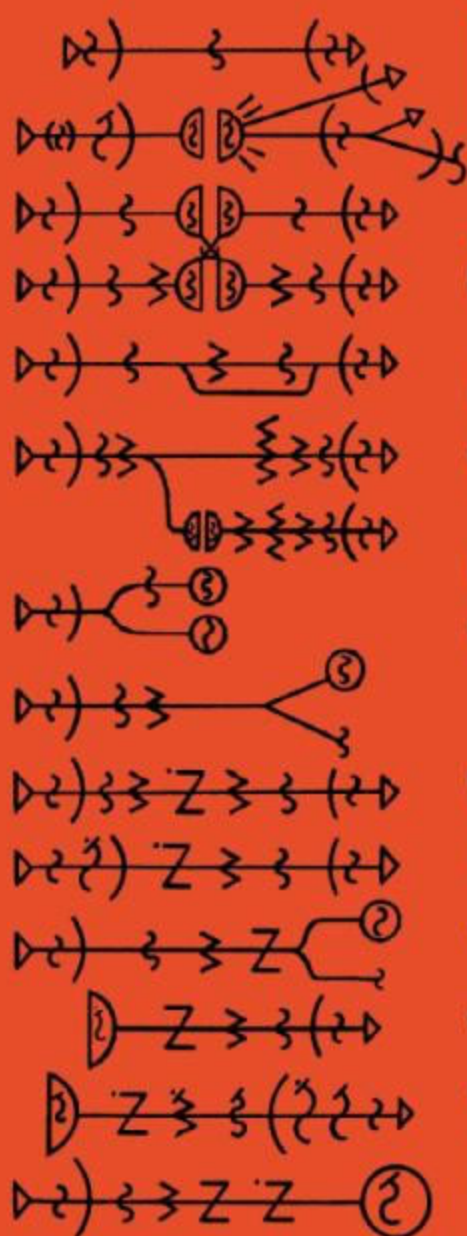


YUEN REN CHAO



Language and Symbolic Systems

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CAMBRIDGE UNIVERSITY PRESS

LANGUAGE AND SYMBOLIC SYSTEMS

BY

YUEN REN CHAO

*Agassiz Professor of Oriental Languages and
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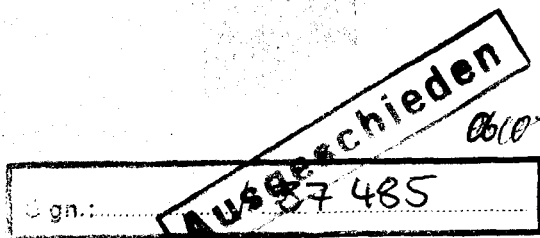
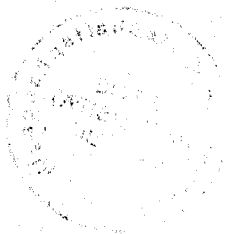
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PREFACE

I have written this book for the general reader—general reader in the sense that he may be a specialist in some other subject, but new to the field of linguistic inquiries. I have therefore tried to start from scratch and to avoid going into technicalities whenever the same thing can be said in plain English. But you who are specialists in other subjects are well aware that you cannot go into a subject seriously without using a minimum of technical terms and symbols. As recently as in 1942, the late Professor Joshua Whatmough, author of *Language, a Modern Synthesis* (London, 1956), used to complain in seminar groups, "Why do they have to use that damn word *phoneme*?" But soon afterwards he not only started to use the word himself, but also insisted on the classically correct form of the adjective *phonematic* instead of the more commonly used form *phonemic*. So I felt free to go ahead and use the term phoneme and even devote a whole chapter to it in a book for the general reader. Thus one thing led to another and from phonemes I had to go into morphophonemes, but before the book got completely out of hand I had to draw the line somewhere and used such words as *sememe* only when quoting from other writers. There may have been some slight loss in accuracy when a technical formulation is phrased in plain words, but, as my teacher of mathematics once said, better say something less rigorously and be sure that the message gets across than give it in absolutely correct form and be sure to be misunderstood or not understood at all.

But the book does not get more and more technical as I add term to term and symbol to symbol and take more and more for granted and assume that the reader will remember from three to four chapters back that IPA stands for International Phonetic Alphabet and that IC means 'immediate constituents'. But even with a minimum amount of technicalities, we must sooner or later get on to the business of linguistic theory after generalities about language.

I do however devote more attention in this book to the place of language as a part of life and as a special case of symbolizing in

PREFACE

general than to schools or theories of language and that is why the word *linguistics* does not appear in the title and occurs with relative infrequency for a book of this nature. Perhaps I owe it to the readers in the profession to explain what school of thought I belong to, though a glance over a few pages of the book will quickly give me away as a practising phonetician and a descriptive linguist. However, I am not linguist enough to stay patiently in any school and for nearly two-thirds of the book I am concerned more with peripheral aspects of language than with linguistics proper. Perhaps my interests are closer to those of Edward Sapir, who on our first meeting learned in little more than an hour not only the main phonemics of my native dialect Changchow, Kiangsu, but also what to say and when, and what expressive intonation to use.

This is a somewhat personal book and the personal pronoun *I* appears much more often than is usual for a book on such subjects. I think I have views on language different enough to justify another book when there are already half-a-dozen books with the title *Language*, not to mention numerous other books with similar titles. When I use the pronoun *we*, I mean the "inclusive we", inviting the reader to consider a problem with me together and not the very impersonal "editorial we", with its peculiar singular form *ourselves*.

It is I and not ourselves who will now have the pleasure of acknowledging the help and encouragement I have received from various sources. Besides specific acknowledgements given in parts of the book, I wish to thank particularly Professor Samuel E. Martin and Mr Jerry L. Norman, who have taken the trouble of going through the manuscript for rough spots, both as to form and as to content. Finally, I wish to thank my colleague Professor Nathan Glazer for getting me first interested in writing such a book, which I was supposed to do in my spare time. As every seeker for spare time knows, that time never comes. Now that the book is here, the problem of finding the spare time to read it will be left to the reader.

YUEN REN CHAO

Berkeley, California

1 June, 1966

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SYMBOLS AND PUNCTUATION

1. *Italics* are used for cited forms, including terms introduced for the first time. Parts of a cited word singled out for discussion are in italics, the rest being in roman. For instance, if it is about vowels, the word *happiness* will be given as happiness.

2. Single quotes ‘ ’ are used for giving meanings, as in *mon ami* ‘my friend’. Double quotes are used for direct quotations and for terms occasionally cited in this book from other usages, e.g. “soft”, as applied to the palatalized consonants of Russian.

3. Square brackets [] indicate that the symbols inside are those of the International Phonetic Alphabet (IPA). For simplicity the Greek letters of the IPA, which strictly should have serifs, will be given without them, namely, β, φ, θ, γ and χ. (See chapter 2.)

4. Forms between slashes / / and braces { } are to be taken in the phonemic and morphophonemic senses, respectively. (See chapter 3.)

5. The conjunction *or* preceded by a comma indicate that the expressions before and after are synonymous, as in *a dozen, or twelve*; if there is no comma, then the word *or* indicates real alternatives, as in *eleven or twelve*.

6. The usual symbols for historical changes “>” ‘changed into’ and “<” ‘came from’ (except in the very few cases where they obviously indicate mathematical inequalities) are to be distinguished from symbols for synchronic derivation “→” ‘changes into’ and “←” ‘comes from’, where the forms before and after the symbol still coexist, as in *do not* → *don’t* and *’bye* ← *good-bye*.

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers, who came to the Americas in search of a new life. They found a land of opportunity, but also one of hardship. The early years were marked by conflict and struggle, as the settlers fought to establish a new society. Over time, the United States grew from a small colony into a powerful nation. It was a process of constant evolution, shaped by the dreams and aspirations of its people. The story of the United States is a testament to the power of the human spirit and the ability to overcome adversity.

The United States has a rich and diverse history, filled with countless stories of heroism and sacrifice. From the early days of exploration to the present, the nation has been shaped by the actions of its citizens. The story of the United States is a story of progress and innovation, of a people who have always been looking forward. It is a story of a nation that has the courage to face its challenges and the wisdom to learn from its mistakes. The history of the United States is a story that continues to inspire and motivate us today.

LANGUAGE AND THE STUDY OF LANGUAGE

§1. *What is language?*

Language is a conventional system of habitual vocal behaviour by which members of a community communicate with one another. It has the following characteristics:

(1) Language is voluntary behaviour. A cough or a sneeze is not a word; laughing or crying is not talking. You cannot say a cough, but you can say *Ahem!* You cannot say a sneeze, but you can sneer *Hm!* Similarly, when you say *Ha-ha!* you are not laughing and when you say *Alas!* you are not sighing.

(2) Language is a set of habits. Like other habits, they are easily formed in early life and difficult to change later. That is why children learn their own language and foreign languages more easily than adults. Much of the difficulty in learning foreign languages comes from the failure to realize that one is to be engaged in changing one's habits.

(3) Language as a form of communication (in the widest sense) is entirely arbitrary in its relation to what is communicated. Before the establishment of a convention, any word could mean anything. Why does it sound funny when Humpty Dumpty makes *impenetrability* mean 'we've had enough of that subject, and it would be just as well if you'd mention what you mean to do next, as I suppose you don't mean to stop here all the rest of your life'? Alice thinks that it is too much for one word to say. But another and perhaps more important reason is that the word already means something else.

Monolingual persons take language so much for granted that they often forget its arbitrary nature and cannot distinguish words from things. Thus, primitive peoples often believed that putting a curse on somebody's name could actually harm his person. Persons unused to foreign languages tend to find something perverse in the way foreigners talk. Even Oliver Goldsmith

could not get over the perversity of the French, who would call a cabbage *shoe* instead of calling a cabbage *cabbage*. The story is told of an English woman who always wondered why the French call water *de l'eau*, the Italians call it *del'acqua*, and the Germans call it *das Wasser*. "Only we English people," she said, "call it properly 'water'. We not only *call* it 'water', but it *is* water!" This spirit of "it *is* water" shows how closely words and things are identified by the speakers, even though the relation is actually arbitrary.

Now this story is entirely wrong. It was not an English woman who said these things, but a German woman. I heard the story from Professor H. C. G. von Jagemann, when I took his introductory course in linguistics at Harvard University. The punch line in the story, as he told the story in English, was: "We Germans call it 'Wasser'. We not only *call* it 'Wasser', but it *is* Wasser." I was innocent enough at the time to wonder why the professor had not told the story in German and made it sound more plausible, but realized only later that the ridiculousness of the statement in English was the very point he was trying to make.

(4) Language is a convention, a tradition, a social institution, that has grown through the common living of a large number of people who carry on the tradition. Like other human institutions, languages change or become extinct and we have this very day instances of languages which are represented by only one or two speakers, whose words are worth more than their weight in gold to linguists, and whose demise would mean the demise of the language. But by and large, most languages, even the most outlandish out-of-the-way languages of the world, are spoken by hundreds of thousands or millions of speakers.

(5) Like other social institutions, language is conservative and resists change. But it changes much more rapidly than the species of plants and animals. While biological evolution is reckoned in thousands and millions of years, change in language is reckoned in centuries or decades and is often noticeable in one person's lifetime. Within the same community, the children will rhyme *root* with *put* and their parents cannot make them rhyme it with *shoot*. A language is kept the same by the intercommunication among its speakers. Separate them by social class, occupation, political divi-

sion, geographical distance or by time in history, and you have dialects and languages.

(6) Language is linear. It is one-dimensional. Unlike polyphonic music, you have to say one thing at a time or even one sound at a time. It is true that certain expressive elements such as intonation and voice quality are present simultaneously with the spoken words, but they are more like accompaniments to a Schubert melody than independent voices in a Bach fugue. This linearity of language has important consequences on grammar and style, as we shall see later.

(7) Every language consists of a surprisingly small inventory of distinctive sounds, called *phonemes*. The human ear can distinguish thousands of different qualities of sounds, but out of these possible distinctions, only a very small number—from a dozen to less than 100—are made use of in any one language. Speakers of English do not notice the difference between the aspirated *p* in *pie*, which is pronounced with a puff of air, and the unaspirated *p* in *spy*, although they can hear the difference if their attention is called to it. But in other languages, they are as different as *p* and *b*, and are often so transcribed. The English word *pie* sounds like the word for 'to dispatch' in Chinese, while the *py* part of *spy* sounds like the Chinese word for 'to bow'.

(8) Language is systematic and unsystematic, regular and irregular. Because of the relative paucity in the number of constituent elements in any given language, what elements there are will naturally occur and recur in regular and systematic patterns. But because of the social nature of language, such patterns are never simple and perfect. Rules have exceptions, laws have subsidiary laws, and both the theoretical linguist and the practical teacher and learner have to give due regard to both those aspects.

(9) Language is learned, not inborn; it is handed on, not inherited. Every child has to learn the mother tongue from scratch. An English baby has no initial advantage in learning English over a Bantu baby. Given the same environment, a child of any country or race learns the language of its speaking community as easily and as well as a child of any other origin.

§2. *Linguistics: the study of language*

The study of language is now called *linguistics*. But conscious concern with language is as old as history or older. Prehistoric people were no doubt aware of the different ways in which other tribes talked and tried to imitate them in order to communicate with them. Ancient philosophers such as Plato and Aristotle were very much concerned with the use of language. Mencius even gave practical advice as to how and how not to learn other dialects. The people of ancient India, to whom the correct reading of the Veda was of great importance, had terms for many of the processes of linguistic change, some of which, such as *dvandva* for certain compounds, *sandhi* for influence of one sound on the next, are used by Western scholars today. Since the study of historical and literary texts have much to do with the examination of words and their changes in different historical languages, there grew up the discipline of *comparative philology* in which the primary interest is in the texts themselves, but from which much of the general principles of language had to be and were considered. That is why for a time the general study of language was called *philology*.

Linguistics as a separate subject is comparatively new. In most universities in the United States a department of linguistics consists mostly of an interdisciplinary committee formed of members of the departments of English, Classics, romance languages, German, etc., and members of other departments who happen to take an interest in or have made contributions to the theory of language from an overall point of view. It is only in recent years that there have been departments of linguistics operating on independent budgets, with full-time members on the staff. Candidates for a Ph.D. in linguistics are often advised to keep an eye on some special related field, literature, history, area studies, so that they can find openings for jobs other than in linguistics as such. All this is of course no new story. At the time I was concentrating on physics, people could not understand what one could do with physics except teach. In the 1910s there was such a profession as a chemist (in the American sense), but not as a physicist. The *Encyclopaedia Britannica*, which was then in its 9th edition, had no article "Physics"; it had only "Natural Philosophy". It is

therefore not at all surprising that there is still no generally understood term for a person who specializes in the theory of language and languages. Because a linguist is usually understood as a polyglot of the Thomas Cook guide type, one member of this unnamed scholarly class proposed that a specialist in linguistics should be called a "linguistician", by analogy with "mathematician", and announced that henceforth he would call himself and everyone else in the profession a "linguistician", but the term did not take and we now have to put up with the ambiguity of the word *linguist*. However, ambiguities, as we shall see later, can usually be resolved when we know the context of use. Thus, one who specializes in linguistics is still a linguist, who may or may not be a practical linguist and is often proud of not being one. This is quite analogous to the case of the mathematician who is proud of being poor at figures. The great linguist Antoine Meillet used to attract students from all countries of the world to hear his lectures, in which he cited copious examples from all languages of the world. But whether it was Sanskrit or Greek, German or English, they all came out with a perfect French accent. And why not so long as he got his points across?

§3. *Dichotomies in linguistics*

1. *Synchronic and diachronic*. Synchronic linguistics is the study of a language at a given time, while diachronic linguistics is the study of a language through different periods in history. The difference is sometimes spoken of as that between descriptive and historical linguistics. These terms seem to lack logic and symmetry, since there is no reason why one cannot describe historical change or why the study of a particular period in the past cannot be both synchronic and historical. The explanation for such asymmetrical usage lies in the special circumstance that much of the technique of analysis and description of languages, especially in America, was developed in connection with the study of languages which have no historical records. It was only in comparatively recent times that linguists have applied the technique of synchronic description to particular periods, such as the phonemic analysis of ancient Chinese, or to the history of languages without a history, such as

the reconstruction of ancestral forms of the American Indian languages.

2. *Descriptive and prescriptive.* In another sense the descriptive is contrasted with the prescriptive, or the normative. Linguistics tells what language is, what languages there are, and how they have come to be the way they are. It does not tell what is right or what is wrong. Linguists have been accused of saying that whatever is is right, whereas all they are trying to say is that whatever is is. True, they are not saying what one would like to have them say. Their reply is that that is the job of the educators. Since in practice many if not most linguists are also engaged in educational work, it becomes a question of whether one is acting as Lord Chief Justice or Lord High Admiral, since Pooh-Bah acts in both capacities. Thus the same person, as educator, can tell you, "Leave your language alone!" while as a linguist he can describe objectively "Linguistics and your language". We shall come back at greater length to this perennial problem.

3. *Pure and applied.* When we know what is, we are better prepared to think about what is right and wrong. That is one aspect of applied linguistics. Foreign language study is also a very important field of applied linguistics. Everybody is familiar with the importance of phonetics to foreign language study. Recently a good deal of attention has been given to what we called contrastive studies, in which aspects of the learner's language are compared with corresponding aspects of the language to be learned. In the technique of translation, one can gain much profit from the application of general linguistic principles. Even in the young field of machine translation, progress can be made no faster than progress in our control of linguistics in general and the linguistics of the languages involved. To come back to our old subject, what is philology but the application of linguistics to actual texts?

4. *Continuous and discrete.* It is obvious that everything in language has degrees. Vowels and tones form continuous spectrums. Even with consonants you are often not sure whether you pronounce *Habana* with a *b*-like *v* or a *v*-like *b*. Lexicographers are forever being haunted by shades of meaning. In drawing the map of Chinese dialects, I have been changing my mind every ten years or so as to whether there are eight, nine, or ten groups.

§4. WHERE, WHEN, AND HOW DOES LANGUAGE EXIST?

On the other hand, it is equally clear that everything in language must be one thing or another. A vowel in Latin is either long or short, a noun in English is either singular or plural. We have seen that every language has a small inventory of a few dozen phonemes. Look up any word in a dictionary and you will find the continuum of meaning neatly broken up into separate meanings 1, 2, 3a, 3b, etc. Thus, in language there seems to be no difference of degree, only difference of kind.

This apparent contradiction is found not only in language and the study of language, but in practically all fields of inquiry. Out of the apparently continuous mass of material under study, the inquirer has to set up clear and distinct categories, abstractions if you like, under which to best systematize his material. But it is not an entirely arbitrary and subjective matter. If you oversimplify, the theory will not fit the facts and has to be revised and refined. This is how any field of inquiry progresses, and the field of language is no exception.

§4. *Where, when, and how does language exist?*

Since language is something that is spoken, it should exist as sound waves in the air where and when one speaks. But in these days of advanced communications technology, what one says here is also heard elsewhere, and what one says now is also heard later. And along the way where speech is being transmitted in space or during the period when speech is being preserved in time, there is no language as we ordinarily understand it, but instead only patterns of matter or energy, be they electromagnetic waves, wiggles in a groove, unevenness in the magnetization of a powder on a plastic ribbon, or anything else. Such patterns, to be sure, have a high degree of fidelity to the pattern of the original sound waves. But one would hardly call them speech. An album of records called "A Complete Course in the French Language" is not the French language.

Apart from these technological extensions of language which we shall go into in greater detail in chapter 11, actual speech has always seemed too fleeting an event to be the vehicle of existence of a language. Thus, both in the popular mind and among the more

literate, a language is regarded as better represented in the texts in which it is written, the grammars that describe its structure, and the dictionaries that gather together the whole inventory of arbitrary items which enter into its structure. There is more existential satisfaction in something that you can take in the hand or store on the shelf. This does not mean, however, that anyone is naïve enough to say that a language is a book. Books and inscriptions may be preserved centuries or millennia after the language is dead. For a language to exist, there have to be speakers. Since the speaker of a language cannot say everything in a language at once but at most only one thing at a time even if he were to talk all the time, the great body of the language spoken must exist in some other form than actual speech. Moreover, since there were languages long before the invention of writing, let alone phonographic recording, languages must have existed in the person of their speakers—in other words, their vocal habits, in the production of sounds and, on the part of the hearers of a language, their habits of responding in specific ways to the sounds produced by other speakers. This means that a language exists primarily in the brain of its speaker as a set of habits and dispositions. It is then possible to say, even in the case of a rare language of only a few speakers, that a language is still a living one even when no person is actually speaking it at the moment.

§5. *'Language' as understood in linguistics*

In everyday usage we speak of language in many senses that linguists disapprove of. We should not, linguists say, speak of written language. Writing is a system of visual signs with which language is symbolized. If language symbolizes ideas, writing is the symbol of symbols. One should not speak of the language of mathematics or mathematical logic. For these disciplines use symbols which are often not pronounceable or pronounced with great difficulty. Some of them are not in the form of a linear succession of elements in time, as every respectable language should be. One should not speak of the language of parrots, bees, or dolphins. A parrot may reply to the question, "What's your name?" by "My name is Polly". One Mynah bird even answered my question

§5. 'LANGUAGE' AS UNDERSTOOD IN LINGUISTICS

"What's your name?" with "What's *your* name?" But it cannot learn, as a human child can, to use the same form and say "What's his name?" or "Your name is Polly". In a bird's language every sentence is an unanalysable vocal response. The language has no structure, it has no words, and does not form a system.

This somewhat parochial attitude of linguists with regard to language is not without its scientific justification. Taken in the narrow sense of habitual and conventionalized vocal behaviour, as described above, it has been possible to develop a science of linguistics, with its relatively systematic and regular features and no more than its fair share of exceptions and unsolved problems as compared with other studies of social phenomena. However, the moment you make language include the language of music, the language of flowers, the language of gestures, etc., you will find that many of the things which are true of human speech are not true of these other kinds of language. In such a situation, one or both of two things may happen. When there is little in common between human speech and what is sometimes called language, such as the language of animals and flowers, we can regard the use of the word as merely metaphorical and need not take it seriously enough to include it in linguistics at the expense of complicating that subject. But if in an extended sense some important features of ordinary language are present, plus other additional features, then the claim for the use of the term "language" in an extended sense is not to be dismissed. For example, it is possible to classify and order the study of gestures, with many theoretical techniques that have been found effective for spoken sounds, and by analogy with phonemics (which is a branch of linguistics), a system of kinesics has been set up with symbols and classifications that are similar to, though not as neat and accurate as, those used for speech sounds. Notations of a somewhat *ad hoc* nature have long been in use for dancing and gymnastics but the first attempt to set up a theoretical system seems to have been that of R. L. Bird-whistell in his *Introduction to Kinesics* (Louisville, Ky. 1953).

The strongest contender for the term "language" is writing. Although writing is like records and tapes in being a representation of speech in a different physical medium, it differs from these close copies of sound waves in that its relation to speech is largely arbi-

trary and has to be learned and carried on by tradition. Moreover, since the conditions of talking and listening are different from those of writing and reading, the changes in one are different in manner and speed from those in the other. Sounds have changed, but people write today as people talked centuries ago. Written characters have been borrowed by one nation from another, but they are often dissociated from the spoken words they originally represented. The so-called arabic figures (originally Indian) represent a different set of spoken words in practically every language in the world. Thus, a system of writing has become something autonomous. Even if it has a high degree of correspondence to speech, it has its own style, its own special kinds of change, and other features of divergence from speech. Haven't you noticed that even with close friends and members of the family you never quite write in the same way and on the same topics as when you are talking with them?

It is therefore not without justification to speak of the written language instead of language written, as linguists prefer to refer to it. Written English, whether in actually written form, or read aloud, is a different language from spoken English. The difference is even greater in the case of Chinese. Until the vernacular literature movement started in 1917 by Hu Shih (1891-1962), everybody wrote, so far as grammar and vocabulary went, in a language two thousand years older than the one they spoke. Today, when most writing is done in the so-called vernacular style, the difference is much less, but still at least as great as that between written and spoken styles in the Western languages. And why should one not write differently from the way one talks? A good teacher should repeat in class the same point in different words, or even in the same words, for the class to catch. But in writing, the reader is free to look back whenever he needs to or to proceed if he does not.

We shall come back to wider senses of language in general (§ 56) and the idea of the written language in particular (chapter 8).

§6. *Language and speech: type and token*

A language is the system of habits as embodied in the brains of its speakers. When a speaker of the language makes an utterance, it is then speech, realized as an instance of a linguistic form. In the terminology of communication theory, a language is a system of *types*, an utterance or speech in the language is a *token*. The English language is a type. The sentence *Come here!* is a type. When someone actually says "Come here!", it is a token. If he says it twice, it is one type, realized as two tokens. In the case of written records as existing in inscriptions and books, the extended text or any word or phrase in it is a token and the occurrence of the same form elsewhere is another token. Since philology is the examination of the form and meaning of actual occurrences of forms in a text, we can say that philology is the study of tokens, and linguistics, which is concerned only with the general type wherever it occurs, is the study of types. For psychological or historical reasons, tokens are sometimes not typical of the type, which means that actual speech is often less systematic than language as an ideal system. For example I heard recently, from a native speaker of American English the sentence: *It was an long envelope*, where one would expect *a* instead of *an*. The reason was of course that he started to say *an envelope* and then changed his mind and added *long* without bothering to change *an* to *a*. While linguistics is chiefly concerned with systematic types, the total study of language will of course have to include both tokens and types. As to which is the real language, it all goes back to the argument between Aristotle and Plato as to whether things or ideas are more real, a question we will not go into for our purposes. It is however of linguistic relevance not to oversimplify things for the sake of neat systems. For further discussion on this point see § 21, pp. 48-50.

§7. *Forms of discourse, language and non-language*

Since speech is behaviour, it is usually mixed with other behaviour, either concomitantly or intermittently. The preoccupation on the part of scholars with long, connected discourse often makes them forget the fact that speech mixed with action is the normal

thing and long, organized monologues or dialogues are the exceptions. Witness the style of dialogues in the early days of the talking movie. Because the movie actors had had to be silent during the decades before the invention of the talkies, they felt that they had to keep talking all the time, as if to make up for lost time. Only gradually did scenario writers realize that real life can be mirrored much more faithfully by action interposed with talk, especially given the unrestricted resources of the camera, as compared with the physical limitations of the stage. The importance as data for linguistics of disconnected discourse, as compared with connected discourse, lies in its greater frequency of occurrence and its closer relation to the rest of life, with consequent greater influence on change of sound, meaning, and structure. Any statistical study of linguistic forms would be much more significant if we could gather speech data from real life instead of, as has usually been necessary, from composed discourse or from question and answer between the linguist and the native speaker.

