pronunciation [paŋo paŋo] is familiar. In Tongan, though, at first the phoneme /ŋ/ was spelled ⟨ng⟩ as in English, even though native speakers would have seen no reason to include the ⟨n⟩. When Tonga's first postage stamps were issued (Figure 12.3), imitating a familiar British design, depicting King George Tupou I (1797–1893, r. 1875–93) the name appeared as ⟨Tonga⟩. Shortly after the accession of the new king, his great-grandson George Tupou II (1874–1918, one of the first casualties of the influenza epidemic), the stamps read ⟨Toga⟩ in accordance with local sensibilities. His daughter Salote [i.e., Charlotte] Tupou III (1900–1965) had reigned for more than thirty years before the spelling was again changed for the convenience of foreigners (and perhaps to avoid confusion with Togo, which from 1897 under successive German, Anglo-French, and French administration had stamps of its own).

12.3.3 A politicians' script

When British influence began to expand through India in the eighteenth century, little concern was shown for the consistent spelling of local words taken into English. The ⟨Hindoo⟩ of those days eventually gave way to ⟨Hindu⟩ (it's taken longer for ⟨Moslem⟩ to yield to ⟨Muslim⟩), but ⟨Parsee⟩ has hung on for followers of Zoroastrianism, referring to their Persian origin—it's essentially the same word as "Farsi," the misnomer for the modern Persian language of Iran (as if we called German "Doitch").

A bit more problematic are the words *Punjab* and *pundit*. In Sanskrit and Hindi they're पंजाब ⟨paⁿjāb⟩ and पंडित ⟨paⁿdit⟩. The ⟨a⟩ is pronounced [ʌ], and the most natural spelling for that sound in English is ⟨u⟩. However, when a more "scientific" attempt at pronouncing words borrowed from Hindi set in, a pronunciation ['puwnˌdʒæb] was often heard, even giving rise to the spelling ⟨Poonjab⟩. ⟨Pundit⟩ seems not to have had that problem; instead, ⟨Pandit⟩ was (re)introduced as the spelling for the term when it was used as an honorific, as in *Pandit Nehru*, and it's not surprising that it's likely to be pronounced ['pandɪt] in that context.

The word *juggernaut*—quite aside from the elaborate explanations of how it came into English—represents Sanskrit जगन्नाथः ⟨jagan-nāthaḥ⟩ 'world-lord', with any number of accommodations. The ⟨u⟩ < /a/ we've already met. The doubled ⟨g⟩ is to preserve the sound of the ⟨u⟩, but it may have kept the legitimate double-*n* of the original from being carried over. The ⟨r⟩ is very interesting. In recent British English, ⟨er⟩ represents [ə]. But early in the nineteenth century, dropping post-vocalic [r] was far from fashionable; there's no evidence of it in stressed syllables before 1800, or in unstressed syllables much before the mid eighteenth century—except that it's found in this word in the mid seventeenth! The final ⟨aḥ⟩ had already been dropped in Hindi, the [tʰ] is the usual English sound—but [ɔ:] for *ā* is a bit odd.

12.3.4 Linguists' scripts

Beginning in the 1930s, important contributions were made by missionary linguists to the development of descriptive linguistics generally, to the description of little-known or unknown languages, and in particular to the creation of writing systems for unwritten languages. Generations of linguists, both missionary and general, between the 1940s and at least the 1960s trained on a series of textbooks by Kenneth L. Pike (1912–2000), the linguist who developed the analytic distinction between *emic* and *etic* (§12.1.4). Particularly significant is the subtitle of *Phonemics: A Technique for <u>Reducing</u> Languages to Writing*. For Pike, a practical orthography was all but equivalent to a phonemic transcription, and his teaching must have played a part in the pervasive view that "one phoneme / one letter" is the only acceptable pattern for a writing system (cf. §2.1.3).

