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Two lectures on writing

Charles F. Hockett

Prepared for publication by Peter T. Daniels

Introduction

Hockett's *Course in modern linguistics* (1958; *CML*) was the most respected, though not the most widely adopted, textbook of linguistics in the post-Bloomfieldian era. Both the respect and the fairly low sales can be attributed to one of the characteristics of Hockett's writing: he had a knack for getting at the essentials of a problem and codifying them in organized, classified lists; he rarely wasted words. The best known example of this style is his "Logical considerations in the study of animal communication" (1960), which contains his very influential catalogue of "design features" of human language (he always took umbrage when the *Scientific American* popularization, September 1960, was cited in preference to this version), though the catalogue was refined over the years; a definitive version appeared in his selected essays, *The view from language*, 1977 (*VfL*). Of inestimable value to the historical linguist is his "Implications of Bloomfield's Algonquian studies" (1948); and "Two models of grammatical description" (1954) is still regularly cited in work on the foundations of syntactic theory. Hockett's valedictory articles on phonology (1995) and syntax/semantics (1997a) deserve to become well known. A third such essay, on historical linguistics, was planned; I do not know whether any work was done on it.

Fashions in linguistics changed, and Hockett's attention largely turned to anthropology. In 1973 he published *Man's place in nature* (*MPN*), a quasi-textbook, quirky, idiosyncratic, studded with sonnets — yet still bristling with numbered and unnumbered lists, catalogues, and charts. As for "quirky", his main treatment of writing occurs within the almost Borgesian sequence *Law / Criminals / Record-Keeping / Thought Police*.

These two books, as far as I can tell, contain Hockett's principal published considerations of writing until fairly recent years (*CML* chap. 62; *MPN* 571–82, 618–20). His last book, *Refurbishing our foundations* (1987 §1.4; *ROF*) revisits the topic; and on my suggestion he contributed a book review to *Language* in 1997 (the last of his many appearances in that journal). He did, however, write a lecture, longer and more satisfactory than those subsequent treatments, dating from 1951, which he did not subject to revision and publication — and this is a great pity, since the lecture anticipates a number of approaches to the study of writing that were to emerge in succeeding decades — as well as a short talk at one of the first Georgetown Roundtables on Language and Linguistics. The 50-page and 13-page typescripts (the latter also published in the Georgetown Proceedings) are presented here with minimal editing. All footnotes are added by me; they supply references where I have been able to determine them, as well as clarifications and indications of points independently made by others over the years.

A word on how these materials came to me: In my time as an undergraduate linguistics major at Cornell University, Hockett held court almost daily in the department lounge. In my senior year I registered for an Algonquian seminar. I did not talk to him again until the 1977 LSA meeting in Chicago. Again at the Chicago meeting in 1999, I noticed Hockett alone and ignored by the newer generation of linguists (though the 50th anniversary of the War Department's language enterprise was being commemorated); I reintroduced myself and told him I had developed an interest in writing systems. He said he had once done something in that area and suggested that I write him asking for a copy of it. A correspondence ensued, which included the loan of these typescripts; to them was clipped a memo reading: "This is my rambling notes on writing, from 1951, direct from my files. Read as you please, and copy or excerpt as you please; but then return this copy to me, since I haven't taken the time to make another copy. At the end you will find me falling for what I have more recently called the 'transducer fallacy.'" I suspect he did not recall that these were two separate items, since the remark about the "transducer fallacy" seems to refer only to the shorter talk.

Unfortunately we have been unable to discover the occasion of the presentation of the first talk or its title. However, for the sake of future bibliographical reference, we have assigned the title "Writing: A linguistic technology". Hockett's sidenoted afterthoughts have here, for typographic convenience, been put in parenthesized bold print. Occasional typographic errors have been silently corrected; words x'ed out in the typewriter are omitted, but passages deleted by hand subsequently are reproduced here in strikethrough style.

Underlining marks passages added by hand, and italics mark passages underlined in the typescript. The slight differences between this version of the Georgetown paper and the published version represent handwritten changes in the typescript; the diagram differs slightly.

We are grateful to Mrs. Shirley Hockett and to Georgetown University Press for permitting the long-overdue (re)publication of these talks. The second one proves to have been the forerunner of a major article a decade later; but had the longer one been published in its time, there might not have been a lag of some thirty-five years — until the death of I. J. Gelb, who "owned" the linguistic study of writing — before Hockett's views began to attract the serious attention of practicing linguists.

1. Writing: A linguistic technology

(Purpose of talk)

When presenting linguistics to laymen, one of our first tasks is to distinguish language and writing. We then toss writing aside and proceed to discuss language, except insofar as our records are written, or we use writing as a tool. Here we will toss language aside, and discuss writing.¹

In the early days of contact between Europeans and the natives of the Pacific Islands, it is said that a ship stopped near New Zealand and that some of the Europeans aboard demonstrated some magic to the Maoris: One of the visitors got together with the natives, while another European went some distance away, out of earshot. The first visitor discussed with the natives what he should have the second European do. When the decision had been reached, instead of shouting to his confederate, the first visitor made some passes at a small piece of white stuff with a short wooden wand, and had one of the natives carry the white stuff to the other European; the latter proceeded to do exactly as the first had predicted he would. This, indeed, was amazing magic — to convey a message to someone else without any talking at all. The Maoris were amazed and dumbfounded. However great their amazement and awe, it could not have been more than a tiny token appreciation of the world-shaking power for transformation of human life inherent in this particular brand of "magic" which indeed constitutes one of the most fundamental items of technology in the hands of those who rule the world today, in the hands of those who are reshaping human life and producing human destiny.

The truth of the tale is irrelevant. It is at least truth-like; something like this must have been involved in the first introduction of writing to vast numbers of

communities all over the world. In our society, we take writing almost as much for granted as we do language itself, despite the fact that the former is a far younger thing, and that in the life of each literate person the acquisition of literacy comes several years after he has learned to speak. And we confuse the two constantly, in such a way that except for a set of technical terms invented only yesterday, English and the other European languages do not supply us with any convenient way of talking about language or about writing: we talk about the complex of the two of them or else struggle and paraphrase to separate them.

The relatively recent development of writing, coupled with the fact that every literate person can already speak when he learns to read and write, puts us in a good position to study the nature of writing, but this is a study which has hardly begun. For this there are several reasons. As, slowly but surely, writing and language have been untangled, our attention has quite naturally centered on that one of the pair which is more universal, more profound, more basic in its ramifications and implications for man as over against other animals. Every human community speaks; only some communities possess writing. There was even question in the nineteenth century as to whether language was a biological or a social cultural phenomenon; no one would question that writing is social cultural. When attention has been focused on writing, it has been from one of two angles. (Previous study of writing.) Linguists and historians have been concerned not with writing as such, but with written records as *sources of information* — either to the utterances which they record or for the content of those utterances, the past history of the human race. Some anthropologists have concerned themselves with writing as such, particularly with its history and development, which they have been able to sketch in broad outline,² but detailed treatment of which has been impossible because no one has built a proper foundation. Furthermore, the anthropologists who have done this have for the most part lacked the specific training in linguistics which is requisite. Writing is not language, but language must be understood if we are to undertake the analysis of writing, for two reasons: first, because writing is *mainly* a substitute for speech under certain conditions, and cannot be understood without clear understanding of that for which it stands; and second, because writing, like language, and regardless of its relation to language, is a human sign-system, and the techniques for analyzing writing can best come by drawing analogies with the study of language as such. For these reasons, the presentation to this body³ of a paper on what is, fundamentally, not a linguistic topic perhaps needs no apology.

How to begin, not with definition

Now where shall we begin? Not, certainly, with a definition; we all know at least approximately what is meant by "writing," and we shall begin with that, without further comment; the actual process of analysis can clear up the various distinctions which need to be made, and the various sets of phenomena for which precise terms will be needed.

(Examination of writing in situ)

So, in place of a definition, let us begin much as Bloomfield does with language: by examining an occurrence of writing *in situ*.⁴

Jack and Jill live in a house behind which there is an apple ~~orchard~~ tree. Jill notices one afternoon, while Jack is still away at work, that the apples are ripe; she decides that they should be picked so that she can make some applesauce. The task is beyond her physical powers. Furthermore she has to go to her bridge club, and will not be back until dinner-time; so she cannot wait until Jack gets home and tell him by word of mouth that he should pick the apples. She has no telephone; ~~or else he doesn't~~. But there is no particular problem; for they are members of a literate community. She used her short wooden wand on a bit of white stuff, which she places on the kitchen table; then she goes off to her bridge club. An hour later, Jack gets home from work, finds the white stuff, and proceeds to go out and pick the apples. Jill gets the apples, not only without expending her own energy to pick them, but even without using her lungs and lips to speak to Jack.

Language accomplishes things that cannot be done by speechless animals, in that it mediates between a practical stimulus on one person and a practical response from someone else. Writing, ~~under some circumstances~~, accomplishes this same kind of result; furthermore, it achieves this result under some circumstances in which language proper would not get the result, or would achieve it clumsily or awkwardly.

(Diagram)

~~Presently we shall return to this differential discussion, but first we need to examine the writing process in more detail.~~ For this let us draw a diagram

exactly like Bloomfield's diagram of the speech event, with two s's and two r's, one big and one little in each case:⁵



but here the lower-case r and s stand for *substitute writing response* and *substitute reading stimulus* respectively; in terms of this diagram, let us see in what ways writing and language are the same, in what ways they differ, and in what ways they are interrelated. We must try to enter into this examination without prejudice; let us not assume *in advance* that writing "stands for" language, although one of our conclusions will be that this is essentially true.

(Reemphasizing parallels between language and writing)

The fundamental similarity of language and writing we have already mentioned: each bridges between a stimulus on one person and a response from another.

The essential *differences* are nine in number: eleven of them.

The dotted lines of the two diagrams represent rather different things. In the speech situation, r is a series of bodily movements, the dotted lines are transmission of sound waves, and s is action of those sound waves on the eardrum and aural nerve-ends. Note particularly that nothing stands between the nervous system of the communicator and that of the communicatee save body-parts which everyone has and the physical medium that is always around us anyway, if we are to keep on living.