To have a correct view of how language operates in life is of course a different matter from how to use language effectively in science, art, or practical affairs, or for that matter, in presenting the facts about a language to linguists. In the more sophisticated uses of language there is usually more use of long, connected discourse, and of technically defined terms in ways that are not usually accepted or understood by most other speakers of the language. In presenting the facts of a language to linguists, say in the form of a grammar and a lexicon, conciseness and completeness are the aims, though the users of the language being described may talk in a diffuse style. It is only in composing a teaching text for a language or in writing realistic dialogues for a play or a novel that one aims at imitating a piece of real life, with its connected dialogue and action and its disconnected discourse. But even here, one must organize, condense, and select the essentials in order to have a realistic presentation of language in real life. For real life is too long and too untypical to present enough realism without being edited. A child has all the waking hours of his early years to learn to talk. A language student has only a few hours a week in which he has to get the language in concentrated doses. The plot of a play may cover days or years of the lives of the characters. The

§7. FORMS OF DISCOURSE

playwright will have to organize his dialogues in such a way as to give the most natural development of the plot with the least waste of words and action. As A. A. Milne has shown in his autobiography, a piece of life taken from real life is the least realistic presentation for use on the stage (see p. 115). For the linguist, the data will still have to come from real life, but in the presentation of his findings, he can organize them as a playwright organizes his plot. However, the linguist has an advantage over the playwright. A play has to seem like real life. A treatise on linguistics is not expected to be as readable as everyday language.

PHONETICS

§8. *The sounds of language*

We have noted that language consists of a succession of sounds. But this truism has by no means been obvious to all peoples in all ages. Writers of the last century and even the general public of today speak indifferently of letters or sounds. Few speakers of English are aware that the so-called long *ā* and long *ō* are diphthongs, and not simple vowels. The word *writing* is commonly regarded as having five consonants, whereas it really has only three: *r*, *t*, and *ng*. For speakers of languages in which each syllable is written as a separate character, such as Chinese, a "sound" is a syllable. The idea of breaking a syllable into a succession of consonants and vowels came comparatively late to the scholars and only quite recently to the Chinese schoolchildren of this century.

The sounds of language can be analysed from one of three points of view. (1) From the point of view of the action of the organs we have physiological, or articulatory, phonetics. This is the traditional kind of phonetics. As it has proved to be and still is very useful for both research and teaching, we shall go into it here in some detail. (2) The study of the sound waves produced in speech constitutes acoustic phonetics. This subject is now at the wave front of phonetic research and has some important applications, but has not yet been so fully developed as to supersede or cover the whole field of traditional phonetics. We shall come back to this in chapter 11. (3) The psychology of perception of speech sounds, a part of psycholinguistics, is a still newer aspect of the study of speech sounds and is not yet a fully developed field. We shall mention such aspects of the perception of speech sounds as will be relevant to our discussions.

§9. *The production of speech by the speech organs*

Speech sounds are produced by the placing of the speech organs in certain articulatory positions, usually accompanied by expulsion of air from the lungs through the larynx, the mouth cavity and/or the nasal cavity and thence to the outside. More than half of the time the vocal cords are half closed so as to be made to vibrate by the outpushing air and the sound is then said to be *voiced* (formerly called "sonant"). If the vocal cords do not vibrate, then the sound is said to be *voiceless* (formerly called "surd"). For example, in the following words:

yes, no, well, aboriginal, exist, extra, strengths, Sh!

the sounds represented by the italicized letters are voiced, while the others are voiceless.

When the air comes out of the mouth and the nasal cavity is closed, the resulting sound is *oral*, as are the majority of speech sounds in any language, whether reckoned by type (by variety) or by token (by frequency of occurrence). If the oral cavity is closed and air goes through the nose, the result is a *nasal* sound, for example, *n*, *m*, and *ng* in the word *nam^{ing}*. If air passes through both the mouth and the nose, the resulting sound is said to be *nasalized*, as in French *un, bon, vin, blanc*. The nasal passage is opened or closed by lowering or raising the velum (see Fig. 1) against the back of the pharynx. Since one does not see one's own velum, you cannot tell a person to raise his velum and expect him to know what to do. But tell him to say "Ah!" or "Oh" (oral vowels) and his velum will be raised. Say "Mm!" (delicious) and his velum will be lowered.

The most active of the speech organs is of course the tongue, so much so that the word for language in a number of languages is the word for 'tongue,' in fact the word *language* itself means something like 'tongue-stuff'. The usual appearance of the tongue is a flat or pointed "tongue-shaped" object that one sticks out to the doctor or at an adversary. But actually, most of the time, whether at rest or during speech, a better image is that of a beef tongue you buy at the market. The tip (or apex) of the tongue is used in various positions, but the front surface and the back of the tongue are also

used in an active manner in forming articulations. The outermost speech organs are of course the lips, of which the lower lips are more active than the upper, since the lower jaw can be moved. The difference can be demonstrated strikingly by attaching a slip of paper to each of the lips and saying "papa" or "mama". Anyone who tries this experiment for the first time will be surprised to find that only the lower piece of paper moves instead of both moving apart, as one would usually expect.

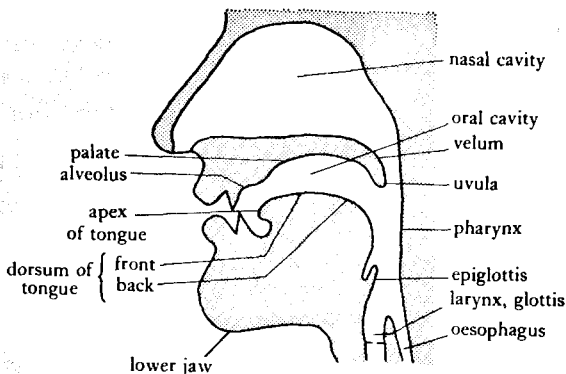


Fig. 1. The organs concerned in speech, side view.

It is important to distinguish between the active and passive articulators in the speech organs in connection with the naming of speech sounds, since common usage in articulatory phonetics has not always been consistent in this respect. For example, when a sound is described as palatal, as in German *ich*, it is named by the passive part, while the active part, the tongue, is not mentioned. But when a sound is said to be retroflex, as in a common pronunciation of the *sh* in *shrew*, it refers to the curled position of the tip of the tongue, which is the active part. To be completely unambiguous, one can call the *ch* in *ich* dorso-palatal (dorsum = 'surface of the tongue') and the *sh* in *shrew* apico-palatal, giving first the active and then the passive articulator. But so long as one is aware that "palatal" always implies that the tongue is in the flat position, there is no harm following the common usage, and the terms are shorter.

In phonetics it is convenient to speak of speech sounds when no

sound is actually heard. Thus, in *Come up!* the *p* usually consists of the lips coming together without any audible release when they do finally get released. In fact, everybody is so used to the idea of a speech sound without any sound that when anyone says a decisive *No!* and shuts up, the hearer thinks he hears a final *p*. Hence the popular form *Nope!* Similarly we have the decisive self-assured *Yeap* or *Yup* from *Yeah* followed by a closing of the lips. Now how can a hearer tell whether it is *seep* or *seat* or *seek* if, as often happens, it is said without audible release at the end of a sentence? For that matter, how can one tell whether it is *pea* or *tea* or *key* that is being said, since *p*, *t*, and *k* are voiceless stop consonants during which there is complete acoustic silence? The answer to these questions is that although the ear hears nothing when those consonants are being “pronounced”, it can get cues about their identity from the nature of their on-and-off glides, namely the transitional sounds from the preceding and/or-following sounds. As a matter of fact, even with voiced sounds, especially with stops such as *b*, *d*, and *g*, the ear identifies them from the cues given by the glides more than from their very small acoustic differences during the actual closure of the tongue or the lips.

§10. Vowels

Every schoolchild knows that the sounds of English consists of consonants and vowels. But when both teacher and pupil call *a*, *e*, *i*, *o*, *u* the five vowels of English, they are talking about letters and not about sounds. In fact, English has one of the richest inventories of different vowel sounds among languages in the world. Try to teach a foreigner to distinguish *peat*, *pit*, *pet*, *pate*, *pat*, *part*, *pot*, *port*, *put*, *pert*, *putt*, *poot* and you will find that their difficulty will be in direct proportion to the paucity of vowels in his own language.

Vowels are formed with relatively little obstruction as the air passes from the lung through the articulating organs. In all known languages, vowels are voiced, with only occasional voicelessness under special conditions, such as the first and third vowels in Japanese *hitotsu* ‘one’ or the very casual French *oui!* pronounced *fi*, where the vowel is not only voiceless, but with air drawn in.

The quality of a vowel is determined by the size and shape of the air chamber above the vibrating vocal cords. Because the positions of the tongue and the lips have more influence on vowel quality than any other factor, the traditional classification of vowels by these factors is still valid and in part even confirmed by acoustic phonetics (cf. Fig. 9, p. 107). There are four largely independent factors in the tongue and lip positions for the formation of vowels:

(1) The height of the highest point on the dorsum, or surface of the tongue. Thus, the vowels [i] as in *see* and [u] as in *who* are high vowels, [e] as in *get* and [ʌ] as in *cut* are mid vowels and [ɑ] as in *palm* is a low vowel. Remember that this way of speaking of the height of vowels is very specialized terminology. It has nothing to do with the musical height, or pitch of the vowel. A soprano can sing [ɑ] at a high C and it is still a low vowel. A bass can sing [u] at the low cello C and it is still a high vowel. Another thing to note is that it is the high point on the surface of the tongue and not the tip or the root of the tongue that is referred to in classifying vowels by position. Consequently the vowel triangle or vowel quadrilateral (Fig. 2, p. 29) are not of the size of the oral cavity of Fig. 1, but occupy a much smaller part of it in the middle.

(2) The second dimension is the position of the high point of the tongue in the horizontal direction. Thus, of the high vowels, [i] is a high front vowel and [u] is a high back vowel, [e] is a mid front vowel and [ʌ] is a mid back vowel, and [ɑ] as in French *patte*, with its shallow, bright quality, is a front vowel and [ɑ] as in French *pâte*, with a deep, dark quality, is a back vowel. Now what shall we call those vowels which are intermediate between front and back, such as [ə] as in *America* between [e] and [ʌ], or the vowel in *palm* as pronounced in Chicago, which is between that in French *patte* and *pâte*? The adjective 'mid' has been pre-empted to refer to the height (of the high point) of the tongue and is thus no longer available. In older usage such vowels were referred to as "mixed", but among current writers they are referred to as *central* vowels. The term *central*, then, refers to the position of the tongue as to front and back, regardless of its being high, mid, or low.

(3) The third articulatory dimension in the classification of vowels is the degree of rounding of the lips. With the same high

front position of the tongue, if the lips are not rounded, the vowel is [i] as in German *liegen* 'to lie (down)'. With the same position but rounded lips, the vowel is [y], as in German *lügen* 'to lie, to tell a falsehood'.

(4) The fourth articulatory dimension in the classification of vowels is the position of the velum. If the velum is up, with the air going through the mouth only, we have oral vowels, as most vowels are. With the velum down, so that the air goes through both the mouth and the nose, we have nasalized vowels, as we have noticed in the French words *un bon vin blanc* 'a good white wine'. In American English there is much nasalization in vowels as in the words *man*, *can't*, etc. This phonetic fact is interesting in comparing the so-called accents of the different types of English, but plays no part within the phonetic system of any one dialect of English.

§11. Consonants

Consonants are sounds made with noticeable obstruction, complete or partial, of the air stream between the glottis and the outside air. The usual dimensions in which consonants are classified are *place of articulation*: *labial*, *dental*, *palatal*, *velar*, etc., and *manner of articulation*: *stop* vs. *continuant*, *voiced* vs. *voiceless*, *oral* vs. *nasal*. For example [k] is a voiceless velar stop, [m] is a voiced nasal labial continuant. These dichotomies of manner cut across each other and are really independent variables. They are grouped together because for purposes of tabulation in two dimensions it is customarily convenient to arrange the places of articulation horizontally and all the other variables vertically under manner, as can be seen in Table 1. Thus, one essential difference between [l] and other continuant voiced consonants formed with the tip of the tongue is that one or both sides of the tongue are lying loose to let the air pass freely. This position could very well be regarded as part of the place of articulation. But since all the boxes for place from the glottis to the lips have already been occupied, the lateral articulation will have to be tabulated under manner.

§ 12. *Simplicity and complexity of sounds
and multiple articulation*

Every sound is physiologically complex in that it involves a particular setting of all the speech organs and acoustically complex in that no speech sound is a simple tone. From the phonetic point of view, a sound is simple if it can be held without change, not indefinitely at will, but at least for an appreciable fraction of a second. The surest way to check whether a sound is simple or complex in the phonetic sense is to record it on tape and run it backwards. (You will have to have a single track machine.) If you record *Bob* and it is still *Bob* when played backwards, then it proves that the *b* is a simple consonant and the *o* (for most Americans actually [ɑ]) is a simple vowel. But if you record *tea*, it will not reverse into *eat*, as you might expect, but into something like *east*. Why? Because an English *t* in stressed position, as single words usually are, is an aspirated stop consonant. There is not only a stop, but when it is released, there is an audible whiff of air before the vowel comes, so that when the word is reversed, the vowel is heard first, then the aspiration (the *s*-like sound) and then the stop, resulting in something like *east*. By the same method, one can tell *diphthongs* from pure vowels. Thus *say!* does not reverse into *ace*, as one might expect, but into *yes*, which shows that the so-called long *ā* in English is not a simple vowel lengthened, but a succession of different vowels and that, moreover, the usual falling intonation becomes a rising, interrogative intonation when reversed.

A single sound can however have simultaneous multiple articulation without breaking up into a succession of different sounds. Besides lip-rounding and nasalization in vowels, which we have already included as dimensions of vowel quality, a vowel can be pronounced with the curled up position of the tongue, giving rise to retroflex vowels as in *never heard a word* in many types of English (cf. p. 132). With consonants, one can have glottalized stops formed with oral closure for [p], [t], etc., made simultaneously with a glottal stop, which are often met with in American Indian languages. To form a [w], there is lip rounding in front and raising of the back of the tongue. This incidentally explains why the letter *w* was at first called *di-gamma* and only later called *double u*

or *double v*. Gamma is the Greek name for *g* and seems to be remote from a *w*. But when a full stop *g* is weakened into a continuant (the phonetic symbol for which is [ɣ]!), then only an additional lip-rounding will make it a *w*, as in Italian *Guglielmo*, which sounds much closer to *William* than it looks.

One type of double articulation is known as palatalization, which consists of having the front surface of the tongue raised toward the palate while the tip of the tongue or the lips are doing something else, giving a *y*-like quality to the consonant and usually a *y*-like off-glide when followed by a vowel. In Russian *p_jat_j* 'five', the *p* is formed with the tongue already in the palatalized position and the *t*, which has a dental articulation, is accompanied throughout its duration by the palatal articulation. In Russian usage, such consonants are called "soft", while the unpalatalized consonants are called "hard". The terminology has no phonetic meaning and is not to be confused with the distinction of *fortis* and *lenis* (or tense and lax), which has to do with the force or incisiveness of articulation. A palatalized sound is different from a palatal sound, which has a simple palatal and no other articulation. The word *onion*, for instance, for most people has a palatalized first *n* followed by a palatal glide in the *i*, but some speakers of English pronounce the *-ni-* as one single palatal consonant [ɲ], like the *-gn-* in French *oignon*, or the *-ñ-* in Spanish *cañon*.

§13. *Tables of phonetic symbols*

We are using the term *phonetics* for the study of speech sounds. In popular usage, *phonetics* is also applied to the symbols or system of symbols used for representing sounds. Except for rare instances when symbols are systematically designed so that parts of them represent parts of the sounds represented, such as Henry Sweet's "Visible Speech" (see also chapter 11), and the Korean alphabet (cf. p. 107), most systems of phonetic symbols are based upon the roman, or latin alphabet, with various modifications. The most widely used system is that of the International Phonetic Association, commonly referred to as the 'IPA', i.e. "International Phonetic Alphabet", systematized and developed by Paul Passy of Paris and Daniel Jones of London and revised and supplemented from time to time by a council of the Association. The system is

used by the majority of European linguists. In the United States the *Linguistic Atlas of America* and some journals such as *American Speech* use the IPA, but most linguists use a modification of it, as represented in *Outline of Linguistic Analysis*, by Bernard Bloch and George L. Trager (Baltimore, 1942). The main differences are that more diacritics are used in American usage, such as "š" for "j", "ü" for "y", "ö" for "ø", etc. The use of "j" in IPA for the sound of y in *yes* is another important difference. The American usage of "ü" and "ö" for the front rounded vowels agrees very well with the orthography of many European languages. Unfortunately, the innovation in Webster's *Third International Dictionary* and the *Seventh Collegiate Dictionary* gives 'ü' the value of the vowel in *bloom*, which is contrary to all known usage, including that of all previous editions of the Merriam-Webster dictionaries. For purposes of this book we shall use the IPA as it is used in *Le Maître Phonétique*, the official organ of the Association, plus a very few necessary additions.

1. *Table of consonants.* In Table 1 the places of articulation proceed from right to left, as in the profile of speech organs in Fig. 1. The manners of articulation are arranged from top to bottom. In each box, the item to the left of a comma is voiced and the one to the right is voiceless. If there is only one item, except for Box 1 l. it is voiced.

As we look across Table 1, the headings from a. to l. represent the various places of articulation which linguists have found necessary to distinguish. The list is both too long and too short: it is too long because no language makes all the distinctions listed here, and too short because languages discovered or evolved in the future may possibly make finer distinctions not allowed for here, though the latter eventuality is not very likely. In column b., for sounds formed with the upper teeth against the lower lip the more usual term is labiodental, but it is not as good as the term given, as the older term might suggest that it is a dental sound, whereas it is mainly a labial sound. In columns c. and d., the stops and nasals actually occur with both places of articulation: for example French *t*, *d*, and *n* are made with a tongue position much more fronted than English *t*, *d*, and *n* and should therefore also fill the spaces in column c. No difference in the notation is allowed for, as it has not

Table 1. *Table of consonants*

Place... Manner	a. Bilabial	b. Dental-labial	c. Dental	d. Alveolar	e. Retroflex	f. Palato-alveolar	g. Pre-palatal	h. Palatal	("Guttural")			
									i. Velar	j. Uvular	k. Pharyngeal	l. Glottal
1. Stops	b, p			d, t	ɖ, ʈ		(d, t)	ʃ, ç	g, k	ɣ, ʁ		ʔ
2. Fricatives	β, ɸ	v, f	ð, θ	z, s	ʒ, ʂ	ʒ, ʃ	ʒ, ʃ	ʃ, ʃ	ɣ, x	ʁ, ʁ	ʕ, ħ	h, h
3. Nasals	m	m		n	ɳ		(n)	ɲ	ŋ	ɴ		
4. Laterals				l, ɭ			ɭ		ɭ			
5. Trills				ʀ	ʀ					ʀ		
6. Flaps				ɾ								
7. Semi-vowels	w ɥ	ʋ		ɹ	ɻ			ɹ ɥ	w			

been found necessary so far to distinguish them for the same language. A tooth-like symbol “ $\square$ ” can be placed under a letter to indicate dental articulation, but it is suitable for descriptive purposes only, for which explanations in words will do just as well, and not suitable for extended transcriptions.

Taking up now the manner of articulation by rows, we find that row 1 in Table 1 consists of *stops*, also called *plosives*, since on release there is often an audible explosion. The voiceless items [p], [t], etc., as pure stops are strictly *unaspirated* stops, such as French or Russian *p* or *t*. But it is customary for writers in English to use these letters for English *aspirated* sounds which are complex and in strict phonetic notation should be represented as [p^h], [t^h], etc. or [p'], [t'], etc. Box 1 g. corresponds to no IPA symbol. But since the sounds exist in modern Tibetan, I proposed the symbols [ɖ], [ɗ] in analogy with [ɟ], [ɢ], which are part of the IPA. Box 1 k. contains only the voiceless glottal stop [ʔ], since if it were voiced then it would no longer be a stop. A glottal stop followed by aspiration [ʔ^h] constitutes a cough, which one would hardly expect to be a speech sound. But once, while I was watching some bargaining on a street market in Yunnan (where the dialect is a variety of Mandarin), I couldn't be sure whether they were quarrelling or coughing. Listening more closely to what they were saying, I began to realize that the cough was simply the dialectal cognate of standard Mandarin aspirated *k*, the unaspirated *k*, as I knew, being a glottal stop in that dialect.

Row 2, the *fricatives*, is fully represented by a rich variety of possibilities. In 2 a., [β] is the sound of *b* in Spanish *Habana* and [ɸ] is the sound you make in blowing out a candle. Box 2 f. corresponds to the *ž* and *š* in American notation. Boxes 2 e. and 2 g. are relatively new additions to the IPA to allow for the contrast between retroflex and (pre)palatal consonants, which plays no part in most of West European languages, but a very important part in many oriental languages. In box 2 h., [j] occurs also in row 7, the difference being the presence or absence of audible friction. The difference is rarely of phonemic importance. In the dialect of Ningpo, the word for 'pomelo' is [jɿtsz] and that for 'sleeve' is the same, with distinctive friction in the [j]. It is possible to represent the latter as [ɟ] of column g., since it is slightly more forward in position.

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There is a whole class of sounds known as *affricates*, consisting of stops which are so gradually opened (a matter of 0.1 seconds instead of 0.02 seconds) that an audible friction results. In this table of simple sounds we are not listing affricates for the same reason we are omitting the aspirates, since affricatives are complex and not reversible. In writing affricates it is customary to use one kind of letter for the stop part and let the fricatives show the difference, for example [ts], [tʃ], [tʂ] are usually simplified to [ts], [tʃ], [tʂ]. Because affricates may occur functionally like simple consonants, they are often given single letters in national orthographies or linguistic transcriptions. For example, German *z* is [ts], English *j* is [dʒ], and American phonetic notation has *č* for [tʃ] and *ž* for [dʒ] (with *t* and *d* in the generalized sense).

In row 3, item g., the prepalatal [ɲ] is more fronted than the [ɲ] in French 'compagnie'. (The notation is mine.)

In box 4 d., [ɬ] is the voiceless *l* of Tibetan *lh* in *Lhasa*, Welsh *ll* in *Lloyd*, or Toishan *lh* in [lhaam] 'three' (Cantonese *saam*).

In box 4 g., [ʎ] is the palatal *l* of Italian *gl* in *famiglia* [famiʎʎa] 'family'. Its relation to an ordinary *l* is the same as that of French palatal *gn* [ɲ] to an ordinary *n*.

In box 4 i., [ɭ] is the dark *l* in *school*, as compared with the clear *l* in *lead*, or the dark *l* in Russian [datʰ] 'he gave', as distinguished from the clear *l* in Russian [dalʰ] 'distance'. The dark *l* usually has a double articulation, consisting of the tongue-tip articulation of box 4 d., plus a velarized articulation with the root of the tongue raised toward the velum. There is, in addition, a variety of velarized *l* formed with the tip of the tongue completely free and is similar to [ʎ] in box 4 g. except in being farther back. It occurs in some American English dialects. Because of its relatively infrequent occurrence it has no other symbol than [ɭ].

In box 5 a. one could say 'Brr!' (it's cold) with a lip trill. But there is no IPA letter for it and it is a marginal case between language and non-language. It is non-language because it does not combine with other sounds to form various words. It is language because it is very much conventionalized. The Chinese don't say *Brr!* in winter. The word, if it is a word, is *Ss!* (with the air sucked in).

In row 7 we have the semivowels, which are high vowels made

consonantal by narrowing the passage so as to have noticeable obstruction. The difference however is of no significance for distinguishing words, as we shall see in the next chapter. Note that [w] occurs in boxes a. and i., since it has a double articulation. So does [ɥ], as in French *huit* in boxes a. and h. The dentilabial continuant [ʋ] in box b. differs from [v] in having no friction. The English untrilled *r*, or [ɹ], as well as the trilled *r*, occur in both column d. and column e., the difference in position being rarely significant.

The list given in Table 1 is by no means exhaustive. For instance it does not include [ʍ] for the voiceless *w*, as in [ʍat] for 'what' (for those who do not say *what* and *watt* alike). This could be placed under [ɸ] in box 2 a. as well as under [x] in box 2 i. because of its double articulation. So can the frictional voiceless [ɸ] be placed in boxes 2 a. and 2 h. for which IPA used to have a symbol formed by combining the letters "h" and "ɸ". Since in actual application to languages one can usually do with writing "hw" or "xw" in succession or writing "hɸ" or "ɸɸ" (or even "hy" or "çy") in succession where the elements are in fact simultaneous, those special symbols are usually avoided. Another way to save symbols is to use modifiers such as "◌̥" for voicelessness. Thus, [ʍ] = [w̥], or for that matter [s̥] = [z̥].

In listing the manners of articulation of consonants we have not included in Table 1 the difference between the *fortis* (tense) and the *lenis* (lax), especially as applied to the articulation of the stop consonants. For example the usual way in which a speaker of Northern Chinese or Southern German tries to say the French word *porter* [pɔʁte] 'to carry' sounds too much like *bordée* [bɔʁde] 'a board'. The reason is that the nearest imitation of such fortis articulation of the French sounds is his lenis voiceless stop. On the other hand a speaker of English does have fortis voiceless stops, but they are aspirated and he tends to give too much aspiration in pronouncing French *porter* as [pʰɔʁt̪e] and will say things like *T'on th'é t'a-t-il ôt'é t'a t'oux?* 'Has your tea stopped your cough?' So you have your choice.