Discussions of creating orthographies frequently point out that on occasion languages have received competing writing systems—because the speakers were arbitrarily divided between (say) French and British colonies, or were proselytized by both Roman Catholic and Protestant missionaries; but beyond lists of spellings of phonemes, they rarely give examples even at the word level. Here, instead, is a pair of orthographies for Kru, a Kwa language of Liberia, that were posited in order to illustrate the problems such conflicts can cause. The "traditional" version reflects a "tradition" going all the way back to 1927, when an "Africa alphabet" for use in all the British colonies was proposed, which in effect intuited the "phonemic principle" that was still somewhat inchoate (cf. §12.1.3). The "Anglicizing" orthography takes advantage of the fact that many Kru-speakers spoke or had studied English and uses conventions taken from that language.

Mɔ Pɔɔ. Mɔ Dyipoteh Klasehẹh plesina. Mɔ ke a dedyu Temɔteh sɔ̧ ɔ̧ tuane. A ponyneoo Falimɔ, a̧a̧ nwene nyuɛke a̧a̧ gbɔmaa nyu. (*Traditional*)	Maw Paw-aw. Maw dyeepowtayh Klasayh-ayhn playseena. Maw kay a daydyoo Taymawtayh sawn-awn tooanay. A pownynay-ow-ow Faleemaw, an-an nwaynay nyoo ehkay an-an gbown-maa nyoo. ("*Anglicizing*")

'Paul, a prisoner of Christ Jesus, and Timothy our brother, To Philemon our dear friend and co-worker ...' (Philemon 1 *NRSV*)

Details *(continued)*

12.3.4 The history of linguists' remarks on the creation of orthographies is outlined by Richard L. Venezky, "Principles for the Design of Practical Writing Systems" (1970a). The *locus classicus* for "one phoneme / one letter" is Kenneth L. Pike, *Phonemics* (1943).

"The Africa alphabet" was set forth in International Institute of African Languages and Cultures, *Practical Orthography of African Languages* (1930); a quixotic proposal to replace all African orthographies with strictly phonemic symbols chosen from a large, uniform set of letters—also under the auspices of the International African Institute, as it had come to be called—is found in Michael Mann and David Dalby, *Thesaurus of African Languages* (1987),

Here for comparison is a different verse from a translation published in 1921, before the introduction of the Africa alphabet, exhibiting a plethora of diacritics.

Dâke wẹ ū neâ nigba ū dâ Jordan winti, ọ mū nó bo ne ọ phedo Nyesõa tae nie ọ pō nyepo ni dibo nie bẹ yeâ kpenê kukui dey ser;

'He went into all the region around the Jordan, proclaiming a baptism of repentance for forgiveness of sins, ...' (Luke 3:3 *NRSV*)

William A. Smalley (1923–1997), by contrast, paid close attention to interaction between scripts, orthographies, and their users. When an existing alphabet is adapted, sometimes the community wants its orthography to resemble that of the local authority or of the former colonial power—and sometimes the community wants its orthography to be as distinctive as possible. Smalley urged the adaptation of local scripts for unwritten languages and provided nearly a dozen examples of the use of Thai-based orthographies for local languages in Thailand. In his view, the cooperation of speakers of the language is absolutely essential—a writing system must not be imposed on a community "from above."

Smalley's influence, though never explicit, is pervasive in a recent collection that includes programmatic articles on non-linguistic factors in orthography design and on orthographic depth, as well as case studies of orthography creation for a wide variety of languages, including a Tibetan-script-based orthography for the related Kurtöp language of Bhutan, a nation where the Tibetan script itself is considered too holy for secular use.

12.4 Writing versus language

Now that we've sampled the world's writing systems, we can return to an observation that opened the book: writing is not like language. In this chapter I talked about duality of patterning and emic analyses, which don't work for phenomena organized consciously. There are a few other major differences.