(Difference 1. No direct transmission of energy in writing)

For the writing situation, the circumstances are normally otherwise. The r represents the manipulation of some *tool* against some other *tool* — in the normal case; of course people do write with their toes in the sand too — and the dotted lines represent not any simple transmission of energy, but rather a relatively static modification of the environment, of such a nature that whenever light waves are present, they will reflect and refract in a particular configuration, and that whenever a human is present, this configuration will strike his retina. Our first sharp difference stems from this: the relative permanence of the external factors involved in writing enable writing to *span time and space* in a way in which language unaided cannot.

(Difference Two: Product of Difference One)

Time is spanned in the episode recounted above, or whenever a man writes a memorandum to himself and reads it a day or a year later, or whenever someone chips wedges on a stone wall and someone else, a couple of thousand years later, looks at the result. Space is spanned in that a written message can be carried, given time enough, by any of numerous means far beyond earshot of the producer of the message. A speaker knows who is hearing him; a writer often does not know who will read what he writes. This external spanning of time and space compares with the internal spanning made possible by *memory*, which, in the absence of writing, sometimes does a most remarkable job.

(Difference 3: Genetic difference)

We speak with a certain portion of the body which we can summarize, for those who know about such things, as the "organs of speech." Now it is known that at least in a few cases different motions of the organs of speech can produce acoustically indistinguishable sounds — the main example being the two ways of producing r-color. Yet these many-one relations between articulation and sound are sufficiently limited in number that articulatory analysis of language (phonetics and phonemics) is practicable; it makes sense. This remains true regardless of how many wonderful pieces of apparatus are devised for direct acoustic analysis; we can still meaningfully deal with speech-sounds in terms of articulation. With writing the situation is otherwise. There are a tremendously large number of different ways to produce what is one and the same written symbol. We may use either hand, with any of a number of writing implements against any of a number of surfaces — pen, pencil, brush, paper, parchment, cave-wall, ink, blood, water, and so forth; chisel and stone, stylus and soft-surfaced clay tablet, finger or toe in sand; or we may write by bending glass-tubing, or even by properly piloting an airplane which is emitting a column of smoke behind it.

(Implications: Diff. Four, analytical approach (expand))

The important differences are two. First, "genetic" analysis is relevant in linguistics, almost irrelevant in graphology:⁶

(Diff. 5.)

Second, the production of writing is a special kind of drawing, or plane-piloting, or something else, as the case may be; but the production of speech is not a special kind of anything more general, but rather something distinctive, in its own right.

(Diff. 6: Necessary material culture.)

Still concentrating on the differences at the point indicated by τ , we may note the following. In the limiting case the production of writing may use only some part of the human body and some generally available part of the environment — as when one writes with one's toes in the sand, or even traces graphs in the air with a finger. But generally this is not true; generally one makes use not only of part of the body — not always the same part — but also of certain items of specialized material culture, of the kind mentioned above. In sharp contrast to this, speaking requires only the body-parts that everyone save the pathological individual has, plus environmental features — namely air — that are always present if we are to survive biologically. No specialized items of material culture are necessary for speaking.

At the reception end, the same contrast holds. Hearing speech calls only for air, the medium of transmission, and parts of the human body. Seeing writing requires the particular object on which the writing is inscribed, superscribed, scratched, or the like. But the contrast is here less sharp.

(Diff. 7. Special biological nature of hearing language.)

Another sharp difference, at the point s , is this. The hearing of speech differs in one important way from the hearing of other sounds. In hearing any sound whatsoever, we hear at each short interval a distribution of energy at various frequency levels. From this distribution, in the normal case, the ear and associated regions of the central nervous system extrapolate to produce a *fundamental*, whether there is any energy at that level or not; this supplies us with the *pitch*. Relative to this fundamental, the distribution of energy at various levels gives us *tone-quality*. The overall amount of energy, influenced by its distribution, gives us *volume*. Changes in these factors with time give us

rhythmic contours. All these things take place in any kind of hearing. Specifically for hearing speech, the ear and aural regions of the central nervous system pay attention to the distribution of energy at certain *absolute* frequency levels — not levels relative to the extrapolated fundamental — and this supplies us with *vowel color* — which both identifies the vowels and does much to give us the consonants. This last part of the hearing process is unique to speech; when we hear an orchestra, we do not hear vowel color. The sonovox is an apparatus for adding vowel color to sounds produced other than by speech; it is precisely by doing this that the foghorn is made to say "B O" on the radio.

So the hearing of speech is a special kind of hearing; we do something in hearing speech that we do not do with sounds in general. On the other hand, and in sharp contrast, there is nothing involved in the seeing of writing that is not involved in seeing in general, except one thing. We see a letter as we see an inkwell or anything else: a figure against a ground. The one arbitrary and specialized feature is that in seeing writing there is a prescribed sequence for looking at the various parts of what is spread, usually, over an area. The sequence is left to right and from top to bottom, or top to bottom and right to left, or anything else — but there is always *some* prescribed sequence. There is no such prescription for looking at a landscape or at a picture of a landscape.

The special feature of listening to speech is a general human thing, obviously; and it may possibly be true that there is something biologically basic about the ability of human beings to hear "vowel color"; this may be one of the biological features in which human beings differ from other animals. The special feature of prescribed sequence in looking at writing is clearly a cultural matter, in that any human being can be trained into any sequence; it is, as Bloomfield points out, a highly abstract procedure that a child by no means learns easily, and yet we may suspect that a non-human could be trained to such a looking-sequence just as a human can be. If so, then writing at this point simply makes special use of a quite widespread biological capacity, nothing which is not requiring something uniquely human.

(included above) Now the factors of difference so far catalogued have an implication for analytical procedure. Genetic analysis for speech is not necessarily the only useful approach, but it is feasible and highly useful; genetic analysis for writing is quite worthless save for certain highly specialized purposes, such as producing beautiful handwriting (for a complex writing system such as the Chinese; this exception becomes relatively important, as we shall see). Acoustic analysis for speech has yet to prove its feasibility; so far it would seem that acoustic analysis has as its most important product the verification of the

validity of genetic analysis. But the analogue of acoustic analysis for writing, that is visual analysis, is definitely indicated as the only really fruitful approach. We know a good deal already, as the result of psychological experimentation about how the eye works, and the vast proliferation of specialized geometries in modern mathematics gives us much more machinery than we shall ever need for the description of the shapes which are seen when we see writing. All of this affords a useful basis for visual analysis of writing.

(Difference 8. Placement: Factors leading to displaced nature of most writing)

Bloomfield⁷ makes a useful distinction between *displaced* speech and a kind which he does not label, but which we may call *placed* speech. Displaced speech is, for example, saying "apple" when there is no apple in the environment. This distinction is a semantic one, and needs tremendous sharpening, but for our present purposes it will serve. The point is this. Some speech is displaced, but a very large amount is placed. Almost all writing is displaced. Writing must be displaced because it uses more of the body in the normal case. Very, very rarely do we write the word "apple" when there is actually an apple around. If we ask how displaced writing — that is, most writing — is biologically possible, the answer, whatever it be in detail, is that it is possible for the same reasons that displaced speech is possible; the answer is certainly to be sought in the complexity of the central nervous system, with its 14,000,000,000 nerve cells⁸—a sufficiently complex structure that nervous energy passing over some specific circuit can, for the speaking or writing process, serve as an adequate replacement or substitute for the external angle.

(Difference 9.)

We arrive at slightly more external factors of difference — not stemming from a comparative examination of our charts — but still important ones. It is worthy of special note that wherever people learn to write at all, they learn this *after* they have learned to speak. Some sign-behavior may precede the development of speech — facial gestures of a kind, noises which are not yet language, smiles, coughs, and so forth. But that particular kind of sign-behavior which we call writing and reading does not. There are pathological exceptions, which prove that it *can* be done — the deaf-and-dumb person who nevertheless learns

to read and write. (Its implications) The important result is that people cannot discuss language as they acquire it, since they are acquiring the very means of discussion, but people can and do discuss writing as they acquire it. We have already mentioned the implications of this for the confusion of writing and language in our terminologies and XXXXologies,⁹ and for the long slow process by which this confusion has been overcome. In this particular case, and without generalizing implications, we may assert that cultural ontology recapitulates cultural phylogeny.

(Difference 10.)

Another important difference is one of dimensionality and directionality. One hears speech in the order in which it is produced. Speech is in essence a linear sequence, of phonemes and of morphemes — this despite componential analysis on either level, or simultaneous morphemes when one utters a string of segmental morphemes with a single intonation. Writing, given the prescribed looking-sequence, matches this linearity; but it remains a fact that writing is a two-dimensional array of graphs, and that in some cases, as we shall demonstrate presently, this two-dimensionality is of importance.¹⁰

(Difference 11. Dual structure of language)

Finally, we may state a difference which is difficult to state but of tremendous importance. Language and writing, like music, dancing, and various other manifestations of human behavior, are *structured*, in the sense that wholes are built up out of smaller recurrent parts, themselves composed of an arrangement of still smaller recurrent parts, down to some minimum level and up to some maximum level. But language is unique among forms of human behavior — sign behavior or otherwise — in having simultaneously two interlocking structures, with a unique and difficult relation between them: language has a phonological structure and a grammatical structure, a structure in which the smallest parts are phonemes (or components) and a structure in which the smallest parts are morphemes (or morphemic components).¹¹ A whole language can be analyzed phonemically — that is, the phonological structure of a language may be determined and described — without saying anything at all about the grammatical structure of the language. And, with greater difficulty,

one may determine, list, and state the structural relationships between, the morphemes of a language (that is, portray the *lexicon* and the *tactical structure* of a language) without saying anything at all about phonology. When, as is usually the case, one attempts both, then morphophonemics has to be added to build the one-way bridge between them.

There is no *dual* structure in writing. One can analyze its structure, but one cannot just do something analogous to phonology in language and not analogous to morphology, or vice versa, because there is no such contrast in writing as a system.¹² In this, writing is like other sign-behavior, animal or human, and unlike language, which is entirely unique in this regard.

This assertion will not here be proved, for it would take too long and would be quite difficult. But the very course of the rest of this discussion will provide, incidentally and without comment, some evidence for it.