Because there is a high degree of correlation among languages between lenis articulation and voicing, it is usual to indicate a lenis voiceless (unaspirated) stop by using the corresponding letters for the voiced stops and adding a devoicing circle and write [b̥, d̥, ɡ̥],

etc., to distinguish them from the fortis type [p, t, k], etc. Now there is no God's truth about the letters *b, d, g*, etc. being primarily voiced rather than being lenis. They have been used for voiced sounds in the IPA, which was developed by leading phoneticians (such as Paul Passy and Daniel Jones), in whose languages there are such lenis voiced stops. The corresponding voiceless stops, then, are given as *p, t, k*, etc. This agrees with the practice of the Wade-Giles system of romanization for Chinese, which writes *p* for (lenis) [b], *t* for (lenis) [d], etc. In recent years, however, because of increased interest in a practical orthography, in which aspiration signs will be a burden—newspapers omit them anyway—the voiced letters, so to speak, are used more and more for the lenis voiceless (unaspirated) stops. This has been the case in the National Romanization ("GR"), the Yale system, the *Pinyin* system of 1956, and very likely in any system which may be devised or revised in the future.

2. *Vowel charts*. Since vowels have three dimensions of *height*, *front-back position*, and *lip-rounding* (not to speak of nasalization), a spatial representation of vowels will have to be in the form of a three-dimensional model. In practice, unrounded and rounded vowels are usually charted or tabulated side by side instead of in a third dimension. The three variables are not completely independent. For acoustic and physiological reasons, front unrounded vowels and back rounded vowels are more common (as types at least) than the reverse combinations of factors. For example, almost every language in the world has the high front unrounded vowel [i], but many languages—English, Japanese, part of China—have no high front rounded vowel [y] as in French *rue*. Almost every language has the high back rounded vowel [u], but very few languages have the high back unrounded vowel [ɯ]. It was therefore not entirely a matter of empirical history that the traditional vowel system was in the shape of a triangle:

i	u
e	o
a	

where the dimension of rounding is practically a dependent variable: back high always fully rounded, back mid always half rounded, low and front always unrounded.

It was however a historical accident, and a somewhat inconvenient one in the history of phonetics, that the standard system of vowels was developed under French influence, resulting in a system of eight *cardinal vowels*. There is, to be sure, nothing wrong with dividing the continuum of gradations of vowels into any number of intervals. But the tradition of the five vowel letters has such a tyrannical hold on phoneticians and printers alike, that with all the legislating, saying that [e] is one thing and [ɛ] is another, neither phoneticians nor laymen can help feeling that [ɛ] is some kind of [e] and that [ɔ] is some kind of [o] and if a language has only one kind, he will call it [e] even though it is nearer cardinal [ɛ] and call it [o] even though it is nearer cardinal [ɔ], in other words, he is not really taking those cardinal vowels seriously. This is in fact exactly the situation with Japanese. If any symbol in the IPA is as good as any other, the nearest symbols for the Japanese vowels should be a, i, u, ɛ, ɔ. But how much more comfortable on the typewriter to transcribe them as a, i, u, e, o.

Another factor which has favoured the grouping of [i] with [ɪ], [e] with [ɛ], etc., is that in English (but not in French) there is a difference in tenseness and laxness in vowels, as in *seat* [sit]:*sit* [sɪt], *fool* [ful]:*full* [fʊl], etc., where the second of each pair differs from the first not only in length and (tongue) height, but also in being more lax. There is no eternal truth in taking length, or height, or tenseness-laxness as the basic variable in vowels. These factors are in most languages partially independent but also partially correlated; and it is to some extent an accident in the history of phonetics that tongue position has been taken as the primary independent variable in vowels.

Although the eight cardinal vowels were influenced by consideration of the French vowels in *si*, *été*, *sept*, *patte*, *pâte*, *or*, *haut*, *ou*, it was Daniel Jones who made them into a standard frame of reference by pronouncing them and making a permanent set of recordings and by training a following of phoneticians who agree very closely in assigning whatever they hear to one or another of the standard sounds.

The eight points of reference are defined thus: no. 1 [i] is the highest most front, no. 4 [a] the lowest most front, no. 5 [ɑ] the

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lowest most back, no. 8 [u] the highest most back rounded. No. 2 [e] and no. 3 [ɛ] are placed at equal intervals between [i] and [a], theoretically according to tongue position, but actually according to quality as judged by the ear. No. 6 [ɔ] and no. 7 [o] inserted likewise, with the factor of liprounding also changing by equal steps from [a] to [u]. Although the division of vowels into eight was influenced by French, no. 6 [ɔ] is not a French vowel. It is customary, to be sure, to use the letter "ɔ" for the French vowel in *hors*, but actually it is so much fronted that it is almost a central vowel. It is sometimes claimed that the first vowel in *joli* 'pretty' is fronted because of its meaning. But it is also fronted for *sotte* 'silly, ridiculous'. The vowel in English *course* is much nearer

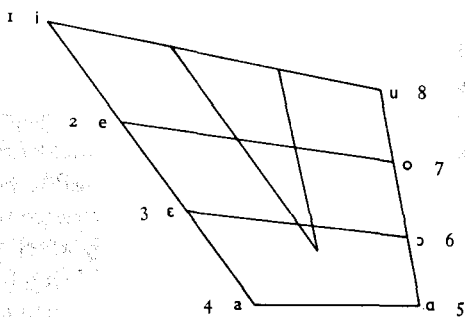


Fig. 2. The cardinal vowels.

cardinal vowel no. 6 [ɔ]. But when my colleague, the grandson of a famous French painter, talks about giving "a curse in comparative literature" and makes his students take this required "curse" and that required "curse", it shows that the cardinal [ɔ] in *course* must certainly not be a French vowel. Rather than dependence upon comparison with particular values of particular languages or dialects, the validity and usefulness of the cardinal vowels comes from its embodiments in the recordings and the group of linguists trained in them.

Because of the distinction between front and back *a*, i.e. no. 4 [a] and no. 5 [ɑ], the low vowels form a front-back line, thus resulting in a vowel quadrilateral instead of the traditional triangle. Moreover, since there is more room for variation in tongue height

in front, the distances between nos. 1 [i] and 4 [a] is greater than between nos. 5 [ɑ] and 8 [u], and since front and back position makes a greater difference for high than for low vowels, the line between nos. 1 [i] and 8 [u] is longer than between 4 [a] and 5 [ɑ]. Thus, instead of a rectangle, the diagram for the cardinal vowels should be a trapezium as in Fig. 2.

In the diagram the triangle in the middle marks off the central vowels from the front and back vowels. The cardinal vowels, as well as the traditional vowels *i, e, a, o, u* of the vowel triangle, are sometimes referred to as *normal vowels*, which, as we have noticed, occur more often among the languages of the world than rounded front and unrounded high and mid back vowels. The non-normal vowels (since they are too common to be called "abnormal") in the same positions as the cardinal vowels are represented in the IPA as [y], [ø], [œ], —, [ɒ], [ʌ], [ɜ], [ɯ].

To complete the inventory of the IPA symbols for vowels, there are [ɪ] between [i] and [e], [æ] between [ɛ] and [a], [ʊ] (recently changed by the Council to a fat small o with a notch at the bottom, but still not commonly used by users of the IPA, possibly for reasons of elegance?) between [u] and [o]. For the very common sound between [e] and [ɛ], I have proposed [ɶ], which has gained some acceptance. The central vowels are [ɨ], [ə], [ɐ], [ʌ], the last symbol being Otto Jespersen's and not officially part of the IPA. Current writers tend to make printed lower case [a] serve for any low vowel and distinguish [a] and [ɑ] only when they are phonemically distinctive. IPA has symbols for certain half-way points in the mid central box, which are rarely used and are not included here.

In the accompanying Table 2 symbols in parentheses are not officially part of the IPA. The vowels in Table 2 are called *dorsal* because they are mainly determined by the position of the surface of the tongue. There is a whole series of what the Swedish sinologist Bernhard Karlgren calls apical vowels, formed with the apex, or tip, of the tongue in the dental or retroflex position, unrounded or rounded, thus forming four vowels ɿ, ʮ, ʮ̥, and ʮ̥̥. In the IPA system, these are written as voiced consonantal carriers of syllables. For example the Chinese word [sɿ] 'silk' is given in IPA as [sʮ]. In such a syllable it is more the position of the apex

that gives the vowel quality, while the dorsum, the flat part of the tongue, is of only secondary importance.

2*a. Diphthongs.* A diphthong is traditionally regarded as a succession of two vowels forming one syllable. If the first element has a lower tongue position (i.e. with the jaw more open), than the second, such as [æ] in Latin *Caesar* (pronounced [kaesar] in Classical times), it is said to be a descending diphthong. If it is in the opposite order, as in Chinese [liɛŋ'] 'to join', it is called an ascending diphthong. Usually it is the more open element that is the carrier of the syllable. When the opposite is the case, the non-syllabic (weaker) part is sometimes marked with a breve, as in [iă], as the word *ear* is pronounced in some English dialects. Note that it is the direction of movement, rather than the nominal end points that gives the special quality of the diphthong. Thus, when the so-called "long i" in English is transcribed as [aj], the tongue position ends far short of that for [i] (as in German *ja*) or even [i]. The German phonetician Eduard Sievers (1850-1932) used to prove that you can say what is commonly transcribed as "ai" in the first syllable of *Kaiser* with three fingers inserted vertically between the upper and the lower teeth, but that you can't say a decent recognizable [i] in *Sie* or [i] in *ist* in that position. Among American linguists it is usual to write the symbols [ɣ] (= [i] of IPA) and [w] in diphthongs, regardless of the actual (tongue) height of the higher of the two elements. In this book we shall write [ai], [ou], etc., when only phonetic values are being discussed, with the same understanding that [i] and [u] are to be taken in the "wide" sense. There seems to be no language which makes a distinction between [æ] and [aj], between [ao] and [au], and the like. Thus, English has mostly [æ] in *eye*, but no [aj], while French has [aj] in *paille*, but no [æ].

3. *Subsidiary symbols.* The slogan of the IPA is "one sound one symbol". This can be taken in one of two senses: (1) one piece of sound to one unitary symbol, no more, no less, (2) one kind of sound to one kind of symbol, no other sound to that symbol and no other symbol to that sound. Neither of these conditions can be met rigorously without involving great complications. When English aspirated [p], [t], etc., are written without a superscribed [h] or aspiration sign ['], you have a succession of two different

Table 2. *Table of (dorsal) vowels*

	Front		Central		Back	
	Unrd	Rd	Unrd	Rd	Unrd	Rd
High	i	ɣ	ɨ	ɤ	ɯ	u
Half high	ɪ					ʊ
Upper mid	e	ø			ɤ	o
Mid	(ɛ)		ə			
Lower mid	ɛ	œ			ʌ	ɔ
Half low	æ		ɐ			
Low	a		(A)		ɑ	ɒ

sounds written with one symbol. When a (simultaneously) double-articulated consonant is written [kp] or [gb], you have one sound written with a succession of symbols. The most important cases where separate symbols are used to write what are modifications or prosodic elements of sounds are as follows (the letters n, a, z, etc., are only examples):

ã	nasalized	a [~]	high level
ŋ	voiceless	a _~	low level
ɰ	voiced	a'	high rising
'a	primary stress	a'	high falling
,a	secondary stress	a _~	low falling
''a	extra stress	a^	rising-falling
,,a	tertiary stress	a ^v	falling-rising
a:	long	ɹ	voiced consonant
a [~]	half-long		carrying a syllable

I have proposed (not as a part of the IPA) a convention concerning the use of subscripts and superscripts which will result in a saving of symbols as well as avoid ambiguities. That is to use a subscript always as a modifier of the main letter and a superscript always as an additional on- or off-glide. For example, a_n = ã, but aⁿ = a followed by a weak and incompletely formed nasal; ə_r is ə with (simultaneous) retroflexion (sometimes written ɐ̣), as in Middle Western America *err*, ə^r is ə followed by retroflexion near the end, as in *nor* [nɔ̣^r] in some types of American English.

4. *Names of Sounds and their symbols.* Every schoolchild learns to distinguish between the name of a letter, e.g. *double you* and the sound it represents [w], or between the letter called *jee* and the sound [g] in *gag* or [dʒ] in *George* represented by it. In talking about phonetic symbols, some of them have acquired conventional names. Just as in printer's terminology the symbol "&" is called *ampersand* and the symbol "'" is called a *tilde*, so in phonetics the symbol "ə" for the mid central, or neutral vowel [ə] is usually referred to by the Hebrew name *sheva* (or its naturalized variant *shwa*), the letter for cardinal vowel no. 5 [a] *script ay*, the letter for the high central vowel [i] *barred eye*, the symbols derived from Greek letters called by their Greek names *beta*, *theta*, *gamma*, *chi*, etc. Such names are also used to refer to the sounds themselves. In fact the Hebrew name *shwa* means the sound [ə] and the symbol in Hebrew is actually "⋮" and not the roman letter "e" turned upside down. There is some difference between European and American usages in naming the sounds. European linguists tend on the whole to name sounds by the sounds themselves, with a minimum of extraneous sounds, such as adding a *sheva* after voiceless consonants, as in "pə" for [p], "sə" for [s]. American linguists, on the other hand, mostly prefer to call sounds by their descriptive phrases or the names of their symbols, for example the sound [r] is referred to as the *trilled ar* (said without any trill), the velar nasal [ŋ] as *eng* in analogy with *en* for [n] and the alveopalatal fricative [ʃ] as *esh* in analogy with *es* for [s]. On the whole the European way is more direct for teaching foreign languages or elementary phonetics and the American way sounds clearer in theoretical discussions. For example, if you refer to the sound [ʔ] as a glottal stop or the symbol as the dotless question mark, it is clear and unambiguous. But if you say: "The German word *Verein* has no [ʔə] in the second syllable", the hearer will not understand whether you mean there is no glottal stop (as you probably mean) or there is no *sheva*, since in saying a vowel sound [ə] or any vowel one often starts with [ʔ] anyway, with a glottal stop which does not count. But even in referring to sounds by the names of their letters, there is also occasional ambiguity. For example, in talking about *ee* and *eye*, the reference can only be made clear by more explicit phrases, such as "the sound repre-

sented by the letter *ee*", in other words, the sound [e], or "the diphthong [ai], not the letter *eye*". During the 1930s I compiled a whole list of Chinese names for the printers of the publications of Academia Sinica, names like "broken figure 8" for the symbol 'x', "reversed figure 3" for 'ε', "inverted c" for 'ɔ', etc., resulting in much better understanding between author and printer. (See also p. 101 on operational synonyms of symbols.)

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§14. *Phonetics and phonemics*

Phonetics may be compared to the lines of longitude and latitude drawn on the globe and phonemics to the mapping of actual continents and oceans and countries. The precise way in which the divisions are made is to some extent arbitrary. During the French Revolution, it was attempted, though without success, to change the quadrant of 90° into 100 decimal degrees. But certain features, such as the North and South Poles and the Equator, are a part of the nature of things. Similarly, stops and continuants, voice and voicelessness are natural variables found in all human speech. In phonetics one tries to anticipate, after a broad survey of the accessible languages of the world, all the necessary distinctions and set up standard points (such as the cardinal vowels and the divisions along the roof of the mouth) and then assign the actual sounds of any language under study to the nearest standard points, with the appropriate IPA symbols, so as to have an accurate representation of the sounds of that language.

One most important aspect of the actual occurrence of sounds in languages is that the same audibly different sounds may make a difference in one language, but no difference in another. We already noted the two kinds of *p*, which make no difference in English, but make all the difference in Chinese. The difference that "makes no difference" need not be a fine one, either. In each of the words *he*, *hot*, *who*, which all seem to, and in one sense do, begin with the same consonant [h], the initial sounds are really very different. You can record these words on a 7½-inch or 15-inch per second tape and snip off their vowels, repaste the consonants and play them back and you will hear the sounds as (remember subscripts are adjectival in effect) [h_i], [h_a], and [h_u], or approximately the voiceless vowels [i], [a], [u]. As a matter of fact, there is no need to go to all the trouble of recording, snipping, and pasting magnetic tapes. The difference in quality of the *h* before different

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sounds is noticeable simply by listening closely. (Try whispering the words.)

The impossibility of keeping strictly to the rule of one sound one symbol makes it necessary both for practical phonetic transcription and for theoretical analysis to organize the sounds of language on the basis of what does or does not make a difference. That has been the motivation for setting up the idea of the *phoneme*, the study of which constitutes *phonemics*. There are two apparently opposite views about the nature of the phoneme. One starts with the idea of a group or class. If different sounds behave as equivalent units in a group, then they belong to the same phoneme. For example, the sounds represented in italics in *call*, *scald*, *key*, *ski* are four members of the same phoneme, with four audibly different sounds. From the other point of view, a phoneme is a distinctive feature or a set of distinctive features, irrespective of the presence or absence of other features. Thus, in the above example, the distinctive feature of the phoneme is voicelessness and contact of the dorsum of the tongue with the roof of the mouth, while the presence or absence of aspiration or whether the point of contact is palatal or velar are irrelevant. There is therefore really no conflict between the two points of view about a phoneme being a group and being a set of features. They are two sides of the same coin. In fact Bernard Russell long before the theory of phonemes had a theory of equivalence between the property of a class and class membership. To paraphrase his "principle of abstraction", we might say that humanity (in the abstract) is humanity (mankind). Applied to phonemics, we might say that the common property of a number of different sounds which makes them members of one phoneme consists in the fact that they belong to this class.

This evident circularity in characterizing the property of a phoneme by its members is unavoidable because if you stipulate that members of a phoneme must be phonetically similar, a condition often included in the definition of a phoneme, then you run into cases where what to foreigners seem very different sounds belong to the same phoneme and the differences are hardly noticeable to the native speaker. The solution to this problem, as to all solutions in science, is to make your circle of circularity as

big as possible. One important step in carrying this out is to look for cases of what is known as *complementary distribution*. If a dorsal stop occurs always with the palatal articulation when followed by a front vowel (as in *key*) and always by a velar articulation when followed by a back vowel (as in *call*) but never the other way round, there is a case of complementary distribution.

But complementary distribution alone is not sufficient to determine what sounds go together to be members of one phoneme. There must also be overall *symmetry* in the organization of sounds into phonemes. For example, besides the complementary distribution of the palatal consonant in *key* and the velar consonant in *call*, there is also a parallel difference in quality in *he* and *hall*. Likewise, we have parallel differences in the *g* of *geese* and *gall*. Thus, we arrive at a neat and symmetrical system of groupings. Similarly, not only is *k* aspirated when initial and stressed and unaspirated when following an *s*, but the same is true of *t* in *team* and *steam* and of *p* in *peak* and *speak*. On the other hand, no one would seriously make one phoneme out of the two sounds [h] and [ŋ] in English simply because [h] always occurs as a syllabic initial and [ŋ] always as a syllabic ending. Not only are the two sounds extremely dissimilar phonetically, but there is no other parallel case of complementary distribution in the sounds of English.

To summarize, then, a phoneme can be defined as one of an exhaustive list of systematized classes of phonetically related sounds in a language, such that every form in the language can be given as a (usually serially ordered) set of one or more of these classes. As definitions go in matters concerning human behaviour, this definition is no more than a summary of usage and procedure among linguists and the definition does not even guarantee that its application will always result in one unique system for any given language. (On the last point see Joos, *Readings*, pp. 38-54.)

§15. *Segmental and suprasegmental phonemes*

The sounds in language as we have already noted, are essentially linear, and this fact is reflected in the letter-after-letter order in alphabetic systems of writing, where a letter corresponds roughly to a phoneme. But there are other aspects of speech sounds which

do make a difference and yet are not part of the succession of sounds. Intonation, speed of utterance, and other expressive elements of speech, which are not in addition, but on top of the sounds, are usually not considered part of the phonemic system. They make no difference in the words themselves and if they are sometimes called phonemes, they are admittedly phonemes of a different order. However, some of those elements do make a difference in the words and will have to be treated as word-forming phonemes. *Stress*, for example, is a phoneme in English. For example, *contract*, with stress on the first syllable is a noun, while *con'tract* (in the sense to shrink), with stress on the second syllable, usually with raising of the vowel in the first syllable, is a verb. In the words *night-rate* and *nitrate* there seems to be no difference in their phonemic make-up and yet they sound different, with a closer *juncture* (i.e. degree of connectedness or separation) in *nitrate* than in *night-rate*. Again, in the following pairs of words or phrases, there is apparent contrast—Chinese fashion—between unaspirated and aspirated consonants:

Unaspirated

Aspirated

I scream

icecream (when the stress is on *cream*)

That stuff.

That's tough.

School today.

(It)'s cool today.

I want the stew.

I want this *too*.

But instead of mixing up the neat system of voiced and voiceless English consonants by the introduction of aspiration, it is much simpler to introduce the element of juncture or "plus juncture", so called, from the symbol "+" with which many linguists write it. If there is a plus juncture before the stop, it is aspirated; if before the *s*, the stop is unaspirated. There is thus complementary distribution and the two kinds of *t*, or of *k*, etc., are still members of the same phoneme.

The usual vocalic and consonantal phonemes are known as *segmental phonemes*, since they occur segment by segment in temporal succession, while the elements which occur simultaneously with the segmental phonemes, such as stress and intonation, which do not occupy extra time in speech (nor usually space on paper when written), are known as *suprasegmental phonemes*.

§15. SEGMENTAL AND SUPRASEGMENTAL PHONEMES

For example, in the greeting for parting 'Good night!' the segmental phonemes are *g, u, d, n, a, i, t*, and a high-rising + low-rising intonation over the words (marked over or after the words, when written, or left unmarked) are the suprasegmental phonemes. That these elements are phonemic, i.e. serving distinctive functions, comes from the fact that it would be a different sentence if the intonation were high-level + high-falling, with extra strong stress and the resulting form would no longer be a form of greeting, but an American exclamation, meaning approximately 'How awful!'

An important exception in which a simultaneous element plays very much the same part as a consonant or a vowel is the case of tones in tonal languages. A Chinese word [lan'] 'blue', with high-rising tone, is as different from and as unrelated to the word [lañ] 'lazy', with a low-dipping tone (a slight difference in length being a secondary feature), as English *bed* and *bad*. The pitch pattern of a word in Chinese, and in other tonal languages, is thus as much a part of the make-up of words as the consonants and vowels and should be put on a par with the segmental phonemes, even though it occupies no additional time and exists simultaneously over and above whatever is the voiced part of the syllable.

One historical aspect of tones as phonemes is that they have often come from the manner of articulation of consonants. In Chinese the modern first tone (high level) and second tone (high rising) were the same tone in ancient Chinese. Syllables with ancient voiceless initials became modern 1st Tone, those with ancient voiced initials became modern 2nd Tone. In the modern Scandinavian languages, a tonal difference in Swedish sometimes corresponds to the presence or absence of a glottal stricture in Danish, which has no tones, but has consonantal distinctions corresponding to tones. Thus there are good reasons, for purposes of analysis of word-forming elements, why tones, as opposed to expressive intonation, should be considered segmental phonemes.

§16. *Phonological load and phonemic distinctiveness*

The *phonological load* of a phoneme is the burden a phoneme carries in distinguishing one word from another, or more generally in distinguishing any linguistic form from another, whether larger or smaller than a word. I used to call it "phonemic burden". In recent years, since the word *phonology* has been more used for the descriptive and synchronic study of sound systems of language (instead of the old usage of *phonology* as primarily historical study), the term *phonological load* will serve just as well. As examples of different phonological loads, take the English phonemes /s/, /z/, /θ/, /ð/, /f/, /v/. We find words like these:

/s/	sees	sink	sayer	sat	lease	—	rice
/z/	—	zinc	—	—	lees	tease	rise
/θ/	—	think	Thayer	—	—	teeth	—
/ð/	these	—	there	that	—	teethe	writhe
/f/	fees	fink	fair	fat	leaf	—	rife
/v/	V's	—	—	vat	leave	—	rive

There is no complementary distribution between any two of these consonants, as they are different phonemes. If we look for cases of what is known as *minimal contrast*, as in sink and zinc, fat and vat, where everything else is the same except the phonemes contrasted, we shall find that they do not occur evenly for all contrasts. The list above is suggestive rather than statistically accurate. But it is obvious that the /s/:/z/ contrast is greater than the /θ/:/ð/ contrast. Moreover, it makes a difference for the language as a whole whether the words distinguished phonemically are common or rare words. For instance I never knew that there were such words as *fink* (informer) and *rive* (to tear) until I looked up such words from a dictionary in order to fill this table. When weighted according to frequency of use the two cases of *Thayer*: *there* and *teeth*: *teethe* are really less important than any of the other pairs. Thus, one says that the /θ/:/ð/ contrast carries a light phonological load. One practical consequence of this is that in a practical orthography, it is not so vital to have distinctive spellings for different phonemes whose contrast carries a light phonological load, as in fact is the case with the usual spelling *th* for both /θ/ and /ð/, which rarely gives trouble of the sort we would face if say /p/ and /b/ were both

written *p* or if /*t*/ and /*d*/ both written *t*. As applied to one single phoneme, the phonological load has reference to its contrast with all the other phonemes of the language. Roughly speaking, it depends upon the frequency of occurrence and number of cases of minimal or nearly minimal contrast with other phonemes. This conception of phonological load has been defined rigorously in mathematical terms, but the application involves so elaborate a survey of the numbers and analysis of the nature of various cases that in practice it has never been applied extensively.

A similar but different conception from phonological load is that of phonemic distinctiveness, i.e. phonetic distinctiveness between phonemes. Thus the phonetic difference between the phoneme /*s*/ as in *see* and the phoneme /*ʃ*/ as in *she* is very easily heard and the two phonemes, both singly and in contrast with each other, carry heavy phonological loads. But the phonetic difference between /*ð*/ in *that* and /*v*/ in *vat*, from the hearer's point of view at least, is very slight and yet the phonological difference between them carries a moderately heavy load. In an artificial language designed specially for efficient communication, one would probably make the phonetic incisiveness or prominence, say [ʃ] vs. [θ], [ɑ] vs. [ɣ], carry the heaviest loads. But language being a tradition, there is no such correlation of phonemic distinctiveness to phonological load. In fact the high frequency of use as one of the factors in a high degree of phonological load contributes to the weakening of the phonetic quality of phonemes and renders them less distinctive.