Most importantly, written language differs in significant ways from spoken language, and the study of written language is a whole different discipline from

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Details *(continued)* ——————————————————————————

206–19. The Kru examples are from Joseph E. Grimes, Augustus B. Marwieh, and Amy Bauernschmidt, "Several Kru Orthographies" (1960), 118, with the comparison verse in E. A. Nida, ed., *The Book of a Thousand Tongues* (1972), 238 #679. Smalley's observations with case studies are set out in *Orthography Studies* (1963); the examples of the application of Thai script to minority languages are in his *Phonemes and Orthography* (1976); and in *Linguistic Diversity and National Unity* (1994) his views are presented in the most detail. The Smalley approach to orthography creation finds exemplary application in M. Cahill and K. Rice, eds., *Developing Orthographies for Unwritten Languages* (2014). The development of a new script in Bhutan is described by Gwendolyn Hyslop, "Kurtöp Orthography Development in Bhutan" (2014).

graphonomy. The way most directly related to the physical existence of writing is the evanescence of speech versus the protracted availability of writing. The ensuing questions of literacy and society, of literacy and the individual have engaged many scholars from many disciplines beyond linguistics and could provide the subject matter for an entirely different exploratory essay.

Returning to graphonomy: language is constantly changing, while writing generally obeys tradition and does not readily respond to changes. Simplification in some areas of language is accompanied by complication in other areas, as a language's overall "efficiency" tends to remain constant; but a script's efficiency—its "goodness of fit" to its language—is maximal when it's devised, and deteriorates thereafter. Writing systems with long histories end up quite "deep" on Dimension I.

Because writing is learned—studied—rather than acquired automatically like native languages, there's no particular pressure on writing systems to be easy to learn. Whether someone is born into a scribal family, as seems to have been the case in Mesopotamia at least, or whether they have to go to school until they're at least 14 years old so that society can attain the elusive goal of "universal literacy," as in most of the developed world, they're required to master their society's writing system no matter how little or much time it might take to do so. Writing systems can thus grow more and more complex, for various reasons, without any counterpressure until some significant change in society prompts a change.

Notably, writing systems can be altered by fiat. Kemal Atatürk could not have ordered the minority peoples of Turkey to stop speaking their languages and use

Details *(continued)* ————————————————————————————————

12.4

> Putting words down on paper and having them printed is dangerous because, once printed, they have a kind of immortality that the spoken word does not. The spoken word, no matter how wise, goes up in smoke and is lost forever.
>
> Andrew A. Rooney, *Sweet and Sour* (1992), 1–2* †

I won't recommend a particular work on written language, but a very good portrayal of the place of writing in world history is Nicholas Ostler, *Empires of the Word* (2005).

A fine introduction to the evolution of language is James R. Hurford, *The Origins of Language* (2014).

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* The quotation reached me as the solution to Michael Ashley, *Giant Book of Acrostics* (New York: Fall River Press, 2013), #126. It appears in the introduction to a collection of recent newspaper columns by the well-known CBS-TV writer and commentator Andy Rooney.

† At this point I might be expected to quote Plato: "[Writing] will introduce forgetfulness into the soul of those who learn it: they will not practice using their memory because they will put their trust in writing" (*Phaedrus* 275a, trans. Alexander Nehamas and Paul Woodruff, p. 551). This is usually taken out of context as a condemnation of writing, but Lane Wilkinson, "Reading, Writing, and What Plato Really Thought" (2010), considering the passages just before and after the anecdote about Thoth's invention of writing, concludes that "To Socrates, the problem with writing is not that it 'creates forgetfulness in the learners' [Jowett's translation] but that people mistakenly hold the written word up as the only path to knowledge, when in reality, books are just information and the real knowledge comes from within the reader."

only Turkish, but he could decree that the Turkish language would be written with a Roman-based writing system rather than an Arabic-based one beginning on November 3, 1928. Noah Webster could not successfully tell Americans to not split infinitives, say, but he could successfully recommend dropping the ⟨u⟩ from words like ⟨colour⟩.

What is the root of these differences between writing and language?

Humans have had language for a very long time indeed, and the brain and the speech and hearing organs long ago evolved to perfect the ability to talk. But writing has been around for only a little over 5000 years—and we have no evidence that people who can read are more successful at making descendants than people who can't—so evolution hasn't provided us with brains that create and process writing automatically. This is why emic sorts of analysis, and other language-derived analytical tools, are not so well suited to writing.