(Relations: General)

Having now tabulated and discussed the differences between language and writing, it is our next task to discuss and tabulate the relations between them. That there is such a relation is beyond all doubt; nor can one question that it is intimate. People can take down what someone says; one can read out loud. Nothing more is necessary by way of evidence of the existence and general nature of the relation between the two. It shows, in a way, that a stream of speech can be transformed, in the mathematical sense, into a stream of graphs, and vice versa. It does not show what all of us know — that language is “prior” in the psychological structure of any given individual — from the fact that all human communities speak, whereas only some communities have writing, from the fact that “the same language” can be written in many different ways, whereas the same set of graphs cannot, with rare exceptions, be “read off” in more than one language; from the fact that the individual learns to speak and understand before he learns to read and write, and from the fact that an analysis of a writing system in terms of the language with which it correlates is relatively easy, the analysis of a language in terms of the associated writing system quite difficult or impossible. Evidence also are the biologically more fundamental facts of language, not found for writing — the special kind of hearing necessary, which can only be a special biological potential of humans, not simply a cultural modification of something else; and the unique duality of structure of language

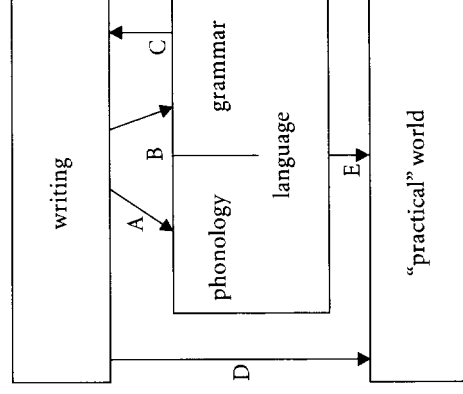
as over against the structure of any other sign-system, human or animal, including writing.

(“Mere”ness)

All of this does not imply that the relation between a language and an associated writing system is necessarily simple. Indeed, if writing were “just” a mnemonic device to remember what someone has said, if it were “merely” a way of representing language, then one could base one’s analysis of language-writing on writing as well as on language, for the structures of the two would be isomorphic. The word “just” or “only” or “merely”, so often included in statements of this kind on the propaganda level, is a mistake. The possible relations between bits of writing and bits of language, or between writing systems and languages, are very complex, and we can find instances of the most complex of them.

(Diagram of possible relations)

As a frame of reference let us diagram the two, plus the “practical” world, as follows:



(Types of writing system)

The arrows on the diagram indicate directions of the *meaning relation*, which we can take for our purposes in a relatively unrefined form. Arrow E is the one that is perfectly clear and will not concern us. Now most writing systems — to qualify as writing systems under Bloomfield's definition¹³ — are mainly representations of language. If the graphs of a writing system stand, in the main, for phonemes or groups of phonemes, as phonemes, we say that the writing system is *phonemic*. If, on the other hand, the graphs represent morphemes, or groups of morphemes, once again regardless of how complex and irregular the pairing off, we call the system *morphemic*. Phonemic writing systems can be subdivided on the basis of the kinds of phonemic entities stood for: an *alphabetic system* is a phonemic writing system in which the individual graphs are, for the most part, paired off with individual phonemes; a *syllabic* writing system is one in which the graphs represent what can roughly be termed syllables; one variety of alphabetic system is that in which the graphs pair off with some, but not all, of the individual phonemes, the rest being unwritten, as the consonantal system of Arabic when written without vowel points.¹⁴

In the strict linguistic sense, a writing system (or a transcription) is phonemic if and only if it represents, in every position within an utterance, all the phonemic contrasts found there, and no others, and represents the same point in a given utterance always with the same graph. No such writing system exists, nor ever has existed, except for very short stretches in extremely recent monographs by linguists. Actual almost-phonemic writing systems are less-than-sufficient, in that they leave some phonemes unwritten; or more-than-necessary, in that they indicate some distinctions that aren't there; or both of these; or irregular in that they represent the same pole of the same phonemic contrast now one way, now another.

Similar remarks could be made about essentially morphemic systems.

Beyond that, we must recognize that no writing system is completely phonemic (even if completely regular) nor completely morphemic; most writing systems are mostly one or the other, but also have features of the other. And beyond that, most writing systems have some graphs or arrangements of graphs or features of graphs that do not represent anything in language at all; their meaning is directly to the practical world, not mediated by language.

Let us list the types of discrepancies and irregularities that are found.

(Sequence discrepancies)

First we take up what we will call *discrepancies in sequence*. Examples from English when my dialect is written, from Chinese when Peiping¹⁵ dialect is written, until further notice.¹⁶

(Regular)

1. One graph represents one thing (phoneme or morpheme as the case may be). This is the "regular" case: thus in English, "p" represents /p/ in the written form *paper*; in Chinese, 我 'I' represents a certain morpheme.
2. One graph represents a thing-sequence — i.e. a phoneme or morpheme cluster. Thus in English "x" represents /ks/ in tax; in Chinese, 圖 *túshūguǎn* 'library' represents the sequence of three morphemes *tú* 'picture', *shū* 'book', and *guǎn* 'place'. Phonemically, if most of the graphs represent phoneme-sequences of some kind, then we will call the system a *syllabary*.
3. A graph-sequence may represent a single thing. In English, "ck" represents /k/ in *tack*; in Chinese 東西 represents the single morpheme *dāngxi* 'thing'.
4. A graph sequence may represent a thing-sequence, without there being any correlation when the sequences are broken up into their constituents. In English, if /č/ is a cluster of /t/ and /š/, then the graph-sequence "ch" in *chair* represents the phoneme-sequence /tš/, although "č" does not occur to represent /t/, nor "h" to represent /š/. Cases in morphemic systems are harder to find. (These discrepancies are *not* ambiguities.)

(Ambiguities)

Next we take up what we will call *ambiguities*.

(Unambiguous)

5. A given graph, wherever it occurs, may always represent the same thing. This is the "regular" case. In Finnish writing, "p" always represents /p/, which is never otherwise represented. In Chinese, 我 *wǒ* always and only represents the morpheme meaning 'I'.

6. A given graph may represent different things in different environments: English "f" in *from* and *of*, and Chinese 中 in *jūng* 'middle' and *jūng* 'to hit'. In such cases as these, one can almost always find a sufficiently large environment in which the graph is not ambiguous; thus in the English words cited above, the following "orm" serves to define the "f" as representing /f/ and the preceding "o" and following space as representing /v/. Ambiguities are always relative to environments.

7. A given thing may be represented in different environments by different graphs. Thus English "c" represents /k/ in *cat*, but the graph "k" represents the same phoneme in *kit*. In Chinese there are two ways to write *chyiiu* 'to get, gather, collect', in Chinese, not in free alternation.¹⁷

(Systemic deviations)

Next we come to what might be called systematic or systemic discrepancies.

(Morphemic features of phonetic system)

8. A phonemic writing system may be partly morphemic. In English, wherever homophones are spelled differently, this is the case: "meet" and "meat" are different morphemes, and the difference of graphs correlates with the morphemic difference, not with any phonemic difference, since there is none.¹⁸

9. Morphemic writing, similarly, may be in part phonemic. Chinese writing, essentially morphemic, is phonemic in two ways. (Is this phonemic?) First, a Chinese character (writing Peiping dialect) stands in sequence for a morpheme or a syllable, whichever is smaller. A two-syllable morpheme is written with two characters; a two-morpheme syllable is written with two characters. Second, many sets of Chinese characters which represent morphemes with partly identical phonemic shape have something similar in shape to the eye. These eye-similarities are the so-called "phonetics" of traditional analysis. A family of morphemes differing in tone, or in presence or absence of aspiration, or both, are often related in this way in the characters which represent them. The relation is a bit obscure, for even though seventy-five to ninety percent of the characters which share a certain shape-partial may stand for morphemes with this similarity of phonemic shape, the remaining characters which have the same visual

shape in common may stand for morphemes with entirely disparate pronunciations.

(Mixtures)

10. A writing system may be partly morphemic and partly phonemic, in such proportion that it cannot be labeled simply "morphemic" or "phonemic" as we have done so far, despite the occasional discrepancies. Japanese orthography is a case in point. A sequence of Japanese graphs can be broken down into smaller sequences, such that those in a given sequence are all morphemic or all phonemic. There is a correlation with classes of morphemes in the language: certain morphemes, which we might call "stems", are written morphemically, whereas certain others, the "endings", plus many recent loan-words from other languages are written phonemically. Apparently certain of the ancient Near-Eastern writing systems — Egyptian at some stages, some cuneiform systems — were thus characterized.¹⁹

(Writing-morpheme ambiguity)

11. A morphemic graph may represent arbitrarily and ambiguously any of a set of several morphemes or morpheme-sequences, the latter set being in non-contrastive distribution, or in almost complete complementary distribution, or in partial complementation, and be related so closely in meaning that for "practical" purposes there is no difference. In our own writing system, individual number-signs are morphemic signs: "3" represents the morpheme *three*, not the phoneme-sequence *three*. Sequences of number-graphs, such as "1927", fall into the case here under discussion. This may be read, as William Edgerton pointed out,²⁰ as "one nine two seven," or as "nineteen twenty-seven" or as "nineteen hundred and twenty-seven" or in a number of other ways. These morpheme-sequences are linguistically different. But they are in partial complementation. In giving a house-number, we more often say "nineteen twenty-seven"; for a year, that is the usual way; for a phone number, "one nine two seven" is most customary, and so on. So Edgerton's characterization of such graphs as "ideographic" is not necessarily correct; we may rather take them as morphemic graphs — "logographic" in the traditional term — with an ambiguity of representation

as between several morpheme sequences, but with no practical ambiguity stemming from this linguistic choice.

(One w. system → several dialects)

12. So far we have been treating writing systems as used to write a single language, or even a single dialect, and its relation thereto. But this misses some important points. A writing system may write several dialects, or even languages, simultaneously, or, rather, it may represent simultaneously a specialized subdialect of any of a number of dialects, such subdialects being grammatically and lexically isomorphic. This is of course true of English writing. People from all parts of this country read the same book; each reads in his own dialect phonologically (most of the time); the morphemes and arrangements which are represented in the book, and which he produces in reading it, constitute a subdialect of his particular dialect. The same is true to even a greater extent in China. Each Chinese dialect (where there are any literate people) contains its own *literary subdialect*; the literary subdialects of Cantonese and Mandarin, for example, are virtually isomorphic; a piece of literary written Chinese represents a stream of speech in the Cantonese literary subdialect for the Cantonese reader, in the Mandarin literary subdialect for the Mandarin reader.