§17. *Allophones and free variants*

The various member sounds which are grouped together to form phonemes are called *allophones*. For example, the [t'] in *terse*, [t] in *stir*, and [ɾ] in *butter*, form three allophones of the American English phoneme /*t*/: the front [a] in Mandarin *fan* 'to turn over', the central [ʌ] in *fa* 'to send out', and the back [ɑ] in *fang* 'square' form three allophones of the phoneme /*a*/. These are phonetically conditioned allophones, such that given the phonetic context, you will know which of the allophones will occur. On the other hand, if the occurrence of allophones is not determined by phonetic

conditions but by other factors such as the mood in which one speaks, or other non-phonetic factors, then the allophones are called *free variants*. For example, in *we are going to fight*, the last /t/ may be said either as [t], without audible release or as [tʰ], with aspiration. This is different from the case of [t] in *stir* and [tʰ] in *terse*, since which /t/ will actually occur in *fight* cannot be determined by phonetic conditions.

Since the number of allophones, whether conditioned or free, is a question of how much sounds must differ before they are counted as different, this brings us back to the problem of how many qualities should be set up in general phonetics to anticipate all future surveys of the languages of the world. As Leonard Bloomfield often pointed out, phonetic discrimination is much influenced by the amount and kind of training the linguist has had, what languages he happens to be acquainted with, and what phonemic distinctions there are in his own language. For example, the Japanese phoneme /h/, is usually described as having three allophones, namely [h] before /a/, /e/, and /o/, [f] before /u/ (or, more accurately, with free variants [ɸ] and [f]), and [ç] before /i/. But this way of counting has been influenced by the fact that the different allophones often belong to different phonemes in the Western languages, while the audibly different qualities of the /h/ before /a/, /e/, and /o/ do not usually play such parts in languages known to Western linguists. Thus the conceptions of allophones and free variants is in the same state as that of general phonetics in that its categories depend, to a large extent at least, upon the languages of its user and is not completely based upon universal traits of human speech.

Since a phoneme is a class of sounds, it is sometimes asserted that you never can pronounce or even hear a phoneme, but only pronounce or hear one of its allophones. This is however too fine a philosophical point to insist on for purposes of linguistic discourse. For, if we come down to it, an allophone is also a class of psychophysically slightly different shades of sounds which for purposes of phonetic description are grouped into one class and given one symbol between square brackets “[]”. The logical situation is very much the same as that of the assertion that you cannot “see a table”, since, according to one theory of the nature

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of physical objects, a table is a class of actual and possible perceptions of oblique and rectangular shapes, light and dark colours, feelings of hardness and smoothness, and various other qualities and therefore you can only see one of the aspects, usually a trapezoid and not even a rectangle and never the concrete object "table", which in theory is an abstract class. Since, however, there is a sense, perhaps the normal, if common, sense in which we do say that we see the table, we can also say sensibly that we can pronounce or hear a phoneme as well as pronounce and hear an allophone.

§18. *Distinctive features vs. segmental phonemes*

We noticed in the tables of consonants and vowels that with enough specification of the various articulatory positions and manners a sound will be sufficiently defined. For example, a high back rounded vowel is [u] and a voiced labial stop is [b]. Now, since a phoneme is a class of usually various sounds which share certain features in common, it follows that specifying the common features of the members, and leaving unspecified the features which vary will define the phoneme. This, in brief, is the theory of distinctive features, which was first emphasized by Leonard Bloomfield and subsequently developed more fully by Roman Jakobson, C. G. M. Fant, and Morris Halle in their *Preliminaries to Speech Analysis*, Technical Report No. XIII, Cambridge (M.I.T.), 1952. For example, the vowel *u* in 'rule' is of apparently uniform quality, but in Mandarin Chinese the syllable *ch'u* in high level tone is the word 'out' or 'go out', in high rising tone is 'to remove' or 'to divide (in arithmetic)', in low-dipping tone is 'to poke', and in high falling tone is 'locality'. The four *u*'s seem to sound alike to speakers of English and other languages without tones, but very different, not only to the Chinese ear, but also in the acoustic recording of the sound waves, since the sound waves of the pitch of the fundamental will look different. The common distinctive feature of the phoneme /u/ is the high-back tongue position, while the pitch setting at the glottis is also distinctive in Chinese, but not so in non-tonal languages. Not only that, the Chinese tones, too, are distinctive features, since they are relative to the key at which

a person happens to be speaking, while a machine will record different sounds according to the speaker and even to the mood of the same speaker.

Again, in the phoneme /l/ in English, the distinctive features are dental lateral articulation, with the tip of the tongue touching the alveolus and the sides open. Whatever the back of the tongue does will make a difference in the phonetic quality of the sound produced, but makes no difference for the identity in the phoneme /l/ in English. Thus, although the *l* in *lease* with the tongue flat, is audibly different from the *l* in *seal* which is [ɫ], with the back of the tongue raised, as if to say [o], it makes no difference in the phoneme since both contain the distinctive features which make the phoneme /l/ for English. In Russian, on the other hand, the tongue position does play the part of a distinctive feature in /l/ and /ɫ/ and so there are two phonemes instead of one (cf. p. 25). Again, in Japanese (to oversimplify the phonetic details slightly without affecting the point under discussion) the consonant [ɸ] (varying with [f]) occurs before /u/, [ç] before /i/, and [h] before /a/, /e/ and /o/. From the point of view of phonemes as classes of sounds, we have [ɸ] [ç] and [h] as the three allophones which constitute the phoneme /h/. From the point of view of distinctive features the Japanese phoneme /h/ consists of voiceless non-apical friction, whether occurring in the glottal, palatal, or in the labial region. As we have seen, the statement that the Japanese /h/ has three allophones has already been prejudiced by the phonemics of the majority of well-known Western languages, and actually there are five and not three allophones, since the three phonetically different sounds [h_a], [h_e], and [h_o] usually form members of a phoneme /h/ in those languages but not including [ɸ] and [ç]. Before we leave the topic of distinctive features, it should be noted in passing that the theory, in its most developed form, is stated in auditory rather than articulatory terms, which we have been using for continuity of discussion.

§ 19. *Morphophonemics and alternation*

Sometimes different sounds occur under specifiable conditions without involving completely complementary distribution. For example, the plural forms of nouns and the third person singular

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present forms of verbs end in [s] after voiceless stops and [f], as in wrecks, slaps, faints, laughs, but in [z] after vowels and voiced stops and [v], as in legs, slabs, adds, loves. Can we say then that [s] and [z] are two allophones of one phoneme? Of course not, since there is only incomplete complementarity. In other cases, we have minimal contrasts, as [s] in lace and [z] in lays, not to speak of the same contrast in other positions. Therefore we must recognize two separate phonemes /s/ and /z/. Similarly, *b* in German *sieben* 'seven' is [b], but in *siebzehn* 'seventeen' is [p]. This however does not make [b] and [p] one phoneme, since they contrast in other cases, as in *Blatt* 'leaf', with /b/, and *platt* 'level', with /p/.

When such partially complementary phonemes occur as alternates under specifiable conditions as part of a word or other linguistic unit, we have what is known as a *morphophoneme*, often indicated by braces { }. Thus, the morphophoneme {z} (which letter is used is a matter of choice, usually the letter for the most frequently occurring phoneme) consists of the phonemes /z/ and /s/, occurring under the conditions described above, and serves as a suffix to plural nouns or to third person singular present tense verbs. The morphophoneme {b} in German is the last element in the roots *sieb-* 'seven', *lieb-* 'love', occurring either as /b/ or as /p/ under specifiable conditions.

The terms morphophonemes and morphophonemics sound fairly formidable and were disapproved of by linguists of the older generation, who preferred to speak of *alternates* (or *alternants*) and *alternation*. If the conditions of alternation is specifiable, it is called *automatic alternation*. While it does not matter what we call things so long as we know what we are talking about, there is a certain advantage in relating morphophonemes to and distinguishing them from phonemes. We shall come back to morphophonemes when we take up the discussion of morphemes in the next chapter.

§20. Transcription, transliteration, and orthography

A *transcription* is the writing down, in phonetic or in phonemic notation, of the sounds of speech. A *transliteration* is the writing over, in some conventional written form, usually the latin alphabet, of a written text which consists of units of a different kind. One

can therefore transcribe any language, whether or not it has ever had a system of writing, while only written languages can be transliterated. For example, a field worker in an unwritten language, say an American Indian language, will start with phonetic transcriptions, then after systematizing the material into phonemes revise his field notes into a phonemic transcription of the text or vocabulary or whatever is recorded. The simplest example of transliteration is the conversion of one alphabetic system of writing into another, say from Greek into latin letters. Besides one-to-one equivalence, such as $\alpha = a$, $\beta = b$, $\gamma = g$, $\delta = d$, etc., there are equivalences like $\phi = ph$, $\theta = th$, $\chi = ch$, and from such rules any Greek text can be transliterated, that is, rewritten, into latinized form, e.g. $\epsilon\acute{\iota}\xi = h\acute{e}x$ 'six', $\chi\rho\acute{o}\nu\omicron\varsigma = chr\acute{o}nos$ 'time', $\theta\epsilon\acute{o}\varsigma = the\acute{o}\varsigma$ 'god'. The transliteration of the Cyrillic into roman is of the same order of simplicity. Let $x = kh$, $\pi = l$, $e = je$, $\delta = b$ and we get Russian $xлeб = khljeb$ 'bread'. To be sure, the $\delta (= b)$ is pronounced $[p]$, just as final b in German is pronounced $[p]$. But we are not transcribing the language but transliterating the writing and δ must have a consistent equivalent, namely b .

In the case of writing systems in which the units represent larger linguistic units than phonemes, the transliteration is more complicated. To transliterate Chinese writing, in which each unit is a syllable, it will have to be first transcribed in some phonetic or phonemic form, and if this is done in roman letters, then the romanization will at once be a transcription and a transliteration.

All systems of symbolic representation are good in so far as the representation and the represented are mutually determinate, so that one can go from one to the other in either direction. In this regard all actual systems of transcription and transliteration are not equally good. In the matter of phonetic transcription Henry Sweet (1845-1912) used to demonstrate that if you transcribe a language accurately, a person who has never heard the language before but knows the values of the symbols should be able to read it off and make it sound like the original. On the other hand, a Swiss lecturer who spoke no English once came to New York and delivered a lecture from notes written in the IPA and the audience could not understand a word he said. The incident does not prove the inadequacy of transcription in general, but rather the incom-

pleteness—even phonemic incompleteness—of simple segmental elements with omission of stress, length, intonation, etc. If a phonemic transcription is used, the reader will of course have to know the “rules of pronunciation”, namely which phonetic value of the phoneme is to be used.

In the case of transliterations, most systems work only one way and are not reversible. If both eta and epsilon are equated to *e*, then seeing an *e* will not make it possible to determine whether to go back to an eta or an epsilon. The same is true of having both omega and omicron equated to *o*. In the Wade-Giles system of romanization for Chinese, one can, to be sure, get the exact pronunciation from the transliteration-transcription, but one cannot go back to the original character without knowing which of the (usually) numerous homophonous characters is meant. Add to this the fact that most newspapers do not bother to use the full Wade system, but quite literally transliterate and discard all the phonemically necessary diacritics and tone marks, so that what is written *chu chun chuan* could have the *ch* aspirated or unaspirated, the *u* as *i* or as *ü*, and each of the syllables in one of the tones 1, 2, 3 or 4, resulting in $(2 \times 2 \times 4)^3 = 4096$ possible ways of pronouncing it, such as: *chu*³ *ch'un*¹ *chüan*³ ‘to boil spring rolls’, *chu*⁴ *chün*¹ *ch'uan*² ‘to station military ships’, *chu*¹ *chün*¹ *ch'üan*⁴ ‘gentlemen admonish’, *chu*¹ *ch'ün*² *chuan*⁴ ‘scarlet skirt turns’, etc., etc., which all sound and look different when transliterated-transcribed in the full Wade romanization.

The orthography of a system of writing is usually more or less representative of the sounds of the language. Since writing is more conservative than speech, the orthography usually retains features of older sounds which have since centuries ago changed or disappeared. This is not only true of alphabetic systems of writing, but also true of those based on syllabic units such as Chinese and Japanese. In the system of symbols which form the Japanese syllabary, there are symbols representing syllables rather than sounds or phonemes. The best known system of transliteration of the Japanese kana is the Hepburn system of romanization, commonly used in English contexts. The following examples will give some idea of the transliteration, as compared with actual phonetic and phonemic transcriptions:

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Meaning:	'two'	'telegraph'	'English language'
Kana:	フタツ	デノボ	エイゴ
Transliteration:	<i>futatsu</i>	<i>denpō</i>	<i>eigo</i>
Phonetic transcription:	[ɸʌtsɯ]	[dempɔː]	[eːŋɔ]
Phonemic transcription:	/hʌtʌtʌ/	/denpoo/	/eego/

In a language with an alphabetic system of writing, orthography usually reflects the phonetic and phonemic structure of older stages and in cases where there are differences between formal and informal styles of speech, the orthography is usually closer to the stressed form or to the more formal style of speech. For example, the *gh* in English *light* is a graphic reminder of the velar consonant corresponding to *h* in Old English *lēoht*, and is cognate with the *ch* in modern German *licht*. As an example of orthography being closer to the more stressed or more formal styles of speech, we have *can* in *Yes, I can*, as against *Can I have this?* where the spelt word *can* is usually spoken as *c'n*.

In spelling reforms the attempt is usually in the direction of keeping up with present-day speech. But since styles of speech vary and it would obviously be a highly inconvenient practice to have various orthographies for the same word spoken in different styles, it is never desirable to have an orthography which is completely phonetic. In many cases it is even desirable for an orthography not to be completely phonemic but only morpho-phonemic. This brings us back to cases like the English plural ending which may have the phoneme /s/ or /z/, but as a practical orthography the common usage of writing just *s* is an excellent morphophonemic notation which is also very practical.

§21. Marginal phonemes

Since language varies in style and changes in time, how is it that the sounds of a language always fall into neat groups, similar in quality in each group, complementary in distribution between groups, and symmetrical in structure over the totality of the groups? The answer is that they do not. Both the ancients who designed the various alphabets, which are usually quasi phonemic, and the moderns, who formulate phonemics for various languages, try to find order out of the chaos of the apparently amorphous

continuum of speech and succeed in finding system and simplicity in some respects and arbitrariness and complexity in other respects: simplicity in sound and complexity in meaning, relative symmetry in grammar and arbitrariness in the lexicon. But language being after all a social process, even the sounds are only relatively systematic. Thus it is that in almost every language, after a good phonemic analysis has been made, there is usually a certain amount of marginal residue which has to be put in a footnote or an appendix, or it would complicate the whole system if included as a regular part of it.

Interjections often contain sounds not occurring in other kinds of words. What is spelt *aha* and conventionally pronounced as [a'ha] is often actually pronounced [ʔa'ɦa], with a glottal stop and a voiced *h*. Nor are such marginal phonemes limited to expressive elements. Frequent foreign sounds in frequently borrowed foreign words also occupy a dubious phonemic place. People who talk about Loch Ness at all are likely to say [lɒx] rather than [lɒk]. Is [x], then, a phoneme in English? Similarly, there are any number of borrowed French words whose users are as likely as not to use the nasalized vowels, which is foreign, in the systematic sense, to English phonemics. Nor are such marginal phenomena limited to foreign or borrowed elements. In the dialect of Nanking, which is the centre of Southern Mandarin, there is almost 100 per cent complementary distribution between palatal and velar consonants, the former before high front vowel /i/ and /y/ and the latter in other cases—with the exception of the single word 'to go', which is, as is normal, [tɕ'y] in most contexts, but, contrary to the complementary distribution, is [k'i] in certain other contexts, where a velar consonant combines with a high front vowel, quite distinct from [tɕ'i], which means 'air'. But if we have to recognize a phonemic distinction between /k'/ and /tɕ'/ because of the minimal contrast between words for 'go' and 'air', there is no case of similar contrast between the corresponding unaspirates [k] and [tɕ] before either /i/ or /y/. Should we then combine the unaspirates as the same phoneme, or, in order to gain symmetry of structure for the whole system, set up also /k/ and /tɕ/ as phonemically distinct even though they have complete complementary distribution? The isolated case of contrast between /k'-/ and /tɕ'-/

before the same vowel is probably a historical relic, as they are not paralleled by any other case in that dialect, but it is there and you have to take it and can not leave it if all the facts of the language are to be accounted for. Such cases of residues or lack of symmetry in phonemicizing are to be expected and recognized, no matter how and where they are to be placed. They are like the dirt which Charlie Chaplin sweeps from one room to the next, from which Buster Keaton sweeps it back again to Chaplin's room when he isn't looking. It is part of the facts of phonemic life.

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§22. *Morphemes and morphs*

We have seen that it is advantageous to deal with phonemes or morphophonemes, since for any given language different sounds make no difference if they are variants of the same phoneme. "Difference" in what? The usual answer is that different phonemes will make a difference in meaning. Strictly speaking, a phoneme is that which will make a difference in the constitution of the next larger unit—the *morpheme*. For practical purposes, we can define a morpheme as the minimum unit that *has* a meaning. Thus, most phonemes in a language, say English /s/, /t/, /l/, /f/, /i/, /u/, have no meaning, although each one of them forms important elements in larger units that do have meanings, as in *sit*, *life*, *it*, *put*.

Morphemes, however, are not necessarily words. Thus in *flyer*, *fly* is a word, but *-er* is not, though it is nevertheless a morpheme, since it has a meaning: 'one who' or 'that which' (flies). In *subdivision* there are three morphemes *sub-*, *divis-* and *-ion*, each of which has a meaning, but none of which is a word. What, then is a word? Before answering this question in the next section, we shall take another look at the function of morphophonemes in morphemes. In our previous examples of German *lieb-*, *sieb-*, we found that although /p/ and /b/ are different German phonemes, they are also two members of one morphophoneme {b}, to be realized as /p/ or /b/ under different conditions. It is called a morphophoneme because it is an element of the morpheme *lieb-* 'love' or *sieb-* 'seven'. When a morpheme appears in different phonemic shapes, each one particular shape is called a *morph*, e.g. /li:p/ and /li:b/ are two morphs of the morpheme {li:b}, quite in analogy with several perceptibly different sounds [h_i], [h_e], etc., forming members of one phoneme /h/.

The idea of subsuming several morphs under one morpheme is sometimes extended to cover cases where the alternation is not between related phonemes under a morphophoneme, but

between quite disparate forms. Thus, it is fairly simple to put *leave* /li:v/ and *lef-* /lef/ of *left* under the morpheme {li:v}, where {i:} is /i:/ and {v} is /f/ in the infinitive and {i:} is /e/ and {v} is /f/ in the preterite, but in *go* /gou/ and *went* /went/ and *gone* /gɔn/, the morpheme for the verb 'to go' appears in the shape of three morphs /gou/, /wen/, and /gɔ/, thus:

Infinitive	Suffix	Preterite	Suffix	Past participle	Suffix
/gou/	(none)	/wen-/	/-t/	/gɔ-/	/-n/

where it will not be possible to set up conditions of alternation under morphophonemes.

We have taken some trouble in going into the complexities of morphs and morphemes in order to illustrate two important aspects of the structure of language with phonemes as its building blocks. In the first place, the smallest unit that has a meaning is not necessarily a word, but a morpheme, such that it sometimes takes two or more morphemes to form a word. Secondly, in dealing with language structure, we have not only to consider strings of phonemes horizontally from left to right, i.e. in the time dimension, but also to compare different corresponding elements in different instances. In fact, such a situation was already met with when we compared the grouping of phonetically distinguishable sounds under phonemes. In general, when language is analysed into units of various *levels* of structure, it is not a simple matter of size of the stretch of sounds, but of colligation of units as regards their occurrence or non-occurrence. These two aspects of levels of structure are sometimes spoken of as being *syntagmatic* and *paradigmatic*. These adjectives are used in wider senses than the corresponding nouns *syntax* and *paradigm*, which we shall discuss in later sections.

We shall now proceed to consider different levels of structure. Some linguists do not even start with the phoneme as an element of language—except of course occasionally when a phoneme happens to be a morpheme—and put all phonemics under “pre-linguistics” and begin to deal with linguistics proper from the level of morpheme on. However, this is more a matter of terminology than a matter of substance and every linguist has to work with phonemes, even sounds, at the preliminary stages of his work.

§23. Words

Between the phoneme and connected speech the most important and best known type of speech unit is the *word*. Everybody of course knows what a word is. One speaks by putting words together. A child is taught the right and wrong use of words. An author is paid at the rate of so much per thousand words and the telegraph office charges so much a word. But, like many other well-known conceptions, when we try to bring the idea of a word into sharp focus, we find that it is a multi-dimensional affair, so that when one plane is in focus, other planes get out of focus. If we go by the written forms, *doorkeeper* is one word, *door opener* is two words, and *door-roller* is a hyphenated word. Are *check* and *cheque* the same or different words? The theoretical situation with regard to "word" is the same as with other conceptions in science. One started with the popular idea of "force", which everybody was supposed to understand easily and when a more rigorous analysis was made, it was found, in the Galileo-Newton era, that one had to distinguish several similar but different things: (1) mass $\times$ velocity, (2) mass $\times$ acceleration, (3) mass $\times$ acceleration $\times$ distance, and (4) mass $\times$ acceleration $\times$ time. It was a pure accident of terminology that only no. (2) has come to be called "force", the important thing was that there were these different things which have been found useful to distinguish. Likewise, from the commonsense idea of a word, it has been necessary to distinguish between the written word and the spoken word, and in the spoken word linguists have found it necessary to distinguish between various similar and related word-like things which are statistically correlated in occurrence, but are nevertheless different things. Following are some of the most important word conceptions.

1. *Free and bound as criteria for words.* A form is *free* (F) if it can be uttered alone, e.g. *come, two days, take plenty of time*, and *bound* (B) if it is never uttered alone (in normal speech), e.g. *-ish, particip-*. The best-known definition of a word is that by Leonard Bloomfield, which says that a word is a minimum free form. Because of the rather drastic nature of this requirement, which would exclude *the, of, a*—and even Bloomfield had to cite the

analogy with *this* and *that* to show that *the* is a word—various modifications have been proposed as criteria for a word. Instead of complete pauses before and after an utterance, potential pauses within an utterance can be used as a marker for word boundaries, as in: *But* (,) *if* (,) *some* (,) *people* (,) *can* . . ., where the words do not occur normally alone but can have pauses as marks of separation from other words. Note that since almost any word can form a compound word with another word and thus becomes bound, it follows that the term *free* means only sometimes free, whereas *bound* means always bound.

2. *Versatile and restricted.* A form is *versatile* if it goes with a large variety of other forms and *restricted* if its occurrence is limited to one or a few. Thus, words like *man*, *good*, *so* are extremely versatile, while the occurrence of *criter-* is restricted to the two forms *criterion* and *criteria*. But affixes like *be-*, *pre-*, *-s*, *-ed* are extremely versatile and bound, while in a few cases free forms with potential pauses are quite restricted. Thus, none is *kith* but also *kin*, and whatever is *au fur* must also be *à mesure*. The distinction between the versatile and restricted is therefore correlated to some extent with, but does not quite coincide with that between F and B.

3. *Words as phonological units.* Some languages have regular marks such as stress or tone for recognizing words. In Latin the end of a word can be identified by the positions of the stress: on the penultimate syllable if long, and on the preceding syllable if the penultimate is short. In Chinese *hsiên 'shēng* 'first to be born, —to be born first' is a phrase of two words, *'hsiēnsheng* 'sir, Mr' is one compound word. For English the phonological pattern of the word is not always regular. For example, *jack in the 'box* is a phrase in *Give me the jack in the (tool) box*, but *'jack-in-the-box* as the name of a toy, is a word. On the other hand, the phrase *man of 'war* (warrior) and the word *man-of-'war* (warship) have the same stress patterns.

4. *Words in functional frames.* Various kinds of words may be identified by the functional frames in which they occur. A noun can be the subject of a verb or object of a verb or a preposition, an adjective can modify a noun and be modified by an adverb, a conjunction occurs between words of comparable classes, etc., etc.,

thus resulting in word classes, or *parts of speech*. But the use of frames for marking out words entails two problems. One is that a given kind of frame identifies not only a kind of a word but also longer strings than a word. In *I drink water*; *water is cheap*, the frames mark *water* as a noun. But the same frames can also be filled by *fresh water* or *fresh water drawn from the well*. In other words, frames can only mark *form classes* (in this case the class of substantive expressions, or nominals) and not necessarily word classes. It still takes the other criteria such as isolated utterance, potential pause, or phonological features to mark out single words. The other problem about the use of frames is that of circularity. If A is defined in terms of B, B in terms of C, and C in terms of A, we still do not know what A, B, and C are. But this problem is not as serious as it seems. All science is circular. All mathematics is defining in one big circle. It will not matter if the circle is made big enough and if the resulting system reflects well, or makes a good *model* of, the object of study.

5. There are other criteria for testing the unity or identity of the word, such as (a) form of writing: Chinese character as a word, Fr. *laissez-le* as one word, *le laissez* as two words, English *leave it* (whether in a command or in a statement) as two words; (b) translational equivalent, which is often used, but obviously meaningless without specifying what language to translate into; (c) independent intelligibility, which in turn depends upon such factors as frequency of occurrence, existence of homophones, linguistic or situational context.

Complicated as the various ideas of the word are, we have so far confined our discussion to the status of a language at one time, that is, at a synchronic level. If we go into the stages of development of a word, its ramifications and occasional coalescences in history, we are in the subject of *etymology*, where the vertical status of a word in time yields a more solid, concrete, and more interesting unit of the *etymon*.

In all the preceding discussions of this section, it has been taken for granted that we know what we are talking about. Everybody has some idea of what a word is and should be prepared to differentiate, if necessary, the phonological word, the minimum free word, the written word, etc. But since we are inquiring what

a word is in language in general, it should be possible to carry on similar discussions in any language. There is no problem in German, since one just starts discussions about *das Wort* which is in fact etymologically "the same word" as *word*. Parallel discussions are fairly easy in French, since *le mot* is used in practically the same way as *word* and discussions in French about *le mot* will arrive at parallel results. But once we get outside the well-known West European languages, then it is even less clear when we ask what is a word. In classical Chinese, almost every morpheme is one syllable and is written with one character and is free, whence the common idea that Chinese is a monosyllabic language, meaning that its words are monosyllables. In modern Chinese, however, while morphemes are monosyllabic, they are not always free or versatile and it often takes two or three morphemes to form units which behave more like what one would call in English a word. What are such units called in Chinese? Nothing, at least nothing in everyday speech. There is an everyday term *tsü* [tsʰʅ], which means indifferently the monosyllabic morpheme or the character with which it is written. It plays very nearly the same sociological role as the word *word* does among speakers of English. For this reason Chinese speakers and even writers of English always tend to refer to such a unit as *word* and have a definite aversion to using the word *character*, even when referring to the written form. Until recently, it was only among linguists of the Western school that the versatile-free form was called *ts'ü* [tsʰʅ], admittedly a translation for *word*, *Wort*, *mot*, etc. But non-linguists, which of course means most people, did not use to talk about units of this size, and to them the term *ts'ü* meant 'wording', 'diction', or 'verse of unequal lines', rather than a certain type of linguistic unit. At the other extreme, in some of the American Indian languages like Nootka and Shawnee, meaningful units, often in the form of subsyllabic morphemes, are strung along in closely bound forms and very often a whole utterance cannot be broken up into free subunits, so that sentences are often indistinguishable from words. On the other hand, other American Indian languages such as Dakota and some of the California Indian language have word units like those in English. By and large, most languages have recognizable units of an intermediate size between the morpheme

and the utterance which may be called the word in English terminology, allowance being made for variations in the sociological status of various units.