Let's look at Stanislas Dehaene's *Reading in the Brain*, mentioned in n. 22 above. Dehaene integrates hundreds of studies of the brain and of behaviors involved in reading. But what's missing is almost any awareness that writing systems denote any stretch of speech other than the segment or, in a few mentions of Chinese characters, the morpheme; nor does he recognize the existence of the two-character Chinese word. He also doesn't acknowledge that language evolved long before certain brain regions were co-opted for reading. And why did he settle on the segment—the phoneme—as the stretch of speech to be connected with units of writing? Why did Baudouin de Courtenay settle on the segment for what "phoneme" designates?

The answer is the same for both these scholars, and for almost all the others who have been mentioned in this chapter: They were literate in French and English, Russian and Polish and German, Latin and Greek at least. What they read were alphabets. What if their first languages had been written with a syllabary? Then perhaps the most basic division would have been the syllable: are *pa* and *pu* any *more* different from each other than *p* and *t* are?

The following passage is especially valuable because the author is quite innocent of any linguistic or graphonomic theory. Referring to students attempting to learn to read and write Cherokee using the "alphabetic" arrangement of the characters as in Table 1.1, she says,

> ... the syllabary organized in this way vexes learners. They have a difficult time finding the right character because first they have to locate the sound according to alphabetical order and the English sound system. Spelling becomes the arduous task of first relying on English transliterations then locating the correct syllabary character within the alphabetical order.

Details *(continued)* ───────────────────────────────

The best account of Atatürk's script reform is the on-the-spot report from Maynard Owen Williams, "Turkey Goes to School" (1929).

The beginnings of neuroscience investigation of writing are presented by Stanislas Dehaene, *Reading in the Brain* (2009).

Half a century earlier, one of the leading American Descriptivist linguists, the Chinese-American Yuen-Ren Chao (1892–1982), had put it this way:

> To one who is used to an alphabetic system of writing, it seems to be the simplest thing to talk about the sound 'o', the sound 'e', the sound 'l' [ɛɬ], the sound 'b' [biː], or even the sound 'w' [ˈdʌbljuː]. But to one used to a logographic system of writing like the Chinese, or a syllabic system of writing like the Japanese, the nature of sound segments in the form of consonants and vowels is not at all obvious and even seems highly abstract. As an intermediate type we may cite Sanskrit or Tibetan writing in which each symbol has what is called an inherent vowel in addition to a consonant, so that it will represent a syllable with a vowel of generally [a]-quality, unless marked otherwise.

"Why segments?" may look like a crazy question. But not long after Baudouin worked out his systematic analysis of linguistic units, Roman Jakobson (1896–1982) began to identify units smaller than segments that he showed were really what made the differences between morphemes. He called them "phonetic features." These are properties like voicing vs. voicelessness, stop vs. continuant, oral vs. nasal—the things that label the rows and columns in Table 2.1. As we saw in the mention of the obsolescence of phoneme theory, Jakobson's disciple and collaborator Morris Halle (b. 1923) used featural analysis to justify his approach. Yet his analyses, and those of all the varieties of phonological theory that have sprung from it, continue to segment speech into precisely the units that are denoted by alphabets—even though phoneticians had meanwhile been demonstrating that there are no physical segments in the speech stream (§12.1.3). A systematization of a phonetic analysis could be done in terms of overlapping articulatory gestures: Voice Onset Time, Advanced Tongue Root, etc., but that has not been attempted: current approaches to phonology are still laden with C-onsonants and V-owels.

Linguists being guided—or misguided—by their scripts is not new. It's my opinion that the notion of consonantal roots arose when Arab grammarians first began to study the Arabic language as it was written in the Qur'ān, when all that appeared on the page were consonant letters. They thought of the vowel sounds as evanescent connections between the consonants, whereas the consonants had real existence because they appeared on the page before them. This is the opposite of what the

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Details *(continued)*

The quotation about learning Cherokee is from Ellen Cushman, *The Cherokee Syllabary* (2011), 45; the other is from Yuen Ren Chao, "Graphic and Phonetic Aspects of Linguistic and Mathematical Symbols" (1963), 71. Jakobson's clearest presentation of feature theory is in Roman Jakobson and Morris Halle, *Fundamentals of Language* (1956), and Halle's development is found primarily in Morris Halle, *The Sound Pattern of Russian* (1959), with its application to English in Noam Chomsky and Morris Halle, *The Sound Pattern of English* (1968). The post-Hallean, non-phonetic, but segment-bound approach to syllables is encapsulated by San Duanmu, *Syllable Structure* (2009).