(Extreme specialization of "written" dialect)

13. Perhaps worthy of mention as a special case is the extreme form of the foregoing, in which the subdialect (or group of isomorphic subdialects) which one writes is a highly special thing, never really used in oral communication. Classical literary Chinese, as now used in all parts of China, is an example.

(Influence of ambiguity of morphemic analysis or characterization of morphemic writing systems)

Now before going on to our next points we must mention an extremely interesting thing in the case of morphemic writing systems, which can vitiate any specific example of discrepancy one might mention. We do not know whether or

not for a specific dialect there is one and only one really fundamentally correct morphemic analysis, but we suspect that there is not; different analysts will reach different results, which will be, if the analysts are explicit as to their techniques, to a high degree mutually convertible, and each of which will give a good, though not complete, picture of the language. Now the actual speech of speakers of a language reflects a morphemic structure; if the speakers of such a language develop or use a morphemic writing system, that system in itself constitutes a morphemic analysis of the language.²¹ Thus the Chinese writing system, developing over three thousand years in the hands of speakers of various changing dialects of a single language-family, constitutes a continuously developing *folk-analysis* of Chinese morphemes. One could very easily claim that the morphemic structure of Chinese as it is written is to be taken precisely as the writing indicates: that wherever two characters are written, there are two morphemes; that wherever the same character is used in different contexts, the same morpheme is involved. There would be no way of refuting such a procedure. All we can do is to say that if one approaches Chinese through the way it is now spoken, then the way it is now written (when they write more or less as they speak) shows discrepancies of the kinds itemized above.

(Consistent omission)

14. A writing system may consistently omit completely any indication of certain classes of things. There are suprasegmental morphemes in Chinese — intonations, stresses, and the like. These are not written in Chinese writing. English gives only a partial indication of intonations (punctuation and the like), and none at all of stresses. Arabic and Hebrew writing systems omit the vowels completely.²² In any such system, the more or less complete skeleton which remains has to be filled in by the reader on the basis of experience.

(Directly semantic features)

15. There may be graphs or features of graphs in any type of system which are neither phonemic nor morphemic, but have *direct* meaning. Actually, there is much of this in any writing system. In Chinese, just as some sets of morphemes with similarities in phonemic shape are represented by sets of

characters with similarities to the eye, so also some sets of morphemes with some vague similarity of meaning are represented by sets of characters not completely disparate in shape. The visual-partials which recur in sets related in this way are called *radicals*. To confuse the issue, the same visual-partial is sometimes a radical, sometimes a phonetic; to the beginner at reading Chinese, neither phonetics nor radicals are much help. But an experienced reader of Chinese who has mastered, say, five thousand characters may read a text in which occurs a character not before encountered, and because of the context *and the radical* be able to "understand" for practical purposes — without necessarily being able to guess at the phonemic shape of the morpheme being represented. In English, some punctuation is phonemic, in that it indicates at least within broad limits what arrangement of intonation phonemes and juncture phonemes²³ should be used; but much of English punctuation is directly semantic: e.g., the difference between a period and a colon for some readers. Many of the graphs found on the pages of a technical journal like *Language* or *Annals of Mathematics* or the *Journal of Symbolic Logic* have direct meaning. And even in ordinary non-specialized writing, such matters as typeface, script versus print, lower-case and capital letters, format and typography, insofar as they have a meaning at all as signs to the reader, have direct meaning, not indirect.

If the surname "Smith" is the same morpheme as the noun "smith," then capitalization in this case is neither phonemic nor morphemic, but directly semantic.

(Distortion of sequence)

16. In some cases the regular prescribed sequence of looking at writing is disturbed. This happens occasionally in English: we see "\$1 billion", but are expected to render the morphemic graph "\$" after the rest, and to say "one billion dollars". (Sequence-markers: add "... " in a table of contents, paragraphs in mathematics) Chinese texts edited in Japan for Japanese readers have small numerals by the characters, telling the reader in what order to read off the characters — the sequence is not only special, but has to be made explicit by instructions. ~~In one novel (The Hoosier Schoolmaster, I think), the manner in which a certain minister would intone the words of a hymn before the congregation sang it was portrayed by putting some of the letters into a line rising diagonally up to the right, with a~~

terminal drop for the last few.²⁴ In the original version of Alice in Wonderland, the letters with which the poem beginning "Fury said to a mouse" are arranged in various type-sizes so as to constitute a picture of a mouse.²⁵ In these cases the unusual arrangement of graphs itself constitutes a signal. In two-dimensional tables, one may read down and then across, or across and then down; in this case the display is to indicate certain relationships, and neither order is the prescribed one — there are simply two syntactical dimensions, which cannot be duplicated in speech.

(Speech → writing → practical world)

17. In a few cases, we can see that a linguistic form (a sequence of morphemes or a morpheme) has meaning mediated through writing. Names of letters are perhaps not such a case, for here the letters being named are items in the practical world, rather than themselves symbols. But in giving a telephone number, the exchange-name, as WOODRUFF 7756,²⁶ is a morpheme or morpheme-sequence which represents the first two letters of the conventional spelling of the form, and those first two letters are among a series of alternate names for positions on a dial (e.g., where A, B, C, and 2 are all names for the same position).

(Summary: Implications of status of writing)

The analysis of a writing system is thus seen to consist primarily of a determination of the way in which it represents a language, or a dialect of a language, or a set of dialects of languages. This is usually a relatively simple matter; whatever complexities of structure the language itself may have, calling for detailed treatment, are not relevant for the analysis of the associated writing system, any more than the details of physics, astronomy, sociology, and other examinations into the structure of the universe which is represented in language are relevant for the analysis of language. Insofar as a writing system does not represent certain features of the speech that in general it represents, additional statements have to be made. And insofar as direct-semantic graphs or features of graphs are involved in a writing system, they require the same sort of analysis as is required when one is analyzing a language. Many a traditional treatment of a writing system has done unnecessary things, in that it has actually been an analysis of

the language represented disguised as an analysis of the writing itself, or vice versa, or both in some confused way.

(Graphemics: Bases for identification)

Our next task is to examine what we may call *graphemics*. We have more or less assumed in our discussion so far that two or more visual configurations, in different places, and not physically identical, are nevertheless in some sense to be regarded as different occurrences of "the same" graph — or grapheme. When such identifications are being made, we must have criteria for them. We shall find several sharper or duller criteria, of varying relevance; we shall not find any particular criterion that is of such overweening importance that it enables us to classify graphs into graphemes to the neglect of the other criteria.

(Outer limit, by contrast with other kinds of seeing)

Now insofar as seeing writing is like seeing other things, identifications can be made. It does not matter, within limits, whether a particular figure reflects light on one or another part of the retina, or whether the figure is perpendicular to the line of sight or at some angle. A book is still a book whether looked at from near or far (not *too* far), squarely or at an angle. A graph is still the same graph also, regardless of such factors as this. Therefore, different figures on a single surface, seen from the same angle, which differ from each other as the configuration made by light reflected from a book differs depending on angle and line of sight and distance, are not apt to be functionally different in writing. (**Influence of context**) If an entire text is in letters that slant upwards to the right, there is no graphemic difference from the same text in upright letters. An entire character text with short squat characters is the same, in a sense, as the same text in long thin characters. However, when such differences occur *within a single environment* — when some words are in italics and others in Roman, or some characters are big and some small, the difference can hardly be taken as graphemically irrelevant.

(Inner limit)

Yet such differences can in some cases reflect nothing about the speech-forms represented. We may say that two graphs are *linguistically identical* if they represent the same linguistic features. In a Shakespeare folio, where some of the type was Italic and some Roman, all jumbled together,²⁷ the difference of typeface is linguistically irrelevant, the Italic *i* and the Roman *i* are both the same grapheme from the linguistic angle. In this case we may even say that they are graphemically identical in some wider sense, as not being used for any sign purposes. In a mathematics text, where some letters are italicized and some are not in the same formula, "i" and "i'" may represent different things, and yet not be *linguistically* different. In a novel, where italics is interpreted in terms of contrastive stress-intonation patterns, an Italic letter and the equivalent Roman letter are neither graphemically the same, nor linguistically the same.

Similarly with size of letters. A road sign has larger letters than a novel but this is irrelevant. But when on a single page some lines are in larger type, some in smaller, the difference is not irrelevant. In some printed versions of Goldilocks, the papa wolf says "Who's been tasting my porridge?" in large capitals, the mama wolf says it in small capitals, and the little teeny weensy baby wolf says it in a smaller size of type than the body of the text. These size differences are by no means irrelevant for some readers, who will read the first in a deep voice, the second in a middle-sized voice, and the third with high pitch and general overall palatalization.

(Arbitrariness of identifications)

An important point in the identification of graphs (as linguistically equivalent or by some more general criterion) is that two graphs which have nothing more in common than either have with some other graph may nevertheless be the same grapheme. A capital "I" and a lower-case "i" are both kinds of 'i's, but the former is no more similar to the latter than it is, say, to a lower-case "l". In some very simple sans-serif type-fonts, the lower-case "l" is in fact identical in shape with the capital "I". (**Intersection**) This is the extreme case; in handwriting, and in some type styles, graphs which are for all intents and purposes visually identical may nevertheless (on the basis of position of occurrence) belong to different graphemes.²⁸ (**Limiting case: Bengali "3" and "t"**)²⁹

This is in sharp contrast to at least one usual procedure in phonemic analysis: two allophones, to be members of a single phoneme, must have some combination of features in common which are not, as a whole combination, shared with any allophone of any other phoneme, and in any case one and the same sound cannot belong sometimes to one phoneme, sometimes to another.³⁰ In graphemics we must allow for identification of graphs without such a common core of shape, and even for partial or total intersection. The linguistic analog for this, absent in at least some phonemic procedures, is to be found in morphemics, where two allomorphs of a morpheme may differ completely in shape, and where the same string of phonemes may sometimes be one morpheme, sometimes another.