§24. *Grammar and lexicon*

In discussing the arbitrary and conventional nature of language, we found that practically nothing can be inferred from the phonemic make-up of a morpheme to the meaning of another morpheme. This is of the very nature of the *lexicon*, i.e. the inventory of the morphemes of a language. On the other hand, the way morphemes and classes of morphemes do or do not go together, and how they go together if they do, can to a great extent be brought under broad categories and generalized statements and this constitutes the subject matter of grammar. To put it in a slightly oversimplified way, a dictionary tells you what things there are in a language and a grammar tells you what things go with what, and how, in the language.

Looking at the difference in another way, in grammar one can make a relatively small number of statements to cover a great many things, while in lexicon one has to record as many individual facts as there are lexical items, which in any given language usually run into tens or hundreds of thousands. That is why dictionaries are compiled separately from grammars and their contents are arranged in an alphabetic or some other arbitrary order, while grammars are much more concise and systematic. Because the description of the phonology of a language can be given very concisely, involving a small inventory of morphemes, it is often included as an introductory part of the grammar of the language. This was especially true of the nineteenth-century European grammarians who were concerned with the phonological correspondences of languages separated in space or time. In the narrow sense, however, grammar is concerned with the aspect of arrangement of morphemes and not of phonemes—unless they happen to be morphemes.

§25. *Morphology and syntax*

Morphology is the study of words as made up of morphemes and *syntax* is the study of phrases and sentences as made up of words. The two are naturally closely related, since the internal make-up of words often depends upon their relations with other words. Take the sentence: *He always forgets his hat*. The singular verb form *forgets* and the possessive form *his* from *he* are matters of morphology. At the same time the agreement of the singular form *forgets* with *he* is a matter of syntax. Moreover, it is a peculiarity of English syntax that if the hat is his, one usually says so, whereas in some other language such as German, one would use the definite article and in Chinese one would add nothing before the word for *hat*.

Since, as we have seen, the nature of the word differs from language to language, the problems of morphology and syntax as well as the demarcation between them will also vary. Most languages, however, make greater or less use of the following features of grammatical process or arrangement, both in the morphology and in the syntax.

1. *Order*. All speech being largely in a string, there is always *order* of precedence whether it is used grammatically or not. That *lift* and *flit* have the same elements in a different order is of no grammatical import, since the internal make-up of a morpheme is a lexical matter. But the order in *wallpaper* and *paper wall* is a question of grammar, since it has to do with the relation of the modifier to the modified. When words have complex morphological structures, order between words is less important, as in the case of Latin, but the internal order of morphemes within the word is of course always fixed.

2. *Modulation*. *Modulation*, including stress, intonation and other supra-segmental elements, if considered separately from the usual segmental elements, often serves to mark grammatical relations. In the sentence: *These are 'paper walls*, *paper* is a modifier, while in *My job is to ,paper 'walls*, *paper* is a transitive verb. When a sign in the reception hall of a large silk store in Kyoto says: "Please Smoke Here", and my daughter Rulan objected, "But I don't smoke", the grammatical difference is more subtle: the

intended predication is in the unmarked contrastive stress on "here, while the usual predicate would be on the verb *smoke*, which would receive the normal stress when left unmarked. Again, between the forms:

'Don't give it to ^{an}y body'. (to none)

and the same words in a different intonation,

'D_on't give it to a ⁿy b_od^y.' (to some only),

the scopes of modification of the negative are obviously different. A difference in tone in tonal languages, however, is not one of modulation, but should be considered under the next heading.

3. *Phonetic modification*. Mere difference in the phonetic or phonemic make-up of a morpheme does not usually constitute *phonetic modification* in the grammatical sense. Thus, *bit* and *bat* are simply different morphemes which happen to have a certain difference in the vowels and the difference is of no grammatical significance. On the other hand, *sit* and *sat* differ grammatically by phonetic modification and we find parallels in such forms as *sing:sang*, *spit:spat*, etc. As indicated above, a difference in tone in a tonal language may (or may not) be a phonetic modification. For example the difference between the low-dipping tone in Chinese *p'ǎo* 'to run' and the falling tone in *p'ào* 'to steep' is purely lexical, but a similar difference between *hǎo* 'good' and *hào* 'to find good, to like' is a phonetic modification which changes an adjective A into a putative verb, that is, a verb V such that V-O means 'to find O to be A'.

4. *Selection*. This term, *selection*, first used by Leonard Bloomfield, means class membership of forms according to their common behaviour in frames, as we have discussed under criteria for words. The finite verb expressions *goes*, *has eaten*, *gladly accepts the invitation*, etc., constitute a class which serve as predicates. The bound forms *-ness*, *-ity*, *-ude*, etc., form a class of suffixes for abstract nouns. The main fact is that each of these lists include

those particular things which show similar grammatical behaviour. In a sense the idea of selection reduces questions of grammar to questions of vocabulary and thus seems to be begging the question, like the situation with regard to the definition of the word by frames in other frames. In the case of selection of form classes, however, this is not always circular and, in some cases, it is possible to start with a small number of vocabulary items which mark the functions of morphemes or larger forms. Thus the class of individual nouns in Chinese need not be "defined" by enumerating all the thousands of such nouns in the dictionary but by enumerating only a few dozen of the so-called *classifiers* which can be used between a numeral and the noun in question.

§26. *Immediate constituents*

Syntax in the narrow sense, as we have seen, has to do with the relation between words and strings of words, while the adjective syntagmatic is usually applied to the concatenative aspect of morphemes or larger units. Since, however, the nature of the word varies from language to language, the difference between the syntactic and the syntagmatic is not as clear as it may seem. The common point is that of horizontal structure of units and their relations.

The basic conception in horizontal structure is that of *immediate constituents* (IC). Take the sentence: *In fact the plan of action you outlined has never worked. In fact*, which modifies the rest of the sentence, is an IC; *fact the* is of course not even a constituent; *the plan* could be a constituent in some other sentence, but not in this one, since *the* is in construction with the IC *plan of action*; . . . when we come to *has never worked*, we find that *has worked* is in construction with *never* and thus forms a discontinuous constituent. Thus we have the whole system of the ICs of this sentence organized, in a Chinese-puzzle fashion, as shown in Fig. 3. (Recently diagrams of ICs similar to genealogical trees have come into common use, the difference being of course purely graphical.)

The idea of the IC is of course also applicable to bound morphemes, as in *outlined* being *outline* + *-d* and not *out* + *lined* and

§26. IMMEDIATE CONSTITUENTS

ungentlemanly being *un* + [(*gentle* + *man*) + *ly*] and not, say, *un-gentle* + *manly*.

In most cases a construction can be analysed as two ICs, each of which, if complex in nature, can be further analysed as two ICs. Occasionally there is a string of three or more constituents which cannot be further reduced to several layers of twos. For example, in *a nice, new, big, shiny doll*, the word *doll* is in construction with the four adjectives and *a* is in construction with the rest, but it would be artificial to put the four adjectives at different levels, since their orders are to some extent arbitrary. It is thus more natural

In fact the plan of action you outlined before has never worked.

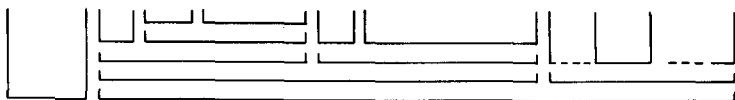


Fig. 3. Immediate constituents.

to regard all four as four ICs at the same level. Again, in *salt and pepper*, though the constituents are not of the same form class, it is not clear whether the conjunction *and* is in construction with the preceding or the following word. It is not like the case of *has never worked*, where *has worked* does occur elsewhere and there are a great many other adverbs in the position of *never*. In such a case three alternatives are possible: (1) Simply treat it as a case of three ICs; (2) consider *and* and a limited number of morphemes or words as empty morphemes or function words, not to be counted as ICs; (3) consider the place of potential pauses, as in *salt, and pepper* (the two parts possibly spoken by different people even) and thus decide on 'and pepper' as an IC. Which procedure is to be taken depends upon the language concerned or even different aspects of the same language.

§27. Linear ambiguity and mixed ICs

In a string of three constituents there is always the possibility of the ICs being 1 + 2 or 2 + 1, and of course more possible patterns in longer strings, unless the ambiguity is resolved by other factors. When the salesgirl asked the customer if he wanted *a narrow gentlemen's comb*, she was taking the ICs as 1 + 2, and when

he heard it as 2 + 1 and answered *I want a comb for a stout gentleman, with rubber teeth*, he was risking having *his ICs* heard as 1 + 2. Again, in the news item: *President Kennedy . . . will spend 7 to 9 billion dollars to send a man to the moon and bring him back in 1970*, it is only from the content of the message that one can tell that *in 1970* is in construction with *will spend . . .* and not with *bring him back . . .* *Punch* (5 February, 1966, p. 182) was not even satisfied with context when he mentioned *the Pope's children's party* and pretended to find it necessary to add: *sorry, the Pope's party for children*. Such ambiguities of constructions are unavoidable as a necessary consequence of the linear nature of language. Sometimes suprasegmental elements such as junctures or pauses between larger constructions will help clear up ambiguities, but such distinctions are not always made in the actual flow of speech, nor usually indicated in writing.

Writing is sometimes even positively misleading in cases where a bound form is in construction with a free form. We noted before (p. 54) that a bound form is always bound, but that a free form is only sometimes free, since it can usually be sometimes bound. For example, the suffix *-s* is always bound, but the word *dog* is free, though it can be bound in *dogs*. In a relatively small number of cases, a longer form than a word can also be bound and form an IC with a bound form. Besides stock examples such as *the King of England's crown*, and H. L. Mencken's example of *the lady I go with's umbrella*, there are similar uses of the same suffix in *this week's programme* and the apparently illogical construction as noted by Pegasus Buchanon:

It used to be proper to say 'someone's else'.
And not 'someone else's', but now it's thought dreary
To argue the point. Language mellows and melts—
At least, that's the tutor that teaches me's theory.

(*Saturday Review*, 26 January, 1963)

The last example, which is intentionally forced, is quite the everyday construction in Chinese, in which the last line will appear as something like:

"At least, that's the teaches me's tutor's theory."

With some bound forms in phrases one hardly notices the discrepancy between the real ICs and the apparent word divisions.

Examples are: *artificial florist*, *first novelist*, *ban-the-bombers*, *Far Eastern languages*, *me tooism*, *old maidish*, *set theoretical* (pertaining to set theory in logic). I have sometimes resorted to the German device of using both space and hyphen to indicate the ICs, as in *old maid -ish*, but this will not only get one into no end of trouble with the proof read -er, but does not even reflect the phonological aspect of word divisions as faithfully as the common orthographical divisions do.

Occasionally, however, one does pause at places where a clearly bound form occurs. In her radio programme Evangeline Baker once spoke of a certain distance as being "an hour[pause]'s drive". At a business meeting of a learned society, a member said: "I had doubts as to what the ACRD—uh—'s functions are supposed to be". In a TV programme a well-known republican debator said "the democrits [correcting himself] -crats", which was perhaps one of those not completely unintentional slips.

Such cases of freeing of the bound are, however, relatively rare. Much more common but less obvious is the discrepancy between the formal constructions and another unexpressed construction which seems to be the actual message. Typical of such discrepancy are cases of displaced modifiers. A sign in an American college cafeteria says "Bus [i.e. take back to the counter] your own dishes", where grammatically *your own* modifies *dishes*, but really it is *your own bussing* that is urged. Similarly, the library sign *Shelve your own books* does not imply that the library has an unusually acquisitive department of acquisition. When a girl "knows her men", there is a sense that the men are hers, but the expression usually emphasizes her knowing of the men. Likewise, when the Red Queen objected to Alice's saying "I have lost my way" because all the ways belonged to the Queen, it was not so much the way as the losing of the way that was Alice's. Such a displacement of the modifier can sometimes result in apparent paradoxes, as in the phrase *fills a much-needed void*, where it is the filling that is needed and the void is to be avoided. Less common, though by no means rare, are cases of displaced or dangling predication, as in the road sign: "Turn Right When Clear", to which a driver might ask: "You mean don't turn right when drunk?" Here a different logical subject after *when* is assumed.

§28. *Generative and transformational grammars*

All science is supposed to be concerned with the objective description of facts, to be tested by predictions which will fit facts beyond the original data. As applied to language, from an adequate description on the basis of a body of authentic material one should be able to predict stretches of speech which have never been heard before and yet be acceptable to the native speaker as possible forms in the language. This is apparently what an analysis on the basis of hierarchies of ICs of a larger body of material or *texts*, whether on paper or on magnetic tape, is expected to and does accomplish. However, as Noam Chomsky has shown in his *Syntactic Structures* (The Hague, 1957), this approach, which he calls *phrase structure grammar*, will not be adequate to give the full answer to the problem of producing new forms on the basis of the old, in other words, it does not give a *generative grammar* which shall give all those and only those forms which can occur in the language. To be sure, more or less good phrase structure grammars have been used for all these years in the teaching of native or foreign languages. For that matter children have learned to speak their native language even without the use of any descriptive grammar. The point of a written grammar is that the facts of the language can be systematically and concisely given within such a manageable size as will not require a whole childhood of time—which means from five to eight years of full-time study during most of the waking hours—to get hold of all the relevant facts of the language. An important incentive toward the generative approach is the need of a purely mechanical approach to language, such as required in communications technology and machine translation, as we shall discuss later. For nothing is so literal-minded as a machine and what is often left to the intuition or intelligence of the learner cannot be taken for granted but must be spelt out for the machine.

The most important conception for generative grammars as developed by Zellig S. Harris and (in somewhat different vein) by his student Noam Chomsky is that of *transformation*, by which certain forms can be transformed into other forms. A special type of transformation is that between synonymous forms. Thus, from: *He killed a snark* one can say *A snark was killed by him*. But the

general characteristic of transformation is that from a given form known to occur in a language one can derive another form which will also occur. Thus, *his killing of a snark* is also a transform of either of the preceding sentences. Moreover, *his not killing a snark*, *He did not kill a snark*, *He does not kill a snark*, *Has he killed a snark?* are all transforms of the above and of each other.

Transformation is useful too in reducing the vast number of related forms to basic forms, the basic form for the above being: *He kills a snark*, which Chomsky calls the *kernel sentence*. But the most important function of transformation is that it can carry on where IC analysis stops short of a complete explanation of a structure. For example, *the hunting of the snark* and *the chortling of the snark* have the same types of ICs and the ICs are also of the same form classes, both *hunting* and *chortling* being verbal nouns. But when we go to their kernel sentences, one is: *They hunt the snark*, while the other is: *The snark chortles*. The analysis is simple enough, but it is not of the type that has a place in the usual IC analyses.

The idea of the kernel sentence need not really be limited to a sentence and can be generalized to include any expression which lies behind an IC structure. Thus, what seems to be a very simple construction of $N_1 + N_2$ in English, where N_1 modifies N_2 and usually goes back to a kernel expression N_2 of N_1 , may in many cases go back to a variety of kernel expressions. Recently a radio announcer mentioned cases of *sex insecurity* in the government. From the context it was obvious that it had nothing to do with 'insecurity of sex', but meant 'insecurity in the national defence as a result of sex involvement on the part of government personnel'. In fact there is practically no limit to the variety of kernel expressions (including kernel sentences) which may be basic to a given IC construction.

Much work is currently being done on the transformational grammar of various languages, notably for English and Chinese, but a complete transformational or generative grammar of any language is still a matter of the future, and considerable argument is going on with respect to the theoretical bases of such grammars.

The preceding discussions are concerned with the general problems of morphology and syntax with which most languages are concerned. Further detail of morphological and syntactical types of various languages will be dealt with in chapter 7.

MEANING

§29. *Meaning or no meaning*

We are devoting a short chapter to the subject of meaning, not because meaning is unimportant, but because it is so important that all the other chapters will have something to say about meaning. For example, all citations of foreign words with translations are instances of reference to meaning. In this chapter we shall discuss only those problems in which meaning is more explicitly involved.

The world of meaning used to be a realm where philosophers rush in and linguists fear to tread. For the proper study of linguistics is language, that is, what language is rather than what language does. As soon as we start to inquire into meaning in language, so the purely formal linguist says, or used to say, we have opened our window to the whole world of things and we cannot render an adequate account of language short of taking up the whole range of human knowledge. That is why linguists have until recently played shy of meaning and stayed within the study of forms and their relations to one another. As David Rynin has observed, the linguist tends to shift the problem of meaning onto the shoulders of some other discipline and content himself with some more or less correct observations on the husks of language. (*Journal of Philosophy*, vol. 46 [1949], p. 373.) In a similar vein Bertrand Russell, in his *Mysticism and Logic* (London 1917, p. 75), has defined mathematics as "the subject in which we never know what we are talking about, nor whether what we are saying is true", though his views have changed somewhat since. Mathematics is language in a very special sense. But linguistics as the study of pure form is like mathematics in that it consists of defining in one big circle, a situation we already met with in connection with grammatical forms (p. 55).

Most linguists, however, take linguistics without meaning only as a starting point. It is sound methodology to study forms as

forms without first asking what they do. But by first taking very small, cautious steps, it has been possible to extend the scope of linguistics to the realm of meaning. For a starting-point, it is important to draw the line between meaning and non-meaning at the level of the morpheme. As we have seen, the morpheme, which usually has more than one phoneme, is the minimum form that *has* a meaning. Moreover, without undertaking to inquire into what meanings linguistic forms have, it is a useful and important second step to ask whether meanings are the same or different. This question is sometimes known as *differential meaning*. To be sure, one could claim that no two different linguistic forms have exactly the same meaning; that is a statement about the world of things. But in practice certain forms are used interchangeably and are accepted by the speakers of the language as having the same meaning. In this way the meaning of forms can be compared without, or before, actually undertaking the complicated task of systematizing the meanings themselves. Another step in entering the realm of meaning is to consider such features of things as are amenable to identifiable correlations with their linguistic counterparts. For example the world of integral numbers is fairly easy to manage, even though in some languages they are expressed with a certain degree of complication. Moreover, most peoples in the world use the decimal system of numbers, with corresponding linguistic forms, though languages vary in their simplicity or complexity in the naming of numbers. Another field is that of kinship terms. Terms of address vary, but the facts of genealogical relations, even if different types of societies are included, are systematizable and the linguistic forms for such facts, though both varied and complicated, can be clearly related to them.

So far we have treated meanings of linguistic forms as parts of the external world of which they are symbols. The word *dog* means the animal dog. The word is said to *refer to*, or *denote*, the thing and the thing is the *referent* or *denotatum*. But much of the meaning of language has to do with the attitude of the speaker toward the referent, toward the person spoken to, and toward his own act of speaking. This makes meaning in language a much more complicated matter than just symbols for things and of course much more interesting, as we shall see below.

§30. *Lexical meaning and grammatical meaning*

In a monolingual dictionary, every word is defined in terms of other words in the language. But if the user does not know the meaning of any of the words, the whole thing is defining in a circle, as we noted in the case of grammatical forms. It might seem that a bilingual dictionary should break the vicious circle by defining words in terms of the user's own native language. But how did the user learn the meanings of words in his own language in the first place? The popular conception about the acquirement of the mother tongue is that the meanings of words are learned by association with the things they mean. The mother points at the baby's shoes and says *shoes*, at a cat and says *cat*, at the baby and says *you*, and thus the baby learns to say *shoes*, *cat*, and to call himself *you*. Actually this is only a small and not very typical part of the picture. Most of the time, mothers, fathers, brothers, sisters, cousins, and aunts do not talk in single words and, when they talk in sentences, they do not talk mainly to the baby but with each other, though often within his hearing. Thus, the child acquires a facility with the language in all its normal formal features, without however necessarily acquiring at the same time the full meaning, or even any meaning, of what is being said with those linguistic forms. Meanings are learned in connection with the manifold situations in which the language is used and, as the child grows, what he has learned to repeat parrot fashion begins to mean more and more. The meanings of words, rather than sharply delineated objects like mosaics to be pieced together, are more like the parts of a blurred picture which are gradually brought into focus.

But the meaning of a linguistic form is not always that of a tangible thing or an observable event. Most languages have morphemes whose meanings have to do with the structure of the language itself or with the speaking situation. They are known as *grammatical meanings*. For example, the conjunction *and* means the co-ordinate mentioning of the forms before and after. The past tense morpheme in various shapes means the past time with reference to the time of speaking. The interrogative form, with or without special intonation, means that the hearer is requested to

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respond verbally in a certain way. From the point of formal linguistics, it is important to note that the grammatical meaning of a grammatical form is only a convenient summary of the *majority*, but not all, of the meanings that come in that form. Thus, the grammatical forms of the past, present, and future tenses in English verbs agree on the whole with past, present, and future time, but in *Men were liars ever*, *Business is business*, *Boys will be boys*, the actual meanings as to time are hardly relevant. Moreover, one important part of the grammatical meaning of the English present tense is that of timeless universality. That there is no grammatical distinction between a present tense in *I have a headache* and a universal tense in *I have a quick temper* is because there is no difference in the linguistic forms. Again, the grammatical meaning of the plural number finds exceptions in such cases as *scissors*, *trousers*, and American speakers say *in these United States* but *The United States has one vote*.

Languages vary in their use of different elements of grammatical form. Latin largely uses inflections. Chinese is said to depend mainly on word order, though the use of particles, or *function words*, the so-called "empty words", plays an equally important part. English comes somewhere in between. All such morphemes have mainly grammatical meanings.

§31. *Referential meaning and behavioural meaning*

Correlated, but not identical, with the distinction between lexical and grammatical meaning in language, is the distinction between the traditional concepts of *denotation* and *connotation*; so is C. K. Ogden and I. A. Richards' distinction between *referential* and *emotive* meaning (as developed in their *The Meaning of Meaning*, 8th ed. New York, 1947, pp. 10 ff.) and the more recently emphasized distinction between *referential* and *behavioural* meaning. For example *Give me that book!* and *Will you give me that book?* express the same request and the use or non-use of the empty word *will* makes a difference in the behavioural meaning of the sentence. Moreover, it makes a similar kind of difference if either of these sentences is spoken with a different intonation.

§32. *Sizes of lexical units*

The morpheme is the lower limit in the size of a unit of meaning. In most cases the meaning of a complex of morphemes is the sum of the meanings of the morphemes, counting the meaning of the grammatical elements as one of the morphemes. For example the meaning of '*tap* ,*water*' comes from the meanings of *tap* ,*water* and the meaning of the word order in the stress pattern '□ ,□, namely, modification. The meaning of '*water* ,*tap*' is the sum of the meanings of the same words, plus the meaning of '□ ,□ in a different order. The meaning of *I come* is that of *I*, i.e. the speaker, plus that of *come*, plus that of the predication, i.e. actor-action. Thus, it is possible for a dictionary to define words with complexes of other words and possible for a child to learn to understand a language by having heard only a small fraction of an unlimited number of possible sentences.

But in a fairly large minority of cases the meaning of the sum of morphemes is not the sum of their dictionary meanings. A *firebug* is not an insect, but a person. *To fall between two stools* rarely means actually to trip and fall down between two seats. A dictionary which aims at giving all the lexical information about linguistic forms not obtainable from that of their constituent parts should include such unpredictable forms, or *idioms*. To be sure, a dictionary planned for a certain size cannot undertake to include all idioms or to include all rare words. But the choice between the inclusion of common idioms like *in spite of* and single but rare words like *serratiostris*—whatever that means—should be decided on the basis of frequency of use. To some extent many dictionaries of moderate size do implicitly follow this principle of frequency. But apparently no dictionary seems to have been designed with a cutoff point between inclusion and exclusion, explicitly based on such a principle of choice, regardless of the size and complexity of the entries.

§33. *Homophony and synonymy*

We referred to differential meaning in connection with the identification of morphemes. Language would be a poor instrument of communication if differences in meaning were not reflected, on

the whole, by differences in form. But under the same form, there is usually much variation in meaning. Under most words in a dictionary one finds more or less related but different meanings numbered 1, 2, 3, etc., sometimes with subdivisions a, b, c, etc., under the numbers. For example Webster's *Seventh Collegiate Dictionary*, 1963, has under *serve* the meanings: "*vi* **1 a**: to be a servant **b**: to do military or naval service **2**: to assist a celebrant as server at mass **3 a**: to be of use **b**: to be favourable, opportune, or convenient . . . **7**: to put the ball in play (as in tennis)", which are the meanings of *serve* as *vi*, or intransitive verb; and there is also a set of numbered meanings under *vt*, or transitive verb. Each of these definitions is a *synonym* of the word *serve*. But since these are different, if related, meanings, they are not synonymous with each other, thus resulting in the paradoxical situation that things synonymous with the same thing are not synonymous with each other. The fact is that synonymy, like many other aspects of meaning is a matter of degree (see § 34). From the point of view of linguistic form, the word or morpheme *serve* is the same, with all its related extensions of meaning. In lexicographical practice, no attempt is usually made to make the defining word or phrase have the same emotive as well as referential meaning. *A featherless biped* certainly does not have the same connotations as *man*, nor does *man* seem to have quite attained the status of *a rational animal*.