etymologies of *our* words tell us: "sonant" is an old term for a sound that has "voice," like *a i u* and *b d g* (matched with "surd" for the corresponding "voiceless" sounds, *p t k*); and a "*con*-sonant" is thus a letter that goes *with* a voiced sound, such as a vowel.

Indian grammarians, on the other hand, were at work before the Indic languages were written; as we have seen (Chapter 5), they did not deem consonants and vowels to require equivalent representation. One of the early commentaries on Pāṇini's grammar, the *Vājasaneyi-Prātiśākhya* i.99–101, states *svaro 'kṣaram: sahādyair vyañjanaiḥ: uttaraiś cāvasitaiḥ* "A syllable is composed of a vowel, together with initial consonant(s) and, *in pausa*, a following consonant."*

Chinese grammarians, on a third hand, saw syllables but heard them in two parts: the initial and everything else, the rhyme (§6.1).

Given all the ways of subdividing the speech stream, why should just one—the "segmental" approach reflecting articulatory activity—have prevailed in the description of language?

Perhaps an insightful way to look at the nature and hence the origins of writing is to recognize that people write what they *hear* rather than what they *say*: alphabetic writing records successive "gestures" of the vocal tract, such as the touching of the tongue to parts of the oral cavity. The activities of the speech organs are not consciously available to a speaker, and they are equally unavailable to a listener. The only thing available to the listener is the sound itself; and as we saw in §12.1.2, the only acoustic unit of divisibility is the syllable. That's why the syllable is so important in the origins and evolution of writing.

Writing is how the writer communicates with the reader.

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* The word for 'syllable' is *akṣara*, and the question arises whether this description might have been influenced by the writing system. The putative date, third century BCE, of the commentary means that that possibility is not entirely ruled out.

Details *(continued)*

The quotation of the Indian grammarian is from W. S. Allen, *Phonetics in Ancient India* (1953), 80.