(Long components)

A convenient technique in graphemics is the extraction of long components.³¹ A Roman and an Italic "i" both are "i", and yet they are graphemically different; we may say that the graphemic difference recurs in the difference between a Roman and an Italic "c" or "e" or "a", and thus extract Romanness and Italicness as long components graphemically. Then the graph "i" is a simultaneous combination of two graphemic components, one of them the "i" grapheme and one of them the potentially long component "Romanness." An interesting product of this is the comparability of different graphs in different contexts. In handwriting, or typing, we often use an underline where in print one would set Italic characters. The underline, however many letters it may stretch under, is a single graph; and it equates then with the Italicness component which stretches through comparable sequences of letters in printed forms. The same may be done with typefaces, type sizes, superscription and subscription, script versus print, and so on, so as to build up a graphemic analysis which recognizes a relatively small number of individual letter-components, as it were, plus a varying and variable and actually non-countable number of long components, such that in some cases a single graph may be a simultaneous bundle of one of the former and a rather large number of the latter.³²

(Gradient contrast in graphemics)

Finally it is to be noted that though the letter-components thus arrived at are

finite in number, such that any particular graph in any particular position is clearly one or another, the long components do not so contrast. Long graphic components stand in *gradient* contrast to each other, not in *point* contrast: given a graph of a certain size, and another which is larger but otherwise graphemically the same, one may interpolate one intermediate in size, and then do the same again, and so on for as long as one wishes — there are no practical limits to the number of contrasting sizes, and one can always interpolate further sizes. Such gradient contrasts again constitute a sharp difference from language, where elements stand in point-contrast to each other — that is, a particular occurrence of an allophone is either one phoneme or another, of some small number, without the possibility of infinite interpolation along the scale, and the same holds for morphemes.

(Graphemic structure: Summary of graphemics)

This, of course, leaves the details of graphemics to be worked out for specific writing systems. All that we have been able to do here is to indicate certain possible lines of approach. But we have perhaps, in our discussion up to the present, laid a sufficiently broad foundation for a discussion now of what might be termed the sociological implications of writing.

(History; Age)

Writing is not very old — ten to fifteen thousand years at the outside, if we allow for the earliest datings and for some development of writing before any which left records for us.³³ Bloomfield, following and summarizing what earlier students were able to discover, has outlined for us the most probable lines along which the early development of writing, wherever it developed, took place.³⁴ This is, indeed, more than we can do for language itself. (Prelinguistic) We may distinguish as a first stage a *prelinguistic* kind of picture-writing, such as that found in the aboriginal plains of North America. Instead of actual full-scale drawings of all details of what was to be portrayed, conventions were introduced, of various kinds, so that a message could be conveyed, fairly well for certain practical purposes, even between peoples who spoke different languages. Such picture-writing is nonlinguistic in the sense that the symbols are neither phonemic nor morphemic, but directly semantic, even though conventionalized.³⁵ Now it is

conceivable that such a system should have been elaborated more and more, quite independently of language, to the point of constituting a highly complex and highly arbitrary, and therefore highly effective, means of communication. This process did take place, but not independently of language. Those who were engaging in picture-writing activities were already speakers of highly developed languages — certainly there is no reason to believe that language has essentially changed in its degree of complexity in the last fifteen thousand years — and the introduction of greater complexities into writing systems inevitably fell under the influence of the languages spoken by the developers — associations were built up between specific pictures and specific words, rather than between pictures and the *things* of which they were, ultimately, though with much conventionalization, portrayals. A symbol which had been a picture of the sun came to be associated, not with the object, but more directly with the morpheme or morpheme-sequence in the language of the users of the graph, which morpheme in turn meant the sun. We have little evidence to this effect for ancient Egypt, but elsewhere where writing has developed, namely China and Mexico, the first stage past pure and clumsy picture-writing, the first *linguistic* writing, is essentially morphemic, though with many direct-semantic graphs still used.

We shall not bother to trace the later developments, in the Near-Eastern — European tradition — which is the only place where much more than this happened. It is a familiar story. The point of the sketching of the earliest development is to emphasize that non-linguistic graphs or features of graphs have, from the prelinguistic period, probably been found all tangled up with linguistic graphs, and that nowhere save under the direct guidance of modern western linguists (or possibly the ancient Hindus) has a writing system become so accurately linguistic that all phonemic distinctions, or all morphemic distinctions, as the case may be, were indicated, and nothing else. Throughout its history, or histories, writing has been only *partially* under the sway of language.

(Basis for writing doing things language can't do)

By assuming a relation to language whereby all, or most, of what language can do became doable with writing, writing gained all the power of fine distinctions, abstraction, nuances, that language has. But there have always been certain potentialities in writing that language does not supply, and that other substitutes for language do not have. These potentialities, realized in part from

the earliest times and increasingly realized now, stem from three factors: (1) the spanning of time and space which writing can do, and which language cannot accomplish save through human memory with all its frailty; (2) the essential two-dimensionality of arrays of graphs, in contrast to the linear nature of speech; (3) the possibility, usually realized in part and sometimes realized in great detail, of non-linguistic graphs in addition to those mediated through language.

(Contrast between writing and modern recording devices)

Various extremely recent forms of records of speech share some of the properties of writing, particularly the time-and-space spanning properties. The telephone, telegraph, and radio span space much more efficiently than either writing or oral messages carried by runner, horseback, or carrier pigeon. But disc, wire, and tape recording apparatus, although they enable someone in effect to hear today what someone else said yesterday or a half-century ago, although they span time, do so in a way essentially different from writing. Such modern recording devices map not the phonemes nor the morphemes of speech into a modulated electric current, or ridges and troughs on a phonograph record, or the like; they map all the acoustic properties of speech or of any other sound. A recording apparatus, within its acoustic limits, records the nondistinctive with the distinctive, the interfering noise background along with the utterance. Furthermore, the necessary apparatus for such recording and retransformation into a facsimile of speech is a set of highly complex external artifacts; writing and reading rely primarily (though with the use of simple tools most of the time) on especially built machinery within the human brain. When speech is mapped into writing, the transformation as it were strains out many irrelevanties, along with some relevancies; when it is mapped onto a phonograph disc, this straining is not there.

Furthermore, such modern recording devices lose the two-dimensionality of writing, which is one of its great powers, and do not have the possibility of non-linguistic signals in addition to linguistic signals. Bloomfield is therefore wrong when he claims that no written record is as satisfactory for the linguist's purpose, specifically, as is a good recording;³⁶ the properly organized written record has already strained out the irrelevant non-linguistic material that the recording will not eliminate. Field recordings are still raw material for analysis; written records from the field can be more than that — materials for shuffling

in a card file until answers appear. Also, the present hue and cry about various types of auditory aid to education or in other activities is valid, so long as we keep in mind the specific special properties of such recordings;³⁷ that such recordings should *replace* written records is quite silly.

Let us give concrete illustrations of what writing does that language unaided cannot do, or cannot do as efficiently, and show how the special powers of writing stem from the three factors named.³⁸

(Time-spanning)

The type of document usually called a "contract" is actually, in law, not a contract at all, but a *record* of a contract. The first thing a lawyer will say to a client when the latter comes to the lawyer with a complaint about breach of agreement is, "Have you got it in writing?" — or the equivalent. Here the time-spanning property of writing, as over against memories that can diverge, and might consciously be made to diverge, is obvious.

This is a sort of intermediate example of the value of time-spanning. Illiterate peoples, or people forced for a time to get along with certain kinds of written records (such as the Norwegian patriots during the Nazi occupation),³⁹ manage far better than we, who are constantly relying on writing to supplement our memories, would be inclined to imagine. (Time-spanning for single reader) But the same time-spanning property is illustrated by any document, short or long, as it is being read at a given time by a given individual, regardless of who produced it. In reading a page on some technical matter, if something is missed, one can go back and read it again, as often as one likes. A speaker must say things in such a way that his audience, hearing each thing he says just once, will understand as much as possible; a writer can rely, in some instances, on his readers rereading or checking back and forth. Particularly in highly technical fields such as mathematics, this is of importance. (Scope) A single complex equation running across a page need not be read in any simple linear fashion; one can jump back and forth, performing operation after operation in an order quite other than that in which the symbols appear, until a simpler form emerges. But even in fiction, written for him who runs to read, can count on this; the reader will check back to chapter one to clear up his memory on which character is referred to by a certain name, and the like.

The macrocosmic importance of the time-spanning is not necessarily the most important, but it is the most striking. We will take it up later.

(Dimensionality)

The two-dimensionality of graphs on a flat surface gives a writer a greater syntactical freedom than is available for a speaker. To understand the illustrations of this, let us distinguish between *iconic* symbolism and *arbitrary* symbolism. A picture of someone "means" what it means because it "looks like" what it means; there is the same general contour of marks in a two-dimensional array as is produced by looking at the original. Where something means something else without this iconic factor, the symbolism is arbitrary. Thus the letter "m" does not "look like" how the first phoneme in the word *man* "sounds"; the relation of the former to the latter is arbitrary. But when the word "man" appears, there is an element of iconic symbolism in that the three successive graphs, given the prescribed sequence of looking, stand in the same linear relation as do the three segmental phonemes of the word represented. Now speech must represent the world primarily in a single dimensional array of symbols; the four-dimensional plenum in which we live has to be mapped into a one-dimensional array of phonemes or morphemes. The requisite amount of arbitrariness is obviously tremendous. One can imagine a language in which a morpheme meaning 'big' would take the phonemic shape of extra stress, and one meaning 'smaller than ordinary' would take the phonemic shape of extra soft stress; one would then say, "The mine-owner lives in a HOUSE, the foreman in a house, and the worker in a ((soft)) house." Actually no such language is found; where suprasegmental morphemes occur, they have no such simple correlation to the world which is talked about, and the slight amount of two-dimensionality imparted to speech by such suprasegmental morphemes does not produce any great amount of iconicism.⁴⁰

(Two dimensions for iconicism)

Now writing, with two dimensions to arrange symbols on, has potential iconicism that speech does not have, as well as a greater freedom for arbitrary symbols. Two dimensions are used iconically in writing wherever one makes a chart or array, instead of following the customary linear arrangement of graphs. The entries in the chart may be sequences of letters, representing morphemes and thus speech; the arrangement of the entries relative to each other can represent anything that can be taken as dimensional. A chart, regardless of the nature of the entries, is a kind of picture. (Add chemical formulas.)