If what seems to be the same morpheme has different sets of meanings, as for example *let*, with meaning (a) 'to cause to', 'to permit', etc., and meaning (b) 'to hinder, to prevent' (cf. without *let* or hindrance), then it should be regarded as separate morphemes. In the case of *let*, it came from (1) Middle English *leten* (< Old English *lāetan*), and (2) Middle English *letten* (< Old English *lettan*). They are, therefore, not only different morphemes, but different etymons. But even if one and the same phonemic make-up came historically from the same origin but has diverged clearly into two or more separate groups of meanings, as for example in *humour* (a) as 'fluid' and (b) as in 'sense of humour', then, so far as descriptive linguistics of a language at one stage is concerned, it is best treated as a case of separate morphemes, thus resulting in *homophones*, or *homonyms*.

The most important cases where homophony has to be recog-

nized are those in which the morphemes belong to different form classes. Thus, what is phonemically /tu:/ is to be differentiated into three homophones *to*, *too*, *two*, not because they are spelt differently, nor principally because they have different derivations, nor only because they have unrelated meanings, but also, and very importantly, because their grammatical behaviour as preposition, as adverb, and as numeral, respectively, are very different. Moreover, because *too* (excessively) and *too* (also) behave differently as to word order, they should be treated as different morphemes, belonging to different form classes, even though they are both adverbs.

Both synonymy and homophony can exist between longer forms than single morphemes or words. When *man* is defined as 'rational animal', we have synonymy between word and phrase. In the frequent ambiguities arising from the linear nature of ICs of the *narrow gentleman's comb* type, we have homophony between phrases. More complicated and less frequent are examples like the now well-known: *The sun's rays meet.* : *The sons raise meat.*

§34. *Degrees of meaningfulness*

Differences of meaning are a matter of degree. Moreover, the meaningfulness of linguistic forms itself is also a matter of degree. On the whole, greater length means more, though of course a talkative person can talk at great length without saying much. Single phonemes, as we have seen, are usually not morphemes and therefore have no meaning. A sentence usually says more than a word and a paragraph says more than a sentence. To be sure, a famous saying or a crucial command in a critical situation may mean more than a lengthy political speech. But other things being equal, length is a rough measure of the amount of meaning. Secondly, the greater the variety of forms of a given type, the more meaningful is each of the forms. For example there are altogether a few hundred common first names in English and one says "it doesn't mean a thing" when one calls an acquaintance *Charlie* or *Margaret*. On the other hand, in what corresponds to first names in Chinese, the total variety is as great as the general lexicon and, even barring such unlikely names as *Damnfool* and *Chopsuey*, the possibilities

are still of the order of millions. It is, therefore, quite common among Chinese friends to be very late, if at all, before they start to call each other such names as *Shēnhuá* or *Měilù*, because each of these names would “mean much more”. Thirdly, redundancy in language is a negative factor in meaningfulness. For example, Esperanto has *tiuĵ bonaj amikoj* ‘those good friends’, where the plural ending *-j* (pronounced like English *y*) occurs three times without any more meaning than the English phrase where the plural ending */z/* occurs only twice. Redundancy, in the information theory sense, need not be in the form of exact repetition. When one can anticipate what’s coming from reading *I should be much obliged to you* without reading on to *if you would kindly*, then the latter is redundant and therefore means little. Similarly, *Journ. Acoust. Soc. Amer.* means as much as *Journal of the Acoustical Society of America*, there being redundant parts in the long form, which add little to the meaning. Finally, frequency of occurrence is another negative factor for meaningfulness. Thus, *I, this, it* is mean less than *very good* and *goodbye* which in turn mean much less than *Thief!* and *Fire!* Common forms of greeting mean less and less as they are used more and more, but when literally translated into another language they will usually have full meaning again. Thus, if you ask a casual acquaintance you meet on the street *How are you?* he may as likely as not answer *How are you?* in return. But if one said that to a friend in Chinese in China, he might answer *I am all right, why?* just as an Englishman would be surprised if greeted on the street with *Have you had dinner?* not knowing that in Chinese the expected reply is *Have you had dinner?* or *Yes, I have, have you?* (even though he hasn’t).

§35. *The structural analysis of meaning*

The disparity in meanings between languages noted above is a constant problem in translation. Recent increased interest and activities in machine translation have accelerated linguists’ concern with meaning and a development in the direction of a structural approach, as for example in the work by Sydney M. Lamb in his paper on “The Semantic Approach to Semantics”, *American Anthropologist*, vol. 66, pp. 57–8 (1964). In such a theory an

element called the *sememe* is set up, which is parallel to the phoneme, morpheme (and lexeme) on the formal side. A sememe is said to be represented by lexemes at a lower level, as for example in the following (where the words in quotes are to be taken for their meanings and those in italics are the linguistic forms):



Thus, sememes and lexemes are usually not in one-to-one correspondence, but mostly many-to-many correspondence. From patterns of occurrence it may be possible to tell when a particular lexeme represents more than one sememe. For example the lexeme *big* in *big rock*, *big sister*, *big fool* seems to "mean the same thing", but from the three different types of distribution in the following:

big rock	the rock is big	how big a rock
big sister	(*the sister is big)	(*how big a sister)
big fool	(*the fool is big)	how big a fool

where the forms in parentheses following "*" are non-existent, we can see that there are three different sememes, which can be given as 'big₁', 'big₂', and 'big₃'. Further, 'big₁' and 'large' belong to the same sememe.

Some sememes refer to grammatical features. For example, the 'agent' sememe is represented in various ways lexemically: by order (agent preceding the action), by *of* (as in *the crying of the baby*), by the suffix *-er*, etc.

Much of recent work in this direction may remind one of the relatively old concepts of differential meaning, of studies in homophony and synonymy, and of resolution of differences of meaning through differences in transformations. What is new and promising lies in the work of actually setting up categories of sememes and lexemes in more rigorous forms than have hitherto been attempted.

CHANGE IN LANGUAGE

§36. *The fact of linguistic change*

Whether or not a country has an official standard for its national language set and maintained by an academy or in the form of dictionaries and prescriptive grammars, the actual language of its speakers keeps changing, not only from generation to generation, but also during the lifetime of a single person. Language being a set of habits maintained chiefly through the interaction between members of a speech community, it will change if the frequency of intercommunication is diminished. Therefore, instead of asking why does a language change, a more natural question is to ask why should a language remain as stable as it is? Habits change, things are forgotten, people drift apart, and it is remarkable that language does not change faster than it does.

Like the principles of geological change which Sir Charles Lyell (1797–1875) discovered to be valid for all time, at present as well as in the past, linguistic change takes the same forms in all the languages in almost all ages, the difference being chiefly in different applications to different languages—in *almost* all ages, because recent advances in the technology of mass media have accelerated the pace of intercommunication and thus retarded the change of language in time and diversifications of languages and dialects in space. We shall now consider some of the most important factors in linguistic change and the types of change.

§37. *Phonetic law*

The most striking thing about the sounds of related languages is the great regularity in their correspondences. It is in fact more on the basis of regular phonetic correspondences between contemporary languages than those between two known stages of the same language, say Old English and English, that the genetic relations between languages have been established. For example, French

pied, English *foot*, Fr. *père*, E. *father*, Fr. *trios*, E. *three*, etc., and after meeting with hundreds of such correspondences between the two types of languages, we summarize the result by saying that there is a *phonetic law* to the effect that voiceless stops in the Romance languages correspond to voiceless fricatives in the Germanic languages. In particular the consonantal correspondences of the Germanic languages as formulated by Jakob Grimm in his *Deutsche Grammatik* (1822), which has come to be known as Grimm's law, has been a model for subsequent work in the field of comparative study of languages. Because of their high degree of regularity, it is sometimes said that phonetic laws have no exceptions. When an apparent exception is observed it can often be explained by a more accurate statement of the conditions of phonetic change. For example, Latin *centum* /kentum/ > French *cent* /sã/, where /k/ becomes /s/ because of the following (originally) front vowel, but remains /k/ before other vowels as in *cordem* /kordẽ/ : *cœurs* /kœ:R/. Another common type of exception is that of borrowing. For example, Old Germanic *sk-* regularly becomes English *sh-*, but the word *skirt*, being a borrowing from Old Norse *skyrt*, does not take the form *shirt*; the latter does indeed exist as a separate word in English derived by regular phonetic change from Old English *scyrte*, and both words ultimately derived from the same Indo-European root **squer-* 'cut'.

It should be emphasized that in phonetic law, systematic regularity is much more important than mere phonetic similarity. For example, German *Riesen* 'giants' has nothing to do with English *reason*, nor German *Last* 'load' with English *last*. But Latin *aqua*, through the regular steps such as *ewe* (c. 1150) and *eaue* (fourteenth century) becomes modern French *eau* /o/, with many other parallel changes. Similarly, archaic Chinese *ni* 'two', through /nɿ > ɿ > ʐi > ɹ > əɹ > ɑɹ/, finally becomes modern /ɑ/ in the modern Yangchow dialect, all the steps being reflected in other parallel changes, geographical as well as historical. If /ni/ can change into /ɑ/, then practically anything can change into anything.

Since phonetic law has reference to historico-geographical conditions, it is not the kind of timeless law as understood in natural science, which is not normally conceived as being dated with

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regard to the time of its validity. A phonetic law is thus like a man-made law in being valid only between the time of its enactment and its repeal. On the other hand, it is partially like the laws of nature in that it is a generalization of observed phenomena and not subject to the arbitrary will of people, even though speech itself is voluntary behaviour.

§38. *Changes from mutual influence of sounds*

In stating the scope of phonetic laws it is usually found necessary to limit the conditions of change, such as Latin *k* > French *s* before front vowels, but > *k* before other vowels. The difference in the changes can usually be attributed to the influence of one sound on another, in some cases on the re-organizing of phonetic values into phonemes. In the case cited, probably at some stage of the change, Latin or Vulgar Latin had a fronted *k* before front vowels and a back *k* before back vowels, just like the *k* of English *keep* and *cool*. There are many types of mutual influence of one sound on another in the near environment. The most common kind is that of *assimilation*, as in that between a consonant and a following vowel in the cases just cited. Again, in the negative prefix *in-* the ending *-n-* is assimilated to the following sounds, resulting in *impossible*, *illegal*, *irregular*, etc. The same is true of the homophonous *in-* in *impress*, etc. Note that all of such processes of change do not occur equally in all languages at all times, as we have noted. According to E. H. Sturtevant, in the time of Classical Latin, say that of Cicero, the assimilation of a final *-n* to a following sound occurred not only within a word, but also between words, though not shown in the orthography. Thus, what was written *quam laetus* 'how happy' was actually spoken as *qual laetus*. This type of assimilation is known as *regressive assimilation*, as the influence acts from a following sound on the preceding sound. Similarly, when Latin *-gn-* was pronounced /ɲn/, as in *magnus* /maɲnus/, the change of the voiced stop /g/ to a nasal /ɲ/ is a case of regressive assimilation. On the other hand, when French *piéd* /pje/ is often pronounced [pçe], the voicelessness of the initial /p/ is carried over to the following semivowel /j/, making it a voiceless fricative, it is a case of *progressive assimilation*.

Since sounds are bundles of distinctive features (pp. 43-44), assimilation may be described as a shifting of the strands of features in time. Thus, the French [pje] → [pɕe] for *pied* involves a shifting of the voiceless-to-voiced line by one segment too late. The American English [k'æ:nt] → [k'æ:nt] (or [k'ɛ:nt]) for *can't* involves a shift of the velum-up-to-down line by one segment too soon. In the case of the *r*-colouring of a preceding vowel in American English the feature of tongue retroflexion is completely simultaneous with the "preceding" vowel if it is mid as in *her* [hə_r] but will be after the vowel if it is high, as in *fear* [fi:^r] (remembering that a subscript is adjectival and a superscript is additional). Note however that in Mandarin Chinese this last condition applies only to the high front vowels [i] and [y], but not to [u], so that a phonemic succession of /u/ and /r/ is realized as an *r*-coloured *u*, as in [kũ_r] 'drum'. The reason for the difference is that, while the tongue cannot at the same time be high front and curled back, there is nothing incompatible between curling the tip of the tongue for the *r*-sound and raising its back and rounding the lips for the *u*-sound. This general tendency for sounds to be bundled together I call the *simultaneity of compatible articulations*. As a tendency it is of course by no means true of all cases. Thus, final *r* is simultaneous with low and mid vowels, as well as high *back* vowels in Chinese, but only with low and mid vowels in American English. For example, Mandarin [p'ù_r] 'a store', but American English [p'u^r] 'poor'.

Dissimilation is a much less common phenomenon than assimilation and usually occurs when a speaker finds two identical or similar sounds difficult to make in immediate or close succession. Thus, *pilgrim* came from Late Latin *pelegrinus*, which was the dissimilated form of earlier *peregrinus*. Again, ancient Chinese had many syllables ending in -p, which is preserved in most cases in modern Cantonese, as in ancient *šjəp* > Cantonese *shap* 'wet'. But when the initial was a labial consonant, then the labial ending was dissimilated into a dental, so that *pjwəp* > *faat* 'law, method', instead of the expected **faap*.

Note that assimilation and dissimilation, like other changes in language, is a general phenomenon limited to certain conditions and time and not a universal law of language. To a speaker of

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English, for example, nothing seems so inevitable as the change of /n/ into /ŋ/ before a /k/ or /g/, as in *sink* /sɪŋk/ and *bingo* /bɪŋɡou/, so much so that he hardly notices the difference, and yet in Russian *bank* 'bank' is /bank/, with a clear and strong dental /n/ and never /bæŋk/, as in English.

Following are some types of change from mutual influence of sounds which are common but not as generally applicable as assimilation. *Anticipation* is the formation of a sound or a sound feature which is in a later part of the word or sentence. Thus, when once I asked the name of a street and was told that it was *Voosevelt Boulevard*, the speaker said *v* too soon. Anticipation also results in permanent changes, as for example in Latin *quinque*, which should theoretically be **pinque* (cf. Eng. *five*, Germ. *fünf*, Greek πέντε), but the *p*- was assimilated to *qu*- in anticipation of the following *-que*.

When two sounds are interchanged within one word, there is *metathesis*, as for example when Latin *parabola* 'word' appears in Spanish as *palabra*. When a Chinese speaker of English says *lore* for *roll*, it is not a case of methathesis, since in his English there is no initial *r* and final *l* to interchange in the first place. If, however, a native speaker of English should imitate him and start a fashion, then it would be true metathesis.

When the interchange is between different words in a sentence, it is called *spoonerism*, after William A. Spooner (1844–1930), who was reputed to have proposed "a toast to our very *Queer Dean*" and to have reprimanded a student at King's College by saying: "You have *tasted* *two worms*, and that's enough." While metathesis often results in permanent forms of words, a spoonerism usually occurs as a temporary slip and the speaker often stops and corrects himself before it is completed.

Haplology is the telescoping of parts of a word where there is a repetition or near repetition of a syllable. Examples are *Anglaland* > *England*, *Worcester* > /wʊstər/, *simply* > *simply*. The words *library* and *necessary*, especially as spoken in Southern England, are often heard by foreigners as *libry* and *nessary*. But when they repeat the words as such, they do not sound right, since there should be a lengthened *r* and *s*, respectively, in those words. It shows that foreigners notice the beginning stages of haplology in those words, when there is as yet no complete haplology.

Fusion is the telescoping of two different syllables, often representing separate morphemes, into one. Examples are *don't* ← *do not*, *won't* ← *will not*, *ça* ← *cela*, lit. 'that there'. In languages written with one character to a syllable, such as Chinese, the fused form will also be written with one character, often consisting of the original two characters squeezed into the space of one, as in the Soochow dialect word *fen* (𢇛) 'didn't' from *fe* (勿) 'not' + *zen* (曾) 'did'. Fusion sometimes occurs across grammatical boundaries, as in Ancient Chinese *ngi'u tsi ?iwo d'uo* 'met him on (the) way', where *tsi ?iwo* (之於) is fused into *tsiwo* (諸), standing for 'him on', 'them at', 'it in', etc., which is not even a grammatical constituent. Likewise, French *du* ← *de le* and *au* ← *à le* are also across grammatical boundaries. Nearer home, though only in a very informal style of speech, one hears *wyncha* (as in *Wyncha tell me?*), which is also not a grammatical constituent.

Aphaeresis is the loss of an initial, usually unstressed, part of a word or phrase. Examples are: 'bye! ← *Good-bye!*, 'morning! ← *Good morning!*, 'nabend! ← *Guten abend!*, and the obsolescent *Zounds!* ← (euphemism for) *God's wounds!*

§39. *More distant influences*

The types of change illustrated above are from influences which may be called syntagmatic, since they are found in close or near environment in speech. Following are changes from influences which are paradigmatic, in a wide sense, as they are found in separate instances of speech. The most important type is that of *analogy*. From *stone* : *stones* = *cow* : *x*, the influence of analogy created *cows*, which has now displaced *kyne*. Analogy is of course continually at work. Children of today say *oxes* for *oxen*, *throwed* (or *frowed*, from substitution of *f* for *th*) for *threw*, and adults waver between *has sewed* and *has sewn*. These are indications that such changes are going on all the time. As usual, various stages of an analogical change are reflected in the speech of various classes in dialects. In south-eastern United States, for example, speakers of the underprivileged classes—this is a term in sociological linguistics—say *I seed you*, while the majority of the people are still at the stage of saying *I saw you*.

A special case of analogical change, known as *folk etymology*, or *popular etymology*, is the substitution of a form better known to the speaker than the existing form, as in *flatform* instead of *platform*, *sparrow-grass* instead of *asparagus*. Note that the term as used here does not mean a popular, wrong understanding of an etymology, such as interpreting *outrageous* as having to do with *rage* (actually *-age* is the suffix for an abstract noun), but involves a change in the form of the word.

Overlapping folk etymology are cases of *blend*, or *contamination*, in which two different forms are blended into a new one. While blends are often made up in fun, as the English *slanguage* (after John Kendrick Bangs), *alcoholidays*, *sextraordinary*, *insinnuendo*, many have come into the general vocabulary and their users are often not even aware of their mixed derivation. Examples are *smog*, from *smoke* + *fog*, and *glimmer*, probably from *gleam* + *shimmer*. The case of *tangelo* is still new enough to be transparently from *tangerine* + *pomelo*, at least to those who know what pomelos are.

A *back formation* is one in which a new form is created by changing an old inflected or derived form, often with different grouping of ICs, into a supposed primary form. Thus, in *Christmas shopping* and *sight seeing* the ICs are 1 + 2 (shopping for Christmas, seeing of the sights). By changing the ICs to 2 + 1, as if the suffix *-ing* were in construction with the rest, we get, as we sometimes hear, *to Christmas shop* and *to sightsee*. Other examples are *was stage-managed* (from *stage manager*), *successfully forced-landed* (from *forced landing*). Sometimes a bound form is made free without involving any problem of ICs. For example, H. G. Wells speaks of making illicit love impossible "by making almost all love-making licit" (*Autobiography* [New York, 1934], vol. II, p. 109).

§40. *Influences between speaker groups*

Different groups of speakers, be they age groups, social classes, dialect groups, or speakers of different national languages, have of course always had some degree of intercommunication and thus influence one another's speech.

(1) The most important case is the influence of parents on children. This is of course the way a language is transmitted and

maintained. One interesting factor in the adult to child transmission is the disparity in the size of their speech organs. When an adult says *ah* [a] and a child imitates him, the closest approximation is obtained, not by placing the speech organs in exactly the same position, but by placing the tongue in a higher and more back position in the direction of *aw* [ɔ], because if the child used the same articulation the adult uses, the result would sound "shallow" and more like [a] or [æ]. This difference in habit is carried over to adulthood when the child's speech organs have grown to full size, thus resulting in a different set of sounds in the new generation. This has in fact been adduced as an explanation of the historical raising of the vowels in many languages such as Old English *stān* > modern English *stone* and Ancient Chinese *kā* /ka/ > modern Southern Mandarin /ko/ 'older brother'. This explanation, however, is short of the whole story in two respects. In the first place, a child does remember sounds as well as habits of articulation and as he grows older he will try to keep a close approximation to the language he hears around him, with imperceptible readjustments in articulation in doing so. Secondly, the difference in size in the speech organs between a child and an adult is much less than that of their bodies. By the time a child has begun to speak, his speech organs are much nearer to normal size than they are often assumed to be. (Cf. p. 167.) Notice how children in ancient paintings often look like grown-ups. That is because the ancient painters often failed to paint the heads of children in true proportion and the true proportion should be out of proportion for adults.

(2) Education of course plays an important part in the influence of one group on another. So does writing, by which not only contemporary speakers but also peoples of different periods in history influence one another's language. These factors usually work in the direction of conservation rather than innovation and thus are to be considered factors for change only in an algebraic sense. But occasionally it works the other way, too. Many cases of so-called spelling pronunciation are innovations arising from using hitherto unknown forms: *often* /afŋ/ giving rise to the formerly non-occurring /aftŋ/. A curious case, reported by E. H. Sturtevant, of a back formation from spelling (mis)pronunciation is the verb *to*

unsh from *unshed* (tears), and I myself, as a non-native speaker of English, was surprised to learn that I was not the first to have invented the verb *to misle* (rhyming with *drizzle*) from the written form *misled*. Similarly, *bedraggled* has been analysed and pronounced as *bed-raggled*.

A special type of group influence is known as *hyperurbanism*, or the overcorrection on the part of a speaker of a dialect in trying to learn a supposedly higher form of speech. Thus, when a speaker of Cockney English tries to put *h*'s in his speech, he overdoes it and puts in *h*'s where "Received English" has none. That is how Eliza of Shaw's *Pygmalion*—or rather Alan Jay Lerner's movie version *My Fair Lady*—both hyper- and underurbanizes when she says "In 'ertford, 'ereford and 'ampshire, 'urricanes 'ardly hever 'appen".

(3) The most important type of group influence is that of *borrowing* between dialects and languages.

(a) The commonest form of borrowing is that of direct borrowing of words. When waves of romance words were brought to England by invading speakers of romance languages, thousands of foreign words were added to the Anglo-Saxon stock by way of borrowing, although that did not make English a romance language. Another case of large-scale borrowing is that of Chinese into Japanese, Korean, and Vietnamese, along with the system of writing. It should be understood that the mere use of the written character is not linguistic borrowing. For example, when the Chinese character 三 is used for the Japanese abstract numeral *san*, it is a borrowing from Chinese, but when the same character is used to write the native Japanese numeral *mitsu* /mitu/, no borrowing is involved, any more than English has borrowings from Phœnician because the English alphabet derives from ancient Phœnicia. When the ultramodern Japanese make up a character 女上, consisting of the Chinese characters for 'woman', 'up', and 'down', and calls it *erebetā gāru* 'elevator girl', it is not a borrowing from Chinese, but a borrowing from English.

The borrower of foreign words is often criticized for pronouncing a foreign language inaccurately. But in real borrowing he is not trying to speak the foreign language to begin with, but is adapting foreign words to his own phonemics. A *menu*, as if spelt *maynew*, is a list of dishes, whereas French *menu* /mæny/ often means a

'complete dinner' and a menu, in the English sense, is called *la carte*. What is called a *detour* /'di:tʊr/ in America is more often called *déviatiôn* than *détour* /de'tu:r/ in France. The sign パーマ (*pāma*) which appears in many streets of Japan is not, as I at first thought, that of a chain store run by a certain Mr Palmer, but an abbreviation of *permanent*, which, when borrowed into Japanese as *pāmanento*, is often displayed prominently on the signboards of beauty parlours.

(b) Large-scale borrowing of foreign phonetic values or phonemic distinctions are rather rare. A well-known example is the borrowing of the soft-sounding uvular [ʀ] of the salons of France by the Germans, which has since become the majority type of *r* used in Germany. The only borrowings of foreign sounds which are at all common in English are those of the French nasal vowels and the Scottish and German *ch* /x/. Thus, one speaks of fugues by Bach /bax/, symphonies by Saint-Saëns /sēsāns/. But even this usage is by no means followed by all literate speakers of English and many (even including those who can speak French or German with those sounds) would say /bak/ for Bach and /sənsəns/ for Saint-Saëns in an English context, in other words, they stay within the normal inventory of English phonemes. This is also the case when one says: "Mayor [wægənɹ] went in a [votksvægən] (Germ. [foltksvægən]) to see an opera by [vægənɹ] (Germ. [vaxnɹ] or [vaknɹ])", where no phonetic borrowing is involved, since only the nearest English phonemes are used in saying the foreign words or names. Another borrowing of a non-English phoneme is that of the Hawaiian glottal stop in the word *Hawaii*. One can usually tell whether a person has lived in the islands by noticing whether he says /ha'vaj?i/ instead of the usual /ha'waji/ or /hə'wajə/, to which an old timer there would retort with *I am very well, thank you!* While /v/ is a common English phoneme, the glottal stop, though often occurring as an expressive element, is never used as a distinctive phoneme. It would be interesting to speculate whether the fashion of saying Hawaii with a *v* and a glottal stop will decline with the acquiring of the status of the State of Hawaii.

(c) One common form of borrowing, especially in scientific terminology, consists of translating literally a foreign compound word or phrase into the native language. This is known as *calque*,

or *translation borrowing*. Thus, when the English use Latin roots to form the word *education* it is a borrowing, but when the Germans translate *e* (< *ex*) as *er-*, *duc-* as *zieh-* and *-ion* as *-ung* and make up the word *Erziehung*, it is a translation borrowing. A more subtle but common form of translation borrowing consists in the use of a word in an extended sense of the translating word. For example, Chinese *wéimào* 'delicate (of things)' is now extended to 'delicate (of situations)', and *wéich'ih* 'support (maintain)' is now extended to 'support (a motion, a candidate, etc.)'. Such extended uses of the words were at first simply bad translations but have later come into general journalistic usage. Translation borrowing of forms longer than compound words is less common, though by no means rare. In *that goes without saying*, most speakers are hardly aware that it came from French *ça va sans dire*.

(d) *Grammatical borrowing*, or *structural borrowing* is less common than borrowings of words or translation borrowings. Hockett (*Course* 415) cites loans of what he calls functors, or empty words, from Scandinavian into English, as *they*, *their*, *them*, *both*, *some*, *till*, *fro*, *though* and the third person singular ending of verbs /z s əz/ as being possibly of Scandinavian origin. Old English had endings with /θ/, still surviving in archaic forms like *goeth*, *doth*, etc.