The background of the concept of "gesture" of the vocal tract is traced by Catherine F. Browman and Louis M. Goldstein, "Towards an Articulatory Phonology" (1986), and they introduce an approach to phonological analysis based on continuous gestures rather than discrete segments. The approach does not seem to have attracted many followers, but its inversion provided the insight into the nature of writing.
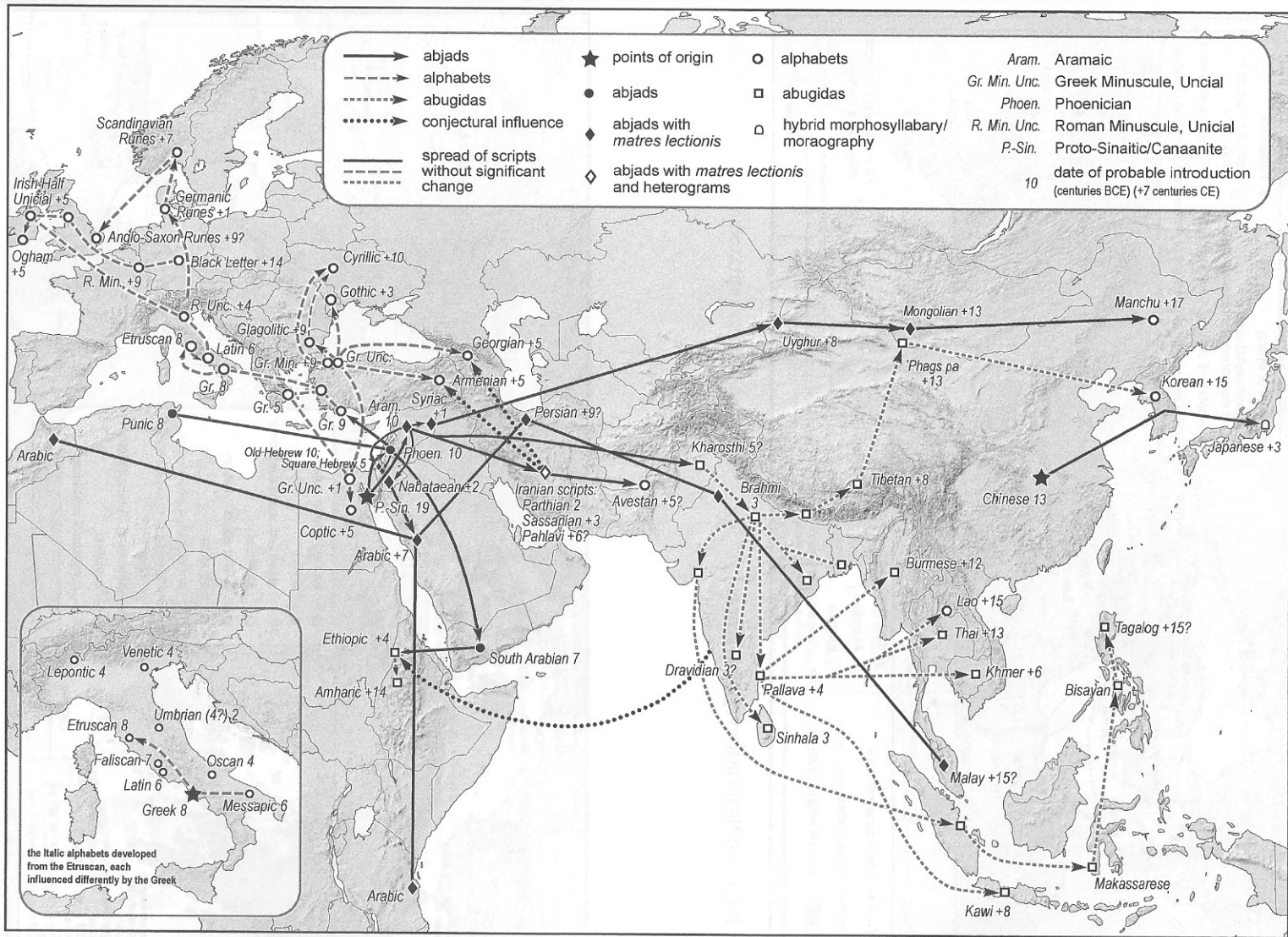
Map 1 The development of modern scripts

Legend:

- → abjads
- ⇢ alphabets
- ⋯▸ abugidas
- ⋯▸ conjectural influence
- — spread of scripts without significant change
- --- spread of scripts without significant change

- ★ points of origin
- ● abjads
- ◆ abjads with *matres lectionis*
- ◇ abjads with *matres lectionis* and heterograms

- ○ alphabets
- □ abugidas
- ⌂ hybrid morphosyllabary/ moraography

Aram.	Aramaic
Gr. Min. Unc.	Greek Minuscule, Uncial
Phoen.	Phoenician
R. Min. Unc.	Roman Minuscule, Uncial
P-Sin.	Proto-Sinaitic/Canaanite
10	date of probable introduction (centuries BCE) (+7 centuries CE)

Map labels:

Scandinavian Runes +7
Irish/Half Unicial +5
Germanic Runes +1
Anglo-Saxon Runes +9?
Ogham +5
Black Letter +14
R. Min. +9
Cyrillic +10
Gothic +3
Glagolitic +9
Etruscan 8
R. Unc. +4
Latin 6
Gr. Min. +9
Gr. Unc.
Georgian +5
Gr. 8
Gr. 5
Armenian +5
Aram. 10
Syriac +1
Persian +9?
Punic 8
Arabic
Gr. 9
Old-Hebrew 10
Square Hebrew 5
Phoen. 10
Gr. Unc. +1
Nabataean +2
P-Sin. 19
Coptic +5
Iranian scripts: Parthian 2, Sassanian +3, Pahlavi +6?
Avestan +5?
Kharosthi 5?
Brahmi 3
Arabic +7
Ethiopic +4
South Arabian 7
Amharic +14
Uyghur +8
Mongolian +13
Manchu +17
'Phags pa +13
Korean +15
Tibetan +8
Chinese 13
Japanese +3
Burmese +12
Lao +15
Thai +13
Khmer +6
Dravidian 3?
Pallava +4
Sinhala 3
Tagalog +15?
Bisayan
Malay +15?
Makassarese
Kawi +8
Arabic