Writing offers other means of escaping the linearity of speech. Footnotes are a device to avoid linearity; the footnote appended to a specific passage is not something inserted in the linear sequence (or it would stand in the text instead of at the bottom of the page), but, quite literally, as "aside". In mathematics one makes explicit use of two syntactical dimensions, so that the two arrays

a	b	a	b
c	d	d	c

can stand for entirely different things — not, in this case, iconically, but quite arbitrarily. Without such devices as this, the kind of mathematics that underlies the atomic bomb and the Einstein theories could never have been developed; their existence is a necessary, though of course not a sufficient, condition for the latter.

In writing one can even insert visual symbols that are not graphs at all, in our sense: pictures, diagrams labeled or unlabeled, graphs in the mathematical sense. And since one can represent on two dimensions a perspective picture which gives the effect of three dimensions, one can have three-dimensional charts or mathematical graphs, with or without graphemic labeling of parts.

(Direct meaning)

Turning to the third characteristic of writing, the possibility of direct-semantic graphs — and we have already given some examples — it is interesting to note how such symbols may arise within an essentially linguistic writing system — for they do arise; by no means all of them are continuous carry-overs from the prelinguistic stage of writing. The morphemic graphs with ambiguity of representation no doubt constitute one basis for such development. It is easy, in specialized discourse, for the various morphemes or morpheme-sequences which such a graph represents to become more and more arbitrary and personal — culturally determined, to be sure, but not by factors relevant in the specific context. Mathematical logicians or symbolic logicians make up new graphs, as they expound their theories on paper, without giving the reader any information at all as to how the graph should be pronounced. When I complained about this to a philosophy teacher once about fifteen years ago, he said, "Make up your own sounds for them." This was of course the right comment. Within the context, it *does not matter* what noises, if any at all, a particular participant in the discourse, as reader or writer, may supply; the visual shape is the common

core for definition and use, and the noises are unimportant. Something more or less similar has happened in the case of literary Chinese; where speakers of many different dialects can read the same literary text, each in his own pronunciation, or, in some cases, with no pronunciation at all — the graphs themselves, and the syntactic rules for their combinations, and the features of the world around us which they (non-iconically) stand for, have become the matters of prime importance, even if it remains true that any Chinese who comes to be able to handle the system passes through a stage in which each symbol represents a definite morpheme of a subdialect of his dialect of Chinese. (Advertising spellings)

It is thus impossible to draw any completely sharp line of demarcation between ambiguous morphemic graphs and non-linguistic direct-semantic graphs; and William Edgerton was in a sense quite right in his analysis of number-combinations in written English. In some contexts this is fine. In others, confusion can result; but only for a short time, for if a graph has no generally agreed-on phonemic or morphemic representation, some such will develop when it is needed. The bus routes, and the buses which follow them, in Washington, are labeled by letter-number combinations, as "Z-4", "S-1", and the like. In a few cases, slightly different routes — differing only in one terminus, usually — are labeled by the same letter-number combination, but one has a red line cutting diagonally from upper left to lower right of the number. I do not know how people label the difference when speaking; I sometimes say "Z-4-red-line" or the like.⁴¹ The difference is not linguistic, save insofar as individual ways of responding to the different graph combinations in speech have developed — no socially agreed-on way — but the difference is certainly relevant, for if you get on the wrong bus you may not get where you want to go. Now if there arises any real need for a simple way to distinguish between the two symbols, when speaking, some agreed-on speech form will develop, and will parallel the graphic distinction. And yet even then the graph may be directly-semantic, for it may be that the linguistic forms will be, primarily, names for the different graphs, rather than names for the different routes. (Specialized notation; Music etc. or post-writing graphic systems)

(Influence on social classes)

We may speak briefly of the influence of some writing systems on social organization. A morphemic or largely morphemic writing system is hard to

learn — it requires much time and energy and leisure from, say, food-producing activities. Certain relatively complex communities, where there was good economic and technological reason for the ruling classes to make use of written records, have developed specialized groups of people to make and interpret such records. A *scribe* is in a sense comparable to a recording and reproducing phonograph: a specialized piece of machinery for translating speech into a record thereof and retranslating the record into speech. We know very little about the social status of scribes in some communities, save that in general there seems to have been a certain amount of prestige and privilege for those who performed these functions — even if they were slaves. Specifically for China, we know more. For two thousand years, dynastic China had a type of civil service system, with competitive examinations as the basis for qualification for appointment. The jobs ranged from relatively minor ones up to positions of considerable power and affluence. To pass the examinations, one had first to acquire thorough literacy in the complex writing system, and beyond this to acquire the ability to imitate certain artistic and philosophical models in what was written. The theory of the system was entirely democratic: anyone could enroll for the examinations, and in fact it occasionally would happen that someone from an extremely humble background would enroll and pass high on the list, thus rising to fame and power. But despite the theory, the very nature of the writing system implied that only the children of relatively well-off families could spend the necessary time and energy acquiring the special training necessary, and this in effect meant that for the most part the sons of civil service personnel became the new generation of such personnel. Thus the “scribes”, to use the term in a somewhat special sense, came to constitute a special privileged class, in a way the real rulers of the land. Emperors might come and go; even dynasties might fall at the hands of ambitious vassals of the emperor or at the hands of outsiders, but the real rulers continued, from generation to generation, in their position of real power, with only minor ebbs and flows between that class and other classes. In this case not the fact that writing was present, but rather the very special nature of the writing system, was a necessary condition for the development of a particular class structure and formed part of the mechanism for the maintenance of that structure through the generations.

(Implications for SOCIAL CONTINUITY and accumulativeness)

We may turn, finally, to the real macroscopic implication of writing: the fact that writing enables us to accumulate information, to inherit it from past generations, in a way far more powerful than can be done by language alone or by language supplemented by other sign-systems than writing. We inherit the unimportant along with the important, often enough; writing produces a kind of long-term continuity and piling-up of myth and error as well as of science. But we inherit the important along with the unimportant, and so our knowledge of the structure of the world around us grows, generation after generation, without the constant need for rediscovery of old things. The complexity of this body of knowledge as it has come to be in our generation in the modern western world is so great that it in itself constitutes a fundamental problem of modern life. In our colleges and universities we have *departments of history*, where “history” is defined pretty sharply, or was until very recently, in terms of that part of man’s past for which written records exist; other parts of man’s story were either ignored or were classed as relatively unimportant. This attitude and this specialized class of people in our society — the historians — are not accidental. They are precisely a product of writing. Our historians are the people whose special task it is to interpret the written records of the past; they are created by the existence of such records; and they are *right* when they consider recorded history as more important than unrecorded, simply because the fact that history is recorded also implies that the peoples whose history is recorded *had writing* in their lives, making possible this more rapid growth, change, and increasing complexity of the fabric of human life. No matter how interested we may become in the rest of the story of the human race, before writing was invented or in areas where writing had not yet reached, it remains true that all that happened in the several hundreds of thousands of years before writing came into existence is small change — this is a pun — compared to what has happened since. Even if by some miracle we were to know, in as much detail, year by year and square mile by square mile, about man’s unrecorded history as we do about his recorded history, a properly balanced description of human history would still devote ten times as much space to the last fifteen thousand years as to the preceding five hundred thousand.

(Technological importance: Why the title?)

I cannot help wanting to end with a remark on the technological importance of writing and of language itself. We live today in considerable fear of some of man's latest technological developments, primarily the atom bomb, in the hands of badly organized world-society. It has even been suggested that the human race might wipe itself out completely, or even wipe all life off the face of the earth. The atom bomb is a product of human life, which means that it is a product of speaking animals; furthermore, it is specifically a product, and could not otherwise have come about, of *writing* humans. The transformation wrought in human life by the development of writing is not so great, of course, as that wrought in anthropoid life by the development of language, but it is great enough. Now we may assess the long-range importance of some of the things that the atom bomb might do. It seems highly unlikely so far that the entire human race would be exterminated. If it exterminates a large percentage of the human race, the important part is not whether it obliterates democracy, or the Christian religion, or the United States of America, no matter how much some of us may value one or more of those things. Of real importance is whether it obliterates continued knowledge of writing. If a few Tierra del Fuegians and a few Eskimos are left, and perhaps some Bantus, but those few do not in the process lose what little they may know about writing, then the setback to the course of human development is after all relatively minor — at most a setback of ten or fifteen thousand years. But if no knowledge of writing is left, and *that* has to be invented again, then there is really no telling how bad the setback is. We need a relative scale of values to live, so long as we can live, with some equanimity in the modern world: a scale of values based on the biological survival value of various factors of human life is one to be seriously considered.

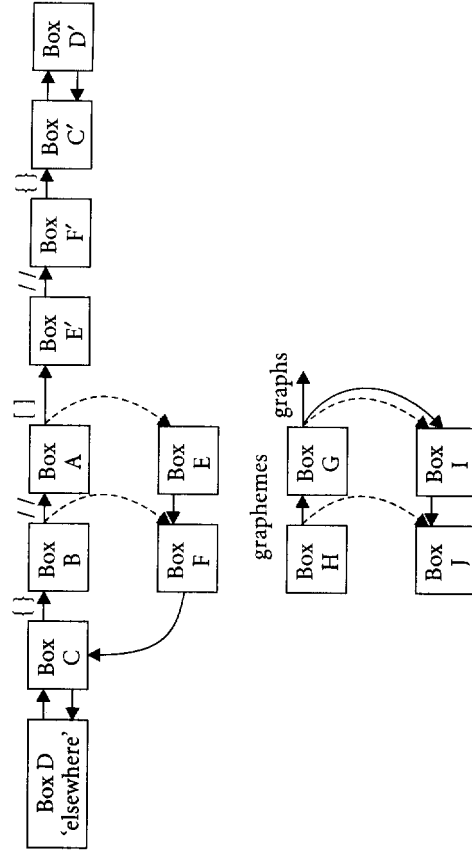
2. Speech and writing⁴²

"Writing is *not* language." This lesson has been dinned in our ears for so long, and with such convincing evidence, that few of us doubt its truth — even though the man on the street would. But to have learned this lesson is rather negative. If writing is not language, what is it? If the relationship of writing to language is not that of identity, just what kind of a relationship is it? If, in teaching people a foreign language, their learning of the language does not automatically subsume

acquisition of literacy, then by what separate organized and progressive steps can we go about the task of imparting the skills of literacy to them?