Borrowing of other grammatical forms such as word order is much less common. When a headline announces *England Side Captain Selection Difficulty Rumour*, cited in Sir Ernest Gowers, *The Complete Plain Words* (London, 1954, p. 103), it is probably an extreme case of the modifier-modified English word order rather than any possible influence from, say, Chinese, where such a word order is not only common, but also obligatory. A clear case of structural borrowing, in the reverse direction, is that of a nominal expression modified by a prepositional phrase, of the *Alice in Wonderland* type. This is quite common with the word *tsai* 'to be at', which is now much used in the English word order, as in *Shüitsai tsai Nánfāng*. Normally, this means 'A flood is in the South', but in current journalistic style this is a nominal expression, meaning 'Flood in the South'. Such a structural borrowing, however, has not yet invaded the style of everyday spoken Chinese.

For further discussions on group influence see § 59 on minority languages and bilingualism (pp. 144-8).

LANGUAGES OF THE WORLD

§41. *The classification of languages*

Languages may be classified according to (1) genetic relationship, (2) their types of structure, or (3) their political or geographical distribution. The three aspects of a language are to some extent correlated, but in principle are quite distinct. For example, many of the languages of South-east Asia are similar in having tones, though they are not all genetically related. In Belgium French is official in Wallonia and Flemish in Flanders, with Brussels officially bilingual; at the same time French is also the language of France.

1. *Genetic classification.* The most important kind of classification of languages is according to genetic relationship, which has until recently constituted practically the only kind of serious comparative study of languages. Because most of the study consists of the comparison of words of the same origin, it is sometimes known as *comparative philology*. Take for example the words in Table 3. The similarity of the various forms is quite obvious, and the list could be extended on and on through the greater part of the lexicons of these languages.

Table 3. *Examples of cognate words*

French	Spanish	Portuguese	Meaning
main [mɛ̃]	mano [māno]	mão [mɛ̃u]	'hand'
deux [dø]	dos [dos]	dois [dojʃ]	'two'
homme [ɔm]	hombre [ombre]	homen [ɔmɛj]	'man'
livre [livʁ]	libro [liβro]	livro [livru]	'book'
blanc [blā]	blanco [blāŋko]	branco [brɛŋku]	'white'
chose [ʃo:z]	cosa [kosa]	cousa [kozə]	'thing'
dent [dā]	diente [djente]	dente [dɛntə]	'tooth'

The commonly held theory in cases like these is that the languages in question have *descended* from a *parent* language, or

that they have all branched off from a common *proto* language, like branches from a tree. French, Spanish, and Portuguese are thus descendants of a postulated Proto-Romance, from which Italian, Rumanian, and a few minor languages are also living descendants. Groups of languages which are believed to descend from a proto language are said to form a language *family*. Thus, the five languages mentioned above are the best known members of the family of the Romance languages. Words such as those in the same rows in Table 3 are similar because they are *cognate* words, i.e. have descended from the same origin. They are said to belong to the same *etymon*.

Further comparative study may reveal that a language family such as the Romance is in turn related to another group of languages, thus leading to the postulation of a still larger family of which our original group is but a sub-family. This is indeed the position of the Romance languages in relation to other groups like the Germanic, Slavic, Greek, Iranian, and Indic languages, all of which, together with the Romance languages, form the sub-families of the *Indo-European* family of languages, so-called because they comprise most (but not all) of the languages of Europe and the languages of the greater part of India. When languages are classified according to origin, as described above, they are said to be genetically related. When two languages are said to be related, it is usually genetic relationship that is meant.

2. *Typological classification*. Languages can be compared and classified according to their types of structure, regardless of whether or not they are genetically related. This method of classification constitutes the *typology* of languages. By this method one may inquire, as we noted, whether a language has tones among its phonemes, whether stress is phonemic, whether it has grammatical inflections, what the composition in its word units is like, etc. The best known system classifies languages into the following types: (a) *isolating*, (b) *inflectional*, (c) *agglutinative*, and (d) *polysynthetic*.

An isolating language is one in which all words are simple roots. Chinese is a classical example, or rather, Classical Chinese is an example, since modern Chinese has moved a considerable distance away from the status of having one root morpheme to one word. Agglutinative and inflexional languages are similar in that they

both make use of grammatical morphemes, or affixes, and to a lesser extent reduplication (which is sometimes regarded as a form of a prefix), phonetic change, and modulation (cf. § 25), to show derivation and grammatical relationships. Inflectional languages differ from agglutinative languages, however, because they fuse two or more roots and affixes into variant forms, while the latter keep all morphemes separate in a string, though still bound together—agglutinated—into more or less long words. Besides such well-known inflectional forms as in Latin, where person, number, and tense are all fused into one morpheme, e.g. the suffix *-i* in *veni, vidi, vici*, let us compare the treatments of the plural forms of words for 'book' in Russian and Mongolian:

	Russian	Mongolian
Nominative	knjŋgi	nomuud
Genitive	knjŋg	nomuudiin
Accusative	knjŋgi	nomuudiig
Dative	knjŋgam	nomuudad
Instrumental	knjŋgamji	nomuudaar

In the Russian forms two different grammatical functions have combined into one morphologically simple form: the function 'plural' and 'dative' are combined in the single morph /-am/. In the Mongolian forms these are kept separate; 'plural' is represented by /-uud/ and dative by /-ad/. Furthermore the case endings are the same for the singular. In agglutinative languages affixes are often added one after another, forming highly complex forms. For example, the Turkish form *çocuklarınızdan* 'from your children' consists of *çocuk* 'child', *-lar* 'plural suffix', *-ınız* 'your (pl.)', and *-dan* 'ablative suffix'. In inflectional languages stems and suffixes frequently fuse in irregular ways: the stem of the word for giant in Classical Greek is /gigant-/; when the nominative singular ending /-s/ is added, the resulting form is /giga-s/. In some cases the stem may take a completely different form when it occurs with a particular suffix; e.g. the past perfect form of the Russian verb /itj/ 'to go' is /ŋol/ where /ŋ-/ represents the stem and /-ol/ ~ /-el/ the past perfect ending for masculine singular.

Polysynthetic languages are those in which a large number of morphemes, some of which are less than a syllable, are bound into a single word. For example, in Menomini, one of the Algonquian

Indian languages, the word *akuapi:nam* 'he takes it from the water' consists of the root *akua-* (no, it is not the root for 'water', but means:) 'removal from a medium', and the suffixes *-epi:-* 'liquid', *-en-* 'act on object by hand', and *-am* 'third person actor' (example from Bloomfield, *Language*, p. 241).

Typological classification was very much the thing during the nineteenth century, until rapid advances in rigorous historical methods brought it into relative disrepute and overshadowed it both in the quality and quantity of linguistic research. But due to more careful systematization of recent linguists, typology is coming back to its own and will be more taken into account by historical linguists. (For more on this, see Lehmann's *Historical Linguistics*.)

In some instances of what have commonly been known as language families, the relationships between the languages have been established more on typological than on strictly genetic grounds. The Sino-Tibetan family, for example, is postulated essentially on the basis of certain phonological similarities (tones, tendency to surdation, i.e. unvoicing of voiced consonants), tendency to have monosyllabic morphemes, lack of an elaborate morphology, etc. Between different languages of this family there are relatively few clearly established cognates, as in the case, say, of the Romance languages, in which the greater part of the lexicon of any one of them have easily identified cognates in any one of the other members of the family. Moreover, in some of the apparent cognates in the Sino-Tibetan family, there may have been cases of borrowing rather than genetic relationships, and most of the phonetic correspondences by which genetic relations are to be established are rather meagre. In the case of the Altaic family of languages (which include Turkish, Mongolian, and Tungus) there is the same lack of detailed historical data, though to a lesser degree.

3. *Politico-geographical classification.* Although it may seem unscientific to classify languages according to their political status and geographic spread, these factors are linguistically relevant, because the fact that languages are spoken by particular groups in certain places will be reflected in the languages themselves. National languages follow political states on the whole, whether standardized formally, as in France, or in practice, as in Germany,

while at the same time the speech of the common people often diverges from the common language more or less widely. In the case of the dialects of Chinese, they are phonologically as divergent from one another as German from Dutch or French from Italian. But the historical association of the speakers of the dialects has always been maintained not only by the use of a common system of writing, but also by the use of a common classical idiom, based on a common body of literature, and more recently by the general use of a common modern dialect, usually called Mandarin, so that there is a linguistic sense as well as a politico-geographical sense in which one can speak of the Chinese language.

On the other hand, cases are common where one language is the national language of more than one country or one continent, or where a political state will have more than one language or even more than one family of languages. One can say for example that the sun never sets on the English language, with all its different national representatives. German is spoken in Austria and part of Switzerland as well as in Germany. On the other hand, a speaker of a Dravidian language in southern India, if he is willing to learn and has learned Hindi, speaks it as a foreign language, quite unlike the case of the Cantonese editors of San Francisco newspapers who compose their editorials (*sotto voce* in Cantonese pronunciation) in Mandarin. We shall come back to this when we take up the questions of standard language and dialects and of bilingualism.

4. *Universals of language and language classification.* Before we proceed to describe the families of languages of the world, classified mainly on genetic relationships, we have to consider the question of the *universals of language*, features of language which are common for all mankind. The problem of common vs. individual traits of languages has been well explained by Antoine Meillet (1861-1936) in his *Linguistique Historique et Linguistique Générale* (Paris, 1926, 2nd ed.). If, for example, all languages have voiced and voiceless sounds, if all languages have recurrent identifiable units, etc., while such traits will be of general linguistic import, they will be of no use for telling one language from another and it is by the non-universal aspects of language that we can classify the different languages. However, as soon as we leave the few obvious points mentioned above, there is less certainty about the validity

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of what are usually regarded as universals of language. Following is a good summary of them by Samuel E. Martin in his review in *Harvard Educational Review* (vol. 34, no. 2, 1964, pp. 354-5) of Joseph H. Greenberg's *Universals of Language* (Cambridge, Mass. 1962). (The exact wording and examples are mine.)

(a) All languages have sentences made of expressions of at least two kinds—nominals and verbals: *John has come*.

(b) All languages have adjectival expressions which modify nominals: *good food*; and adverbial expressions which modify verbals: *very good*.

(c) All languages have devices for converting some or all verbals into nominals: *shrinkage*. Many languages have devices for converting at least some nominals into verbals: *typify*.

(d) All languages have devices for converting verbals or sentences into adjectivals: *singing kettle*; *kettle that sings*.

(e) All languages have devices for the linking of nominals and verbals: *heaven and earth*; *sink or swim*.

(f) Many languages have dummy elements as substitutes: *John likes to dance, so do I*.

(g) All languages have devices to negativize and interrogativize and to turn some sentences into commands and propositions: *I am not going, are you? Come on!*

(h) All languages have at least two kinds of involvement of verbals with nominals: *The dog is sleeping*; *the cat has caught a mouse*.

(i) Many languages have devices that shift agent-goal reference: passives, causatives, etc.: *The mouse was caught*.

While it is not claimed that all the preceding statements hold when applied to any given language, they may be regarded as valid unless cogent counter-examples can be demonstrated.

§42. Indo-European and minor languages of Europe

As we have seen, languages can often be grouped together in families the members of which are believed to have descended from a common ancestor. Where evidence is abundant the relationship may be worked out in great detail and the features of the proto-language may be reconstructed. Very often certain languages are

felt to be related on the basis of less extensive genetic evidence, or on the basis of typological evidence. Recently, linguists working on bolder assumptions have placed together in *phyla* or *stocks* languages and language families whose mutual relationship cannot be rigorously demonstrated, at least on the basis of available information. This has especially been true of the languages of Africa and the indigenous languages of the Western Hemisphere. We shall now survey some of the main languages of the world, indicating what families or phyla they are supposed to belong to.

(1) The most widespread and most important language family, from the point of the numbers of speakers, is the *Indo-European* family. Note particularly the fact that, due to historical circumstances, genetic divisions often cut across geographical divisions. For example, the very term *Indo-European* (called in German *Indo-Germanisch*) cuts across the geographical conceptions of the Oriental versus the Occidental, English being linguistically closer to Hindi, for example, than Russian is to its neighbour Finnish (of the Finno-Ugrian family).

Thanks to the availability of records dating back several millennia and the great variety of the Indo-European languages, the interrelationships among the various languages are well delineated, and the history of their development can be traced in great detail. It is safe to say that the Indo-European family is the best described of all language families known.

This family can be subdivided into a number of branches, as briefly outlined below:

(a) *Indic*. The Indic languages are spoken throughout northern India, Pakistan and part of Ceylon. The most important member of this group is Hindi-Urdu (India, Pakistan), with over 62 million native speakers; the literary forms are the literary language of another 30 million, and Bazaar Hindi is used as a lingua franca by several million more. Eastern Hindi, or Kosali, with 30 million speakers, is a separate language. Bengali is spoken in India and Pakistan by 70 million and Assamese, spoken by 6 million in Assam, is very nearly the same language as Bengali. Other important Indo-European languages in and around India are Punjabi (20 million), Marathi (3 million), Gujarati (16 million), and Singhalese in Ceylon (7 million.)

(b) The *Iranian* branch has three important modern representatives: Persian, spoken in Iran by 20 million speakers; Pashtu, used in Afghanistan and Pakistan by over 12 million people; Kurdish, spoken in parts of Turkey, Iraq, Iran and the U.S.S.R. by perhaps 5-10 million people.

(c) The *Armenian* branch has but one member, Armenian, limited chiefly to the Armenian S.S.R. within the Soviet Union, with over 3 million speakers. *Albanian*, like Armenian, forms a separate branch; it is spoken in Albania by an estimated 2 million people.

(d) The *Balto-Slavic* branch contains languages spoken over a vast area, from Eastern Europe to the Pacific Ocean. The Baltic part of the branch is represented by Lithuanian (3 million speakers), and Latvian (2 million speakers), both spoken in those Baltic states now part of the Soviet Union. The most important member of the Slavic group is Russian, which in the last few centuries has spread from its original European homeland to the vast stretches of Siberia, even though still sparsely settled. At the present time it is spoken by 136 million native speakers, and also known by several additional millions in the U.S.S.R. who use Russian as a second language. Other important Slavic languages are Polish (32 million), Ukrainian (38 million), Serbo-Croatian (12 million), Czech (10 million), Bulgarian (7 million), Byelorussian (38 million), Slovak (4 million), and Slovene (2 million).

(e) *Greek*, with nearly 8 million speakers, is another language which is the only member of a branch. It should be remembered of course that we are now going over the present-day languages of the world and that "Greek" as a well-known school subject means Classical Greek, often with a conventionalized English pronunciation, which is a very different matter from Greek as a modern language. That is in fact why in our enumeration of the languages of the world there is Greek but no Latin or Sanskrit, since the descendants of Latin are called Romance and those of Sanskrit are called Indic languages.

(f) Of the *Romance* branch of the Indo-European family of languages, *Spanish* ranks first in the number of speakers, with over 140 million, including those in Spain and, as a result of colonial expansion during the sixteenth and seventeenth centuries, in most

of the countries in Central and South America. *Portuguese*, with over 75 million speakers, spread from Portugal to Brazil during the same centuries and is spoken also in Portugal's overseas possessions. *French* has 42 million native speakers in France, about 10 million in Canada, Belgium, and Switzerland and over 12 million in Africa, Vietnam, etc., who speak it as a second language. *Italian* is mainly confined to Italy, with 55 million speakers. *Rumanian* surrounded by Slavic and Hungarian speakers, with consequent abundant borrowing from those languages, is used by some 19 million people in and around Rumania. *Catalan*, a minority in Spain, is used by about 5 million people.

(g) The *Celtic* branch is rapidly declining. There are remnants of Celtic speakers in Scotland (Gaelic), Wales (Welsh), Eire (Gaelic) and Brittany (Breton). None of these languages is spoken by as many as a million people. So few travellers passing Shannon understand the language of the country, that they usually smile when arrivals and departures of trans-Atlantic planes are announced first in Gaelic before being announced in English.

(h) *English* belongs to the *Germanic* branch of the Indo-European family. It has been diffused widely over the world and is used extensively as a second language. As a native tongue it is spoken by more than 250 million people and is second only to Mandarin Chinese in the number of speakers.

The *Germanic* languages of course include German, spoken in Germany, Austria, and Switzerland by some 100 million speakers. To this branch belong also Dutch, spoken in Holland and Belgium (where it is known as Flemish), spoken by 17 million speakers. The *Scandinavian* languages, spoken by about 18 million inhabitants of Sweden (Swedish), Denmark (Danish), and Norway (Norwegian) are so close to each other that they are mutually intelligible. Once I conducted a seminar on Chinese phonology which happened to consist of three students, one from each of those three countries. They simply carried on discussions, each in his own language, and understood each other without difficulty.

(2) Of the relatively few non-Indo-European languages of Europe, there are the relic language of *Basque*, spoken in southern France and northern Spain and languages of the following family:

(3) *Finno-Ugrian*. To this family belong the *Finnic* branch,

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including Finnish, spoken in Finland by 4 million people, and Estonian, spoken by the Soviet Republic of Estonia, with 1 million speakers. The only major member of the *Ugric* branch is Hungarian, used by the 13 million citizens of Hungary. Some linguists group this family with the following under the name of *Ural-Altaic* languages.

§43. *The Altaic family*

The *Altaic* family contains three branches: *Turkic*, *Mongolian*, and *Manchu-Tungus*. The *Turkic* branch stretches over a vast area, from the Arctic Ocean in northern Siberia to the Mediterranean in Turkey and Cyprus. The important members of this family are Anatolian Turkish (25 million speakers), Uzbek (6 million), Kazakh (over 3 million), Kirghiz (1 million), and Azerbaijani (over 5 million), the last four all spoken in the Soviet Union, the last one also in Iran. In China's Sinkiang province there are over 4 million speakers of Uigur. The *Mongolian* branch is spoken in the Soviet Union, the Mongolian People's Republic, and in China by around 3 million people. Depending upon the fineness of distinction as to what constitutes a separate language, Mongolian has been divided into nine or four languages. In the latter case, the languages are Mogul, Monguor, Dagur, and the remaining forms of Mongolian, namely, Oirat, Khalkha, Buryat, Pao-an, Ordos, and Khorchin, would be considered dialects. The *Manchu-Tungus* branch consists of a group of minor languages such as Evenki, Lamut, Nanai, and Sibo, spoken in the U.S.S.R. and China.

§44. *Languages of north-eastern Asia*

Recently attempts have been made to place Korean in the *Altaic* family, but the question is still unsettled. It has also been suggested that the *Altaic* languages are to be grouped with Korean, Japanese, and Ainu to form one "North Asiatic" group, but their genetic relationship is still largely conjectural.

Japanese, spoken by over 100 million people in Japan and the Ryukyu Islands, most probably forms the only member of a family, though some scholars would set the language off as a separate branch. *Korean* is spoken by 34 million people in Korea and part of

Manchuria; in grammar it is very similar to Japanese. As we have noted, the large-scale borrowing of Chinese words as well as Chinese writing into Japanese, Korean, and Vietnamese is no proof of genetic relationship between Chinese and Japanese, Korean, and Vietnamese or between any two of those languages.

§45. *Sino-Tibetan languages*

Centred in China is the great *Sino-Tibetan* family of languages, which is conventionally divided into two branches: *Tibeto-Burman* and *Chinese*. The chief languages of the Tibeto-Burman group are Tibetan, spoken by some 6 million people in Tibet and China (though Tibetan is strictly not one language), and Burmese, spoken by 15 million in Burma. Chinese, for reasons mentioned above (p. 90), is usually spoken of by the Chinese and by sinologists as one language. In its standard form, or Mandarin, it is spoken (with relatively minor variations) by 387 million speakers. Apart from a small percentage of speakers of non-Chinese languages, the remaining population, concentrated in the few provinces in the east and south of China, speak what are commonly referred to as dialects: Wu (e.g. Shanghai, 46 million), Min (e.g. Foochow, 22 million), Cantonese (e.g. Canton, 27 million), Hakka (e.g. Kiangsi province, 20 million), Hunanese (e.g. Changsha, 26 million), and a few other minor dialects (figures based on Yuan Jia-hua *et al.*, *Hanyu Fangyan Gaiyao*, Peking, 1960, p. 22). It should be noted however that in point of phonology, lexicon (especially in the high-frequency morphemes of everyday use), and to a lesser extent in grammar, the dialects are as different from one another as, say, English is from Dutch or French is from Spanish and are thus often rated by linguists as different languages.

§46. *Languages of south-eastern Asia*

The various languages of south-eastern Asia are not all related to one another.

(1) The relationship of *Thai* (and such close relatives as *Laotian*) is debated. Most probably it is to be included in the Sino-Tibetan family, but attempts have also been made to show its relationship

to the Malayo-Polynesian languages. The difficulty, as is often the case, lies in distinguishing large-scale borrowing from genuine sets of cognate words between cognate languages. Thai, in a somewhat wide sense, is spoken by 18 million people, mostly in Thailand, with a small number in the south-western provinces of China.

(2) The affiliation of *Vietnamese*, like that of Thai, is disputed, though attempts have been made to relate it to Thai, Sino-Tibetan, and Mon-Khmer. The number of speakers of Vietnamese, with varying estimates, is of the order of 20 million.

(3) The *Mon-Khmer* family of languages is chiefly represented by Cambodian, spoken by over 3 million people in Cambodia.

(4) Finally, the *Dravidian* family of languages, are spoken chiefly in the South of India and on Ceylon: Telugu has 37 million speakers in India. In Ceylon and South India there are 32 million speakers of Tamil. Kannada has 33 million speakers and Malayalam, also in South India, has about 20 million. The spread and influence of the Dravidian languages has been receding, but the absolute number of the speakers is still increasing, as a result of the increase in population.

§47. *The Malayo-Polynesian family*

The *Malayo-Polynesian* family includes a great many languages and spreads over a vast territory, from Madagascar to Formosa to New Zealand to the State of Hawaii. Some of the more important languages of the group are Malay (10 million speakers), Javanese (45 million), Sundanese (15 million), Tagalog, the national language of the Philippines (nearly 4 million), Visayan (5 million), and Indonesian, which is a language very close to Malay and is the national language of Indonesia, where, although it is not spoken widely as a native language, it is widely used as a second language. The kinship of some of these far flung branches of the family was once strikingly brought out when a group of tourists from the Philippines visited central Formosa and was entertained by the girls from the mountains. As they started to sing, the visitors found the songs so familiar that they were able to join them in chorus.

§48. *Languages of Africa*

So far we have been dealing with established language families or with language groups with some partial evidence of genetic relationship. From here on, the headings have even less to do with genetic relationship than with typological or merely geographical groupings. This heterogeneity in the method of classifications is unavoidable in view of our present inadequate knowledge of these languages, as compared with the well-documented records of the Indo-European languages.

Africa is an area of very great linguistic diversity, sometimes estimated at more than 800 different languages, commonly grouped under four or five phyla: (1) Afro-Asian, (2) Niger-Congo, (3) Nilo-Saharan, and (4) Khoisan. Some linguists set up a Nilo-Hamitic phylum, separate from either (1) or (3), thus making five divisions.

(1) The *Afro-Asian* group is not limited to Africa, but is also widespread in Asia, the most important family belonging to this group is the *Semitic*, and the most important language of this family, Arabic, is spoken from Iraq in the East to Morocco in the West in varying modern dialectal forms by upwards of 50 million people. Hebrew, spoken in Israel, has been artificially revived during the last few decades and now has over 1 million speakers. The national language of Ethiopia, Amharic, with 6 million speakers, is the most important member of the *Ethiopic* group of the Semitic languages.

The other families comprising the Afro-Asiatic group are *Berber*, *Cushitic*, and *Chadic*; the *Egyptian* family is for all practical purposes extinct now. The Berber is a group of 24 languages, with a total of at least 11 million speakers. They are spoken mainly in Morocco and Algeria and a few other parts of North Africa. The Cushitic languages spread over a wide area in East Africa in the countries of Ethiopia, Sudan, Somalia, Kenya, and Tanzania. The only important member of the group is Somali. The languages of the Chadic family are chiefly spoken in the region of Lake Chad, where the countries of Nigeria, Cameroons, Chad, and the Central African Republic border on one another. The chief language of the group, Hausa, spoken by over 9 million people, is

widespread in West Africa, especially in northern Nigeria. All the other languages put together have a little over 1 million speakers.

(2) The *Niger-Congo* group comprises over thirty distinct families, the most important of which is the *Bantu* family, which is spread over a vast area of Central Africa—how vast an area can only be realized when we remember that we usually only see all of Africa on one map and moreover disproportionately small, since it is across the equator in the usual Mercator projection. Of the Bantu languages, Swahili, together with three other languages to which it belongs, is spoken by perhaps as many as 7 million people in East Africa, including those who use it as a second trade language. Other important Bantu languages are Kikuyu, Lingala, Ronga, each of which has over 1 million speakers; Sotho, Zulu, and Xhosa are each spoken by over 2 million; so are Ruanda and Rundi of the Ruanda-Rundi subgroup. Other Niger-Congo families are the *Kwa*, *Adamawa*, *Mande*, *Gur*, *West Atlantic*, and *Kordofanian*, some of which are not very well known and ill defined; for example Kwa and Adamawa are probably phyla, with several families each.

(3) The *Nilo-Saharan* is a group of several language families whose relationships are at present far from clear, as can be seen from the non-committal geographical name. One important language of the group is Kanuri, spoken by over 1 million people in Nigeria and Niger; Dinka and Luo (of Kenya), which belong to the Sudanic family, have almost 1 million speakers each.

(4) *Khoisan* is the name applied to the languages of the pre-Bantu peoples of South Africa, the Bushmen and Hottentots. It may also include some isolated groups as far north as Tanzania.

It should be noted that the numbers of speakers, especially those for languages of Africa, are mostly tentative, because (1) much of the data was based on estimates and (2) authorities differ as to the scope of groups, languages, or dialects. (For further detail see the comprehensive treatment by Charles F. and Florence M. Voegelin in *Anthropological Linguistics*, especially vols. 6, 7, and 8 (1964–6). A. Meillet and M. Cohen's *Les Langues du Monde* (Paris, 1952), is of course a classic, but the world's population has grown since that new edition.)