Inset:

Leponitic 4
Venetic 4
Etruscan 8
Umbrian (4?) 2
Faliscan 7
Oscan 4
Latin 6
Greek 8
Messapic 6

the Italic alphabets developed from the Etruscan, each influenced differently by the Greek

Map 2 Ancient Near Eastern syllabic scripts

Map 3 Ancient Near Eastern segmental scripts

Map 4 text labels:

Mongolian +13–20 Orkhon Runes +8–9 to Manchu
'Phags pa +13–14
Uyghur +8–9
to Korean
Christian Sogdian +5–8
Tocharian B (Kuchean) +6–8
Turfan
Tocharian A (Agnean) +7–9
Dunhuang
Sogdian +4
North Turkestan Brahmi (Slanting Gupta)
Man. Sogdian
Parthian core area
Nisa
Tumshuqese +7–8
Kharoṣṭhī 3–+3
Xi'an
Syriac
Man. Parthian
Parthian +2–7
Dara (Abivard)
South Turkestan Brahmi (Upright Gupta)
Khotanese +7–
Kharoṣṭhī 5?
Pahlavi +6–
Tibetan +7–
Manichaean
Man. Middle Persian
Middle Persian +3–6
Naqsh-i Rustam
Avestan +9–
N.W. Gupta +4–6
Sassanian core area
Middle Brahmi +2–3

Legend (Map 4):
7–6 date of use (in centuries BCE) (+3 for centuries CE)
"Silk Road"   Man. Manichaean
◆ abjads with matres lectionis   → abjads
greatest extent of Parthian Empire
◇ abjads with matres lectionis and hererograms   --→ alphabets
greatest extent of Sassanian Empire
○ alphabet   ····→ abugidas
Kharoṣṭhī   Zoroastrians
□ abugida   ·····→ conjectural influence
■ major discoveries of documents
0   1200 kilometers
0   1200 miles

Map 4 Iranian and Indic scripts of Inner Asia

Map 5 text labels:

to 'Phags pa
from Imperial Aramaic
Taxila
Śarada +8
Kandahar
Kharoṣṭhī 5?
Gurmukhī
Tibetan +7
Kandahar: Bilingual inscription of Aśoka in Greek and Aramaic
Taxila: Inscription of Aśoka in Aramaic
Brahmi 3–+6
Siddhamatṛka +6–10
Bengali
Nagari +10
Kaithi
Gaudi +10–14
Gujarati
Devanagari
Burmese +12
Modi
Oriya
Mon +6?
Lao +15
Telugu/Kannada +6–14
Telugu
Thai +13
Tagalog +15?
Kannada
Pallava +4
Khmer +6
Hanunoo
Bisayan
Grantha +6–20
Tamil
Cham +4
to Ethiopic
Malayalam
Sinhala 3
Batak +15
Thaana +16
Malay +14
Incung +16
Makassarese +17
Buginese +15
Rejang +16
Bima +17
Lampung +17
Kawi +8
Ende +17
Javanese +13
Balinese

Legend (Map 5):
7–6 date of use (in centuries BCE) (+3 for centuries CE)
◆ abjads with matres lectionis   → abjads
○ alphabets   --→ abugidas
□ abugidas   ·····→ conjectural influence
The Indic scripts of Indonesia and the Philippines (not all are shown) are moribund at best, but some are being revived as reflections of ethnic identity.

Within India, tints designate the script used for the principal language of each state.
Earliest stages
Intermediate stages   Arabic script
Contemporary scripts
Used informally until recently   Tibetan script
0   1200 kilometers
0   1200 miles

Map 5 Spread and modern-day distribution of South and Southeast Asian scripts