These problems have concerned the writer for a number of years, and the present brief talk might be taken as an interim report; certainly there is nothing of a conclusive nature in it.

As necessary background, let us portray what goes on when individual A says something to individual B and is understood by the latter — A and B being members of a single speech-community. We can draw a sort of box-diagram of the sequence of events, confident that the functions we assign to the several boxes are actually performed by the human organism during the production and reception of speech, but without in any way implying that the actual physiological processes are more than remotely parallel to our description. This diagram is given here; we shall discuss it starting from the outside and passing "inwards", and for best effect the reader should at each point examine only that portion of the diagram that has been discussed up to that point.



What comes from the lips of a speaker is a continuum of sound. The phonemic hypothesis implies that although what is emitted is a continuous signal, this is a transformation of a discrete, discontinuous stream of units flowing along somewhere inside; in Sapir's words, there is an "ideal flow of phonetic elements which [a speaker hears], inadequately from a purely objective standpoint, as the intention of the actual rumble of speech."⁴³ Nowadays we call these "phonetic elements" phonemes. Box A, in the diagram, is intended to

subsume that portion of the human central nervous system, and appended musculature, which, as one speaks, maps the discontinuous "inner" flow of phonemes into the "actual rumble of speech", the continuous sound signal which we can record on wax, tape, or spectrograph.

This inner stream of phonemes, however, itself must come from somewhere; wherever that somewhere may be, we have drawn a box for it (Box B). The output of Box B is the phoneme-stream which gets "smeared" or "continuized" by Box A into the speech signal. The input to Box B, which drives Box B and determines what shall be the particular sequence of phonemes that is emitted, is a discrete flow of what we shall call *morphemes*.⁴⁴ I cannot show you a picture of a morpheme, or present one marked "Exhibit A", but I can illustrate by giving a pair of English utterances which will differ in only one way as to their ultimate morphemic content:

That's a dog.

That's a cat.

Or another:

That's a dog.

That's a dog?

Or another:

That's a dog?

Is that a dog?

What is implied is that as these utterances enter Box B inside my head, one of each pair differs from the other of the same pair only in one point, just as the sequences of letters ABCD and ABCE differ only at one point. But I have not actually displayed these utterances to you in pure morphemic terms, because in order to present them I have had to lead them through Box B, converting the relatively small number of morphemes into a somewhat longer series of phonemes, and have then had to lead the sequences of phonemes through Box A, smearing them into the "rumble of speech" which you heard as I gave the examples.

The output of Box B is a stream of phonemes; the input to Box B is a stream of morphemes, and this input is in turn the output of Box C, the "morpheme generator". We can assume that there is an almost continuous morpheme flow passing around inside of Box C, bits of which are from time to time routed all the way through Boxes B and A to become observable as speech aloud. Now this chain of boxes cannot go on back "in" forever; for convenience I have added a single additional Box, Box D, called simply "elsewhere". This Box is of no linguistic importance; dogs and apes have it just as do men, whereas only humans have Boxes C and B. Presumably, if I say, in a given life-situation,

That's a dog, I have said that rather than, for example, *That's a cat*, because of the state of affairs in the "elsewhere" box. If an ape or a human is driving a car and stops at the sight of a red light, that is presumably due to events in the "elsewhere" box. For the most part in the present context the "elsewhere" box does not concern us.

Now let us turn around and look at Individual B, who is hearing (and understanding, we assume) what Individual A says. What reaches B's ears is a continuous train of sound. If this continuous signal is to have any impact, the first processing to which it must be subjected is that of recovering from it the phoneme sequence which, in individual A, drove Box A to the production of the continuous sound signal. For this function we supply Box E'. Box A smears a discrete signal into a continuous one; Box E' quantizes the continuous signal back into (a reasonable facsimile of) the discrete signal. In the hearer, the output of Box E', a discrete flow of phonemes, constitutes the input to Box F', which performs the inverse function to that of Box B in the speaker, converting or "transducing" the discrete flow of phonemes into a discrete flow of morphemes, matching the morphemic input to Box B in the speaker. The output of Box F', in turn, is fed into Box C', where, so to speak, it "induces" specific lines of development in the continual inner flow of morphemes in the hearer. Then, by mechanisms which we do not understand and need not worry about, the various hook-ups between the hearer's Box C' and Box D' bring about what we simply label "understanding".

Now with few — and pathological — exceptions, any speaker of a language is also a hearer. This means that our original speaker, individual A, even though at the moment he is transmitting a linguistic message rather than receiving one from someone else, necessarily has inside his own skin the various "reception" boxes we have described for individual B. These will be found in the diagram, directly below the analogous output boxes. Furthermore, we know that when a person speaks aloud he both feels and hears himself speak. For this reason, a dotted line on the diagram is given to show the output of Box A *reentering the speaker* via Box E. Indeed, various experimentation shows that this "feedback" is absolutely essential; it is impossible to speak, at least in any satisfactory way, without this "monitoring" of output via immediate kinesthetic and acoustic feedback. The other "feedback" routes which have been sketched into the diagram with dotted lines are more conjectural. But it is reasonable to assume that the output of Box B, the morpheme-to-phoneme encoder, is channeled not only to Box A, but also directly into Box F, where it is reconverted to morphemes and fed back to Box C, to constitute the basis for a kind of internal

monitoring of what is being produced in Box C. Indeed, when we "speak silently" or "think in words", and yet feel that we are hearing what we say, the output of Box B is not being sent through Box A, but is presumably travelling along this inner feedback route. No doubt an individual momentarily performing the function of hearer rather than speaker makes similar use of such internal feedbacks.

So much for the process of speaking and hearing speech. This is a human universal, and has been for a long time; in every human community, literate or not, the physiological analog of the boxes we have described — whatever its actual physiological nature may be — is to be found in every human past the age of infancy. The boxes are not constructed; the raw-material for them is there at birth, and they *grow*, under the impact of life in a community where other individuals are so equipped. *Nihil in lingua quod non prius in intellectu* etc.⁴⁵

If we observe, next, a member of a literate community in the act of writing, we can postulate and sketch in the additional boxes that are needed for this type of behavior. We see the individual moving his hand and fingers (or, rarely, some other portion of his body), equipped with one or another type of writing implement, and the results of these motions are visible patterns of marks on some flat surface — for simplicity let us just say pencil and paper rather than bothering with the actually very great variety of artefacts that have been or could be used. The marks may be more or less continuous, or they may be discrete; this does not seem to be an essential problem. Experience shows, however, that a physically very wide variety of marks, even for a single individual, may all count as in some sense "the same"; on this the theory of *graphemics* has been built, paralleling more or less closely the phonemic hypothesis in linguistics. So, for the most external output box, Box G, what we need is one which will have a discrete flow of *graphemes* as its input, and which will map that discrete flow into the arrangement of *graphs* that all can see on the paper. In series before Box G comes Box H, which is the source of the discrete grapheme flow that constitutes the input to Box G. Just as we hear ourselves when we talk, so usually we see what we write as we write it, and certainly feel the motions of writing; so below Box G, for the writer (paralleling Box G' for someone else who reads what our given writer has written) we place an input box, Box I. This involves the eyes, at least, and other parts unknown of the human body; what it does is to interpret graphs back into graphemes, straining out irrelevant differences of physical shape in what is seen. Similarly, below Box H we put Box J, which has graphs as its input. And dotted lines indicate external and internal feedback routes much as for speech.

But now comes the main question. What drives — what is the input — to Box H? And to what Box is the output from Box J routed? Let us look at the parts of the diagram we had drawn earlier and see what the possible answers might be.

In the first place, our "elsewhere" Box might function directly as the source of impulses for Box H, and the output of J might be routed directly thereto. When we see conventionalized geometrical road signs (not printed words, but stereotyped maps and pictures), this is undoubtedly the case. We can take our choice as to whether such man-made marks as these shall be called "writing"; the common-vocabulary use of the word "writing" would tend to exclude such items, and this has been the general tendency among linguists and graphonomists.⁴⁶ However we label phenomena of this type, there is no question but that they exist, and in rather complex forms.

A second possibility is that the input to Box H would be a flow of morphemes, routed directly from Box C, and that the output of Box J, similarly a flow of morphemes, would be routed directly back to C. There is no known writing-system in the world in which this is the *only* mechanism involved, but there are writing-systems in which this is clearly the major routing; Chinese writing, used for the writing of Chinese, is an example.

A final possibility is that the input to Box H would be a flow of phonemes, routed from Box B, and that the output of Box J, likewise a flow of phonemes, would be routed to Box F. Once again, there is no known writing-system which is to be completely characterized by this routing, but our familiar writing-systems in the western world show more of this than of any other possibility. A pure and complete instance of this is to be found only in a well worked-out phonemic transcription. A phonemic transcription, of course, is just as much a variety of writing as is any traditional orthography, but most actually used "phonemic" transcriptions do not prove, on close examination, to be "pure and complete", so that the reservation made above can stand.

Most actually used writing-systems involve a mixture of these three sources, with the output of Box B or of Box C clearly predominating. We can illustrate the presence of all three easily enough with English. On a picture-display page of a newspaper one may find a caption such as the following:

Mortimer Smith holds the largest beet on record (←). At auction it finally was knocked down for \$17.00.

We hardly need dwell on the features of this written passage which stem from the output of Box B, since that is the predominant factor in English writing.

Notice, however, the word "beat". This sequence of four letters correlates with a particular phoneme-sequence, but there is at least one other sequence of letters which correlates with exactly the same phoneme-sequence: "beat". The choice of the spelling "beat" rather than "beet" in this particular instance has nothing to do with the underlying phonemic flow, but must be traced to the direct influence of one morpheme rather than another present in the appropriate place in the inner morpheme-flow. Similarly, the symbols "1", "7", and so on, at the end, do not directly correlate with any phonemes; they correlate, in a fairly complicated way, with certain morphemes. Finally, the parenthesized arrow, telling the reader that the picture being described is to the left of the caption, does not correlate with phonemes or morphemes, but directly with something in Box D. The complexities and irregularities and mixtures of type of representation (phonemic, morphemic, and "direct") which are to be found in the writing systems of the world are almost past belief; a detailed analysis of any but the simplest and most regular writing-system requires a very lengthy exposition. We need not get into this, but there is one more generality that does concern us.

If one has a message which must be transmitted via a channel through which it cannot be sent in its original form, then what one has to do is to "transduce" it into a physical shape fit to travel the channel in question, and "retransduce" it into something more or less closely matching the original at the other end.⁴⁷ Old fashioned telegraphy will afford an example. The message that one has, just before it gets put through a key onto the wire, is in written form; and at the receiving end it is transformed back into that form. But writing cannot be sent along a wire; what goes along the wire is a series of voltage pulses, assigned by certain conventions to the letters of the written form. Now a particular channel, and the associated conventions of transduction, may not render possible the transmission of everything which can be contained in the original message. Telegraphy, for example, makes no special allowance for the transmission of the difference between lower-case and capital letters. A message which in written form achieves some of its meaning by virtue of this distinction may become ambiguous by losing the distinction during the transduction and retransduction. An amusing example is to be found in a telegram received by the wife of a colleague of mine a few years ago:

ARRIVING TOMORROW NIGHT WITH CHAOS

— on which any of us would do at least a double-take, and perhaps fail to understand. In written form, with the distinction between lower-case and capital letters maintained, it is easy to distinguish between "chaos" or "CHAOS",

something lacking order, and "Chaos", recognizable to someone who knows them as the plural of a Chinese family name.

Now if a particular variety of channel is customarily used over a period of time, its limitations may lead to the development of a special *style* of message-preparation for transmission over it, a style which compensates for what the channel will not carry. One could easily enough have reworded the above telegram into "ARRIVING TOMORROW NIGHT WITH CHAO FAMILY" — but it might have cost more.

This is what has happened in every case of an established writing-system so far studied. The conventions of the writing-system fail to provide for all the phonemes, or for all the morphemes, and as a result a special *writing style* of the language grows up, in which the phonemes (or morphemes) which cannot easily be written are replaced by various types of paraphrase. In English, for example, our writing-system provides a very limited machinery for the indication of intonation phonemes, and therefore, indirectly, very limited machinery for the indication of a set of morphemes which are extremely important in English oral communication. In reading, we learn in time to compensate for this by making best guesses; but all of us have had the experience of coming across passages, particularly in newspapers, which make no sense until we have tried several alternative groupings of words and several alternative intonations. These passages have not been sufficiently adapted to the *writing style* of English.

Part of the traditional confusion of "writing" and "language" has been due to failure to recognize this special writing style. The writing style of a language spoken by literate people is not writing; it is part of the language itself. It is the particular variety of the language which a person speaks to himself just before transducing what he is saying into written form. But its peculiarities, its divergences from ordinary conversational style, stem causally from the nature of the particular writing-system in use.

Notes

1. These first two paragraphs are handwritten on a separate introductory page.
2. At the time of writing, Diringner 1948 was the most comprehensive and up-to-date discussion. Diringner was a Semitic epigrapher and philologist rather than an anthropologist.
3. Probably not the Linguistic Society of America, since there is no reference in the very detailed Bulletins of the Society for that period.

4. This anecdote is based on that used by Bloomfield (1933:22) to illustrate an "act of speech-utterance."
5. Bloomfield (1933:25), where S is *practical stimulus*, R is *practical reaction*, r is *speech* (or *substitute reaction*, and s is *speech* (or *substitute stimulus*).
6. "Graphology" was apparently Hockett's first suggestion for the name of the field comprising the study of writing. He lately settled on "graphonomy", presumably because "graphology" had the existing sense "handwriting analysis" (cf. note 46, below).
7. Bloomfield (1933:30, 141-43, 149-50). "Displacement" was to become the 10th of Hockett's initial list of 13 "design features" (1960:428).
8. These days the estimate is more like one trillion.
9. Xed out in the typescript is "typologies"; the handwritten substitute is illegible.
10. A major concern of Roy Harris (e.g. 1995).
11. This may be Hockett's first expression of the 12th "design feature" — "duality of patterning" (Cf. note 6.)
12. Cf. Daniels 1991.
13. "Writing is not language, but merely a way of recording language by means of visible marks" (1933:21).
14. Unpointed Arabic records all long vowels obligatorily along with the consonants.
15. "Peiping" is a different name for the city whose modern name is variously romanized "Peking" or "Beijing".
16. Hockett's manuscript refers to Chinese examples in various abbreviated ways. We have done our best to specify them here in terms of traditional characters, Yale transliterations (which Hockett used in other works), and glosses. Many thanks to Prof. Terry Kleeman for Sinological consulting. — WB.
17. Hockett probably refers to 取 'to get (in general)' and 娶 'to take a wife' — WB.
18. This may have been the first adumbration in Hockett's writing of the joke featured in "Where the tongue slips, there slip I" (1967, ex. E23): "A father called his cattle ranch "Focus" because it was where /ʔəə+sənz+rəz+³mɪyt/ ... *the sons raise meat/sun's rays meet*."
19. The hesitancy is warranted. The orthography neither of Egyptian nor of any of the cuneiform-written languages can be said to operate much like Japanese orthography (e.g., there is no analogue to the Japanese graphic distinction between logograms and syllabograms).
20. This is the burden of, though not an example in, Edgerton 1941. I am grateful to John Larson, Egyptologist and Oriental Institute Museum Archivist, for trying to track down a more specific reference to this particular example. W.F. Edgerton was the linguist-Egyptologist brother of the linguist-Sanskritist Franklin Edgerton. (I am indebted to the late Carleton T. Hodge for that information.)
21. An insight developed in O'Connor 1983.
22. Cf. note 13. The situation is more nuanced in Hebrew; in ancient Phoenician, however, all vowels are omitted.
23. "Juncture", roughly speaking, was a device for acknowledging that phonological analysis cannot in fact be carried out without reference to morphological information.
24. This is in *Tom Sawyer*, chap. 5.
25. The manuscript of the original version of Lewis Carroll's poem is reproduced in *ROF* p.8.
26. There was a time when telephone numbers, in the US, had only four digits after an exchange name; the letters assigned to the numbers on a telephone dial (now keypad) were chosen so that every combination between 2 and 9 could be assigned a pronunciation. For several decades, the exchange designation comprised a name plus a fifth digit, so the example number might have been "WOodruFF 2 7756," usually pronounced "double-u oh two"; WO 2 was later codified as 962, and only then could the fad for spelling telephone numbers as seven-letter words commence.
27. I fear this is a misremembering of the appearance of Shakespeare folios (or other early prints).
28. In Hockett's handwriting, *n* and *u* merge; in many scripts in the Aramaic family, ⟨d⟩ and ⟨r⟩ are nearly or completely indistinguishable.
29. The reference to Bengali is inexact. Bengali ⟨ʒ⟩ looks much like the roman; ⟨t⟩ is the same EXCEPT it has an obligatory horizontal overstroke. A better example might be Roman ⟨l⟩ (cap "eye"), ⟨l⟩ ("ell"), and ⟨1⟩ ("one"), which are identical in some styles.
30. The slogan "Once a phoneme, always a phoneme" was a hallmark of one approach to post-Bloomfieldian analysis.
31. The classic reference for long components is Z. Harris 1944.
32. An approach pursued in Herrick 1966.
33. Even if we so allow, these figures are five to ten thousand years too large.
34. Bloomfield 1933, ch. 17.
35. Only the writing typology by A.A. Hill (1967) admits "directly semantic" scripts as writing.
36. Perhaps an allusion to Bloomfield 1933:22.
37. This must refer to a controversy that only a historian of education could identify.
38. Happily, Hockett did not anticipate the approach to "literacy studies" associated with the anthropologist Jack Goody, which has by now proved unfruitful (cf. Sawyer 2002). Even in MPN he takes no notice of it.
39. A less time-bound example might be Ray Bradbury's novel *Fahrenheit 451* (1953).
40. The phenomenon of *ideophones* was not widely known in 1951.
41. A contemporary analog is now found in the New York City subway system, where placing a line's designating number or letter in a circle or a diamond marks a local or express run respectively — except that Q-in-a-circle and Q-in-a-diamond are treated as two separate lines.
42. Previously published in *Report of the Third Annual Round Table Meeting on Linguistics and Language Teaching*, Georgetown University [1952], 67-76.
43. Sapir 1921, ch. 3.

44. The wording suggests that the term was new or likely to be unfamiliar to the audience, but it was familiar at least since Bloomfield (1933: 161) and is found already in his "Postulates" (1926).
45. "Nothing on the tongue that was not first in the mind." This appears to be a variation on a statement attributed to Aquinas, *Nihil est in intellectu quod prius non fuerit in sensu* 'Nothing is in the mind that was not first in the senses.'
46. At the end of the manuscript is a longhand note: "Define graphonomy." Presumably this is simply Hockett's word for the study of writing systems (*graphonomy* : *astronomy* :: *graphology* : *astrology*). Had his definition been published, it might well have preempted Gelb's (1952) *grammatology* (cf. Hockett 1997b: 383).
47. The "transducer fallacy" mentioned in Introduction is described as follows in *ROF* 84ff., §7.5: "A phrassology of LEVELS ... has been molding our discussions of language design for half a century or more ... Different levels seem to present us with different basic units ... so if we are going to speak of morphophonemes it seems there must be a morphophonemic level, and allophones or phones imply an allophonic, phonic, or phonetic level. Also in this conception there must be conversion principles of some sort to move us from one level to another ... This I formulated years ago, by positing TRANSDUCERS in tandem, a level sandwiched between each adjacent pair, and the output of each constituting the input to the next ... The focus of the fallacy is the insistence on processing in SERIES. I propose, instead, that the listener may operate on the incoming signal in several ways at once, in PARALLEL." Hockett's notes (p. 154) add: "In my own work the transducer fallacy was apparent though subsidiary in 1955, dominant in Hockett 1961." The diagrams there are simpler than that here; this paper may thus represent the germ of the idea that was fully expressed (though not with relation to writing or written language) a decade later.

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