§49. *Languages of the new world*

The indigenous languages of the Western Hemisphere, with perhaps one or two exceptions, have one feature in common: they are declining in number of speakers; in fact many have already become extinct and others are on the verge of extinction. On more than one occasion linguists have had to go to great trouble to record the language of the one or two elderly speakers whose remaining years will coincide with the remaining years of their language. The American languages present a bewildering problem to the taxonomic linguist. Many of them do fit well into families, such as *Iroquoian*, *Souian*, *Algonkin*, *Athabaskan*, and *Kechuan*; however, because a great number of the languages did not fit well into these well-defined families, Edward Sapir proposed grouping the languages together according to more general typological criteria and leaving rigorous demonstration of relationships until more would be known about the languages and their genetic relationships. Proceeding on this basis, he classified the indigenous languages of North America into six stocks: *Eskimo-Aleut*, *Na-Dene*, *Algonkin-Wakashan*, *Hokan-Siouan*, *Penutian*, and *Aztec-Tanoan*. The relationship within these groups is not universally accepted and various forms of reclassification are still being attempted. The languages of Mexico, Central and South America are in general not as well known as those of North America and their classification is only now being undertaken. It goes without saying that the preceding discussion is about American Indian languages, as we have already discussed the distribution of the Indo-European languages spoken by the post-Columbian immigrants, namely Spanish, Portuguese, French, and English.

WRITING

§50. *Writing as symbol of language*

There is no people in the world that has no language, but there are many languages in the world that have no writing. For example, the indigenous languages of North America are as numerous and as divergent from one another as languages can be anywhere else in the world and yet have no writing systems of their own. However, although one cannot say that most languages have systems of writing, at least those languages which in historical time have occupied important cultural positions have had systems of writing. In a sense this is practically a tautology, since historical time implies that there has been recorded history.

Visual symbols do not begin to be writing until they have a close correspondence to language. When, according to Chinese tradition, rulers of high antiquity tied knots for running the affairs of the country, it was cited as an example of what they did before the invention of writing; nor is the modern man writing a note when he ties a knot around his little finger in order to remind himself of what was it? When a skull and bones are marked on a bottle, or when a road sign in Europe shows “” at a street corner, are those examples of writing? The answer is, if a sign represents a specific part of language, it is writing; if it represents things directly, it is not. Thus, the same picture of the skull and bones could be “read” as *poison* or *poisonous* or *danger* or even as *skull and bones*. The same road sign will be read by an English-speaking person as *no left turn*, by a German as *links abbiegen verboten*. But if at any time a usage is established such that a certain visual symbol, however simple or complicated, is specifically associated with a linguistic form, however simple or complicated, so that a person who knows the usage on seeing the symbol will say only that particular linguistic form and not one of its synonyms, then we have a true case of writing.

Naturally writing was not invented all at once and most systems

of writing began with pictorial representations of things capable of being spoken of in more than one way. The same picture of a man standing on the ground  may represent variously what later became Chinese *lì* 'to stand', *wáng* 'king', or *tà* 'great'; but the fact that only certain spoken words and not any set of words of related meaning could be represented shows that the symbol was already becoming writing proper and no longer direct pictures of things.

The earliest forms of writing in the sense defined above began with symbols for relatively large units of language, namely words or morphemes; then, as it began to be more analytical in the representations of smaller units of language, writing by syllables and by phonemes developed into the now widely used alphabetic forms of writing. It is generally believed that writing was first invented in lower Mesopotamia by the Sumerians (c. 3100 B.C.). Egyptian writing began soon afterwards (c. 3000 B.C.) and it is possible that the Egyptians learned the idea from the Sumerians. The Phoenicians and other Western Semites, probably on the basis of Egyptian writing, developed what is commonly referred to as an alphabet. However, the Phoenician and Hebrew alphabets, as shown by Gelb (*Study of Writing*), are in fact syllabaries rather than alphabets. For example, the Hebrew letter , called *bêth*, did not simply stand for *b*, but for *ba*, *be*, *bi*, *bo*, or *bu*. It was not until the time of the Greeks that a true alphabetic system of writing was developed, in which each symbol represents, more or less closely, the phonemes of a language rather than a sequence of phonemes forming syllables or morphemes. From the Greek later developed the Latin and Cyrillic alphabets, the two most widely distributed systems of writing in the world today.

§51. Chinese as morpheme-syllable writing

Chinese is almost a perfect example of *morphemic writing*, in which each symbol, usually referred to as a character, represents a morpheme, and since most morphemes are monosyllabic, each character also corresponds to a syllable. Since in old Chinese a morpheme was usually also a word in the sense of a free syntactic unit, the system of writing can also be described as a *word-sign*

system of writing. In emphasizing the dissyllabic and sometimes polysyllabic nature of the syntactic word in modern Chinese the late George A. Kennedy of Yale University rightly warned his students of the "monosyllabic myth" about modern Chinese. But so far as Classical Chinese and its writing system is concerned, the monosyllabic myth is one of the truest myths in Chinese mythology. A sidelight on this comes from the way the Chinese unit of writing is referred to in English as a character. Since each character is a morpheme, and a morpheme is usually also a word in the linguistic sense of a free syntactic unit, an English-speaking Chinese will always speak of a character as a *word*, and is puzzled or annoyed when a native speaker of English refers to it by the unusual term *character*. If, as he reasons, perhaps subconsciously, a spoken or written word in English is referred to as a word, why shouldn't a spoken or written word in Chinese also be referred to as a word? In modern spoken Chinese, to be sure, although the morpheme is still largely monosyllabic, the word (as a free syntactic, versatile unit) is often of more than one morpheme. Since the original undifferentiated morpheme-sign-syllable unit is called in Chinese *tzù* ([tsʰ] unaspirated, falling tone), a new term is applied to the (usually longer) syntactic word *tz'ú* ([tsʰ'ʒ] aspirated high-rising tone). In this sense the term *tz'ú* belongs to the jargon of modern Chinese linguists and was until quite recently neither used nor understood by the general public, to whom the word used to mean 'wording, diction' or 'verse of unequal lines' (cf. § 23, pp. 55-56).

In the traditional classification of the Chinese writing system of almost two thousand years ago, there were six classes of characters. Of these we need not stop to discuss the class called *chuānchù*, as its nature has been obscure and there are few established cases of characters clearly falling under this class. The other five classes are as follows:

1. *Pictographs* are characters that originated from pictures of objects. In the present form they are not clear, but in the primitive forms of three thousand years ago their pictorial aspect can still be seen, as in Table 4.

2. *Ideographs* are diagrammatic indications of ideas, as in 上 *shàng* 'up', 下 *hsia* 'down', 一 *yī* 'one', 二 *èr* 'two', 三 *sān* 'three'.

3. *Compound ideographs* are characters in which the meaning of the whole is a combination of the meanings of its parts. Stock examples of these are 武 *wǔ* 'military', consisting of 止 *chih* 'to stop' and 戈 *kō* 'arms' (cf. idea of 'a war to end all wars'), 信 *hsin* 'honest', consisting of 亻 *jén* 'man' and 言 *yén* 'word'; 明 *míng* 'bright', consisting of 日 *jih* 'sun' and 月 *yuèh* 'moon'.

Table 4. *Pictographs*

Primitive forms	Present forms	Pronunciation	Meaning
象	馬	<i>mǎ</i>	'horse'
水	水	<i>shuǐ</i>	'river; water'
木	木	<i>mù</i>	'tree, wood'
龜	龜	<i>kuī</i>	'turtle'

Characters under the preceding three categories are often taken as representative of Chinese writing, but actually form only a small minority of characters, and it must be remembered that they represent words (or rather morphemes) and do not directly represent meanings. They are therefore strictly not pictographs or ideographs, but, to follow Peter A. Boodberg's terminology, *logographs*, that is, written forms to represent spoken words.

4. *Loan characters* and the next category of characters are primarily phonetic in conception. The term *loan character* is not to be confused with the phenomenon of borrowing from a foreign language (pp. 83-85). A loan character is one used for its phonetic value although originally it represented a different, homophonous word. Thus 來 *lái*, originally a pictographic character for the word for '(a type of) grain' came to be used as a homophonous word for 'come', and 其 *ch'í*, originally a pictograph for the word meaning 'dustpan' is borrowed to write the (formerly) homophonous word meaning 'his'.

5. *Phonetic compounds* are by far the most common type of Chinese characters. Under this class each character consists of two parts, a *signific* (or "radical") and a *phonetic*, the former giving in

a very general way something of the meaning of the character and the latter suggests the pronunciation. For example, 糖 *t'áng* 'sugar' consists of a signific 米 *mǐ* 'rice', indicating that it has something to do with cereals and 唐 *t'áng* a word principally used elsewhere as a proper name and serving here only to give the pronunciation.

The Chinese never carried the principle of phoneticization further than a relatively small number of loan characters, and since the development of Chinese writing dates back to the middle of the second millennium B.C., the structure of many characters in use today is obscure, especially since the phonetic aspect of Chinese has changed drastically since the beginning of the Christian era. Several other scripts based on the Chinese model, such as Hsi-hsia and Jurchen, have become extinct.

§52. *Syllabic writing*

It is making a false dichotomy to say that Chinese writing represents meaning and that syllabic and alphabetic writing represents sound. The written symbol 人 represents as much the spoken word *jén* as the meaning 'man'; the written form *man* represents as much the meaning 'human being' as the sound [mæn]. The important difference is that of size and variety of the units. If the category of loan characters had developed freely, Chinese writing could have developed from a morpheme-syllable system to a purely syllabic system. There were in Classical times enough variety in syllables not to be bothered by homophones and a purely syllabic writing might have worked. But, as we have seen, the attrition of distinctions eventually led to a poorer inventory of syllables, so that variations in shapes have had to be retained to keep morphemes apart. (For an extreme example, see p. 120.) At this point however we are simply inquiring into the nature of morphemic, syllabic, and phonemic writing as a matter of size and variety and not concerned with the feasibility and efficiency of various writing reforms, which will be dealt with later (Chapter 12).

Syllabaries, as we have seen, were developed very early in the Mediterranean area, at least in rudimentary forms. As a matter of fact, most of the alphabets in use today are graphically and

historically descendants of those early syllabaries. Note that a complete syllabary of a language in which a different symbol is used for each different syllable would run into a very large number of symbols. Even as poor an inventory as that of modern Japanese has a nominal fifty or so, not counting phonemically necessary distinctions such as that between *pa*, *ba*, and *ha*, since if a language has *n* consonants (C) and *m* vowels (V), even if all syllables were of the simple CV type, there would be *nm* syllables. In practice the early syllabaries were not full representations of all the syllables of the languages which they wrote. To the present day the Arabic and Hebrew alphabets represent vowels only imperfectly. There are ways of distinguishing vowels unambiguously, but they are not used in normal writing, which is intelligible without full syllabic representation, just as *ngl*sh w*d b* *nt*ll*g*bl wh*n sp*lt w*th n*th*ng b*t c*ns*n*nts.

The only major language in the world today that employs a syllabary, or *kana*, is Japanese. In fact it has not one but two syllabaries in common use: the cursive *hiragana* is mainly used for writing suffixes, particles, and some native words, and the squarish *katakana* is used for transcribing Western words, e.g., チヤイナタウン to transcribe CHI-YA-I-NA-TA-U-N, which is the sign in neon lights of the "Chinatown" nightclub in Kyoto. Most of the full words, i.e. nouns, verbs, adjectives and adverbs, in a written text are in Chinese characters and not in *kana*. When the Chinese characters are used to write loan words of the Chinese language, which means that they are pronounced with approximations to Chinese sounds, then we have loan words both in the linguistic and in the graphic sense. In such a case the character is said to have an *on*-reading, the word *on* being itself such a case, written with the Chinese character 音 pronounced ?iəm in ancient Chinese and *in* in modern Chinese and *on* is the present Japanese pronunciation of the way the ancient Japanese approximated ancient Chinese ?iəm when it was first borrowed. Another case of *on*-reading is 日 read as *nichi* ('sun'), from ancient Chinese *njēt*. *On* means sound, that is, reading a Chinese character by the (Chinese) sound. When on the other hand a character is read in Japanese, then there is only a borrowing of writing and no linguistic borrowing is involved. For example, when 日 is used to write the native Japanese word *hi* for

'sun'. This manner of reading Chinese characters is called *kun*-reading or reading by gloss, i.e. by meaning. (The word *kun* itself, however, is a case of *on*-reading.) Extending such a terminology, one might say that when *e.g.* is read as 'for example' and *etc.* is read as 'and so on', it is *kun*-reading, while if read as *exempli gratia* and *etsetra* (not necessarily *et kētera*) then there is *on*-reading, the only difference being that in the case of English such cases are very rare and sporadic, whereas they are the rule in Japanese.

The Korean writing system is like the Japanese in using Chinese characters for the main body of the vocabulary and a small number of phonetic symbols for grammatical elements such as affixes and particles. As in Japanese, a Chinese character is either a grapho-linguistic borrowing (*on*) or a purely graphic borrowing (*kun*) to write native words, though in the case of Korean native words are now nearly always written phonetically.

The system of phonetic symbols in Korean (called *Han-gŭl* or *ŏnmun*) is interesting in two respects. First, it is much more of an alphabet than the Japanese syllabic *kana*. Secondly, from the point of view of the design of symbols (chapter 12), it is a writing system in which parts of unit symbols represent analytically features of the sounds. Except for sporadic cases in Chinese, no other system of writing in the world does that. One cannot say, for example, that the consonant *b* in English is voiced when the stem is up and voiceless when the stem is down, that is, *p*, since the symbol for the voiced dental consonant *d* with stem down would be *q*, which, if this graphic analysis were valid, should represent the voiceless dental consonant [t]. In the Korean system, on the other hand, even parts of symbols are sometimes phonetically relevant. For example, the symbol for the tense consonant phonemes are made of doublets of the symbols for the corresponding non-tense consonants, such as ㅅ for ordinary *s*, ㅆ for tense *s* (usually romanized as "ss"), ㄱ for *k* or *g* and ㄲ for tense *k* ("kk"), etc.; a certain modification of a vocalic syllable stands for a preceding front semivowel, for example ㅏ for *a*, ㅑ for *ya*, ㅓ for *ŏ*, ㅕ for *yŏ*, ㅗ for *o*, and ㅛ for *yo*, etc. The practical value of such features, however, should not be overestimated, since in actual reading, as we have seen, one does not stop for the individual sounds, to say

nothing of features of sounds, but takes in whole words or even sentences. It may be noted in passing that in North Korea the Chinese characters have already been replaced by the phonetic system of writing.

§53. *Alphabetic writing*

An *alphabetic writing system* is one in which each symbol corresponds more or less closely to the phonemes of the language. As we have noted above, in the case of early Hebrew, the users were not clear as to whether they were using the symbols to represent syllables or sounds. In what is known as the Sanskrit alphabet (or Devanagari), each symbol has what is called an "inherent vowel", such that the symbol ऋ, when not modified by a vocalic mark above or below, to form *ki*, *ku*, etc., will automatically be pronounced *ka* (actually [kə]) and thus represents a transitional form between syllabic and alphabetic writing. The same practice was followed when the Sanskrit writing was borrowed to write Tibetan and other languages.

It is not without significance that the very act of calling each letter by a speakable name would represent a transitional stage between a syllabary and an alphabet. The vowel letters of an alphabet can be named by their usual values, but consonants cannot be spoken of conveniently by their values. Even though it is possible to pronounce audibly the values of letters representing the sounds [m], [s], [f], it is not possible to make a pure unaspirated stop such as [p] without first telling the "listener" to "look at my (closed) lips", since the maker of such a "sound" is not making any sound. In the case of an unaspirated [k] or a glottal stop [ʔ], there is nothing either to see or to hear. Hence even modern phoneticians name the sounds by adding extraneous sounds, such as [ɛs] for [s], [ɛŋ] for [ŋ], [pə] for [p], etc., as we have observed before (pp. 33-34). In practice the traditional names of the letters did not all originate from a minimum addition of extraneous sounds to make the sounds of the letters easily pronounceable and some of them had to do with visual or other aspects of the letters, such as *w* being called *double you* or, as in French, *double vé*, the two kinds of *o* in Greek as *omicron* 'little o' (i.e. ο) and *omega* 'big o' (i.e. ω).

The earliest purely alphabetic system of writing was that of the

Greeks, which developed from the Phoenician syllabary. The Greeks' innovation was to use some of the Phoenician system to represent vowels. It is generally believed that all the world's alphabets are in one way or another descendants of this original Semitic-Greek invention. The forms of the individual letters in some of the alphabets may have been original, but the idea of alphabetic writing has been borrowed. Among the major systems of writing today, except for Chinese and Japanese, alphabets are in almost universal use. By far the two most important types of alphabets are the Latin, developed by the ancient Romans, and the Cyrillic, developed from the Greek by early missionaries to the Slavs.

The Arabic is the next most widely used alphabet and was invented to write Arabic, for which it is fairly well adapted. It is also used for many other languages, mostly spoken by peoples who have accepted the Islamic faith. It is very poorly suited for non-Semitic languages. It is now used for such languages as Persian, Urdu, and for Uigur in China. Until fairly recently, it was also used for Malay and Turkish.

Many languages have their somewhat locally limited alphabetic systems, for example, Hebrew, Amharic, most of the languages of India, Burmese, Thai, Cambodian, Mongolian, and Korean. As we have already indicated, in all these systems the basic idea of highly versatile interchangeable phonetic parts can be traced to the same source, though in many cases the actual visual symbols in use may be original, being sometimes adaptations and simplifications of syllabic or morphemic writing.

The *Cyrillic alphabet* is used for Russian, Ukrainian, Byelorussian, Bulgarian, and Serbian in Europe. In the present century it has been adapted for the use of many indigenous languages of the Soviet Union. Languages like Tatar, Uzbek, Khirgiz, Buriat and Yakut all employ the Cyrillic alphabet. It is also used for Mongolian, except that the Mongols in China still use the old vertical Uigur script. A few languages of the Soviet Union, for example Armenian, are still written in their traditional scripts.

The *Latin alphabet* is so widely used that it would not be practical in this brief survey of writing systems even to enumerate the languages written with it. As a result of the political and cultural

ascendency of Western Europe during recent centuries, it has been newly adopted by many languages. The Latin alphabet is used in all of Europe except for those areas already mentioned which use the Cyrillic system, and Greece, which continues to use the Greek alphabet. From Europe it has been adopted in modern times by such diverse languages as Turkish, Swahili, Vietnamese, and Indonesian, in each of which the Latin alphabet has replaced an older script. It is safe to say that the majority of writing systems being developed at the present time are making use of the Latin alphabet. Even in China, the government promulgated a system of *Gwoyeu Romatzyh* (GR) or 'National Romanization' as early as in 1927. While the official position was that it was to be used whenever Chinese was to be spelt in Latin letters, such as in dealing with foreigners, those who devised the system, of whom I was one, had in our minds the design of a practical system of writing. On mainland China at present there is an official system of writing Chinese in the Latin alphabet, the *Pinyin* system of 1956, for the express purpose of using it as a writing system, although for technical as well as social reasons it is still far from being in a position to supersede the characters. At the same time a number of systems of writing have been devised to write the minority languages in China in Latin letters, such as Chuang and Uigur.

§54. *Some practical aspects*

No writing system commonly in use records all the elements of speech. Most systems, for example, record very poorly if at all the prosodic elements of speech—intonation, stress and pause, sometimes even when some of these elements are phonemic, such as stress in English or in Russian orthography, in which it is never indicated except in texts for teaching the language. Some languages have systems that come close to a phonemic writing, that is, where one sign of the system corresponds to one phoneme of the language. This is more usually the case when the orthography was devised more recently, with the advantage of greater linguistic sophistication, as in the case of the latin script used for Finnish and Turkish.

In the orthography of some languages the correspondence of

sound and symbol works only in one direction, but not in the reverse direction, that is, given the spelling there is only one unambiguous pronunciation, but for a given sound there are a number of ways of spelling it. Examples of this type of system are French, Spanish, German, and Vietnamese. The extent of reverse ambiguity, however, is not the same for different languages. Thus, a syllable like [si] appears in half a dozen different shapes in French (cf. p. 120), whereas possibilities of variant spellings of the same sound in German is so slight as to make it almost as good as Finnish.

English spelling represents still a third type of situation. The phonemes of English may usually be represented in more than one way, for example, /f/ is usually represented by *f*, but also by *ph* in *Philip*; /i/ by *i* in *it*, but also by *y* in *physics*; /ʃ/ usually by *sh*, but also by *ch* in *chivalry*. If someone claims that the sound /ʃ/ is always spelt with *sh*, the usual challenge is to ask him: "Are you sure?" If a market has a sign *Ghreti Ghoti for Sale*, one needs only to be reminded that the *gh* is as in *cough*, *o* as in *women*, and *ti* as in *nation*. Conversely, one letter or sequence of letters in the English writing system may represent more than one kind of phoneme or more than one unit of phoneme, for example, *a* represents /a/ in *what*, /æ/ in *hat*, /o/ (i.e. [ɔ]) in *call* and it represents a diphthong /ei/ in *ace*; *th* represents /θ/ in *thin*, but /ð/ in *then*. Usually systems of this type are also plagued by the so-called silent letters, such as the *s* in *island* or the *k* in *knot*. The origin of such complexities is almost always historical. Sometimes even a pseudo-historical orthography gets into general usage, as for example, by analogy from *would*, an *l* crept into *could*, where there had been no *l* to begin with.

A common concern on the part of teachers and learners of a writing system is the regularity and simplicity of the system. Of the three types of correspondence: 1-to-1 (Finnish), 1-to-many (French), and many-to-many (English), the 1-to-1 correspondence is of course the easiest to learn. Of the three sizes of units of writing: morphemic, syllabic, and alphabetic, the first involves an enormous number of symbols to learn, the second a lesser number, and the third only a handful, which can be learned in a few hours. But it is one thing to teach or learn a system and another thing to use it. As we have noted, reading is not by letters or by words but by much larger units. From this point of view, a morphemic or a

word-sign system of writing can be taken in faster than a system based on smaller units. One does to be sure take in English by words and sentences in one glance too, but since there is less individuality in the shapes of letters, the words do not stand out as prominently as in a text of Chinese characters. In looking for something in a page of English you have to look for *it*, but in doing the same on a page of characters the thing looked for, if it is on the page, will stare *you* in the face. In the language of communication theory (which we shall take up in chapter 12), each symbol in a character text, being one out of several thousand, carries more "information" than one in a small class of items. The simplest kind of system of writing consists of two words: 0 and 1 and all text consists of nothing but a succession of zeros and ones. Such a "language" will suit a computer but not the brain of a speaking and reading person. It is of course another question whether it is worth the cost of learning a more complicated system for eventually more convenient use. I often say that students of Chinese to whom I taught the somewhat difficult system of the National Romanization begin by swearing against it and after they have learned it they swear by it. In a more important sense, the old style children were beaten by their parents or teachers for not learning their characters and after they learned how to read and write their characters, they beat *their* children for not learning the characters. I often speculate whether an ideal system of writing would not be some golden mean between the unwieldy thousands of arbitrary units and the paltry few letters of the Latin alphabet. To make a wild guess at an optimum number of symbols, if we take say the geometric mean between the number of letters of the Latin alphabet and the number of one of the sets of basic characters of 1000 or 1100, it will come out to a list of roughly 170 symbols, which seems to be a list of manageable size.

LANGUAGE AND LIFE

§55. *Language as a part of life*

We live so closely with language that we get the illusion that language is something *sui generis*. It is so much a part of life, that it seems as if it were something apart from life. We use language during so much of our conscious life, that we are not language-conscious most of the time, and then only when something goes wrong or something unusual happens, such as saying the wrong word or coming in contact with a foreign language. That was the point of our story (§ 1.1) in which the German woman insisted that we not only call the thing water, but it *is* water. That was also the point of primitive peoples' belief in the efficacy of affecting persons and things by using their names.

Philosophers did not, of course, have to wait for modern linguistics to be self-conscious about language as language. Rhetoric and philology are as old as civilization. Thus, language has come to be treated as a separate activity among other activities. A corollary of the recognition of language as an institution on its own account is that its occurrence will also be considered in connection with that of other activities in life, sometimes present, sometimes absent and in various proportions of mixtures with the rest. People who have much to do with extended text—and that means most people, since nearly everybody reads the newspapers, if not books—get the illusion that the typical form of language is in sentences and sentences form paragraphs and paragraphs form articles. But it needs no keen observation to realize that language as lived is usually not in the form of connected discourse. Following are examples of occurrences of language arranged in descending order of connectedness:

(1) A broadcast lecture read by an inexperienced person. In terms of linguistic description this is likely to have a very even tempo and very even stress and intonation patterns. In other words, if the lengths of syllables (and especially the lengths of pauses

between phrases), the degrees of stress, and ranges of intonation are measured and compared statistically, there will be very much less mean deviation than in ordinary conversation. If there is no studio audience, the reading will sound even more stiff and impersonal. Such reading is, therefore, very far from language as it is found in real life.

(2) A story as actually told or the dialogue of a play well acted can be a pretty good mirror of life. But in the hands, that is mouth, of an inexperienced reader, a previously composed story or a play can have the same defect of low mean deviation as in the reading of any learned text (take *learned* either way).

(3) An extemporaneous speech from sketchy notes or no notes, with uhs and wells, long pauses, hesitations, and sudden accelerations is much more typical of language as lived than connected reading. Apart from the desirability of having the contents well ordered and important key words and phrases prepared beforehand, a well-prepared speech should sound unprepared and thinking at the desk should come out to sound like thinking on one's feet.

(4) Connected conversation, as between two ladies or two teenagers over the telephone, is a typical cross-section of language as really spoken and Charles C. Fries has used extensive recordings of telephone conversations in his analysis of English structure. However, one thing about telephoning which is atypical of normal speech is that pauses are rarely longer than ten or fifteen seconds, not so much for fear of wasting the money as from the uncertainty of loss of connections when nothing is heard, since nothing is seen.

(5) However, when remarks are made occasionally during the progress of some action or event such as playing or watching a game or at a cocktail party or dinner, or even when a monologue is carried on by someone performing a demonstration, then action and speech are thoroughly mixed and this is a much more common situation than is the usual impression among teachers and writers, who have so much to do with connected text in sentences and paragraphs. Sometimes non-language and language even occur in syntactical relations, as in the label *Shake well before use*, where the object of the transitive verb is the bottle itself, or when a teacher says *right* or *good*, as a logical predicate to a subject which is not a

word but something a pupil in painting, music, or sport has just done. The opposite of this is the occurrence of language mixed with action or event in asyntactic relation, when one changes the construction as things are happening, as in *Heh! there's a wasp in the st-* (swish!), *in the stud-* (swat!), *in the study I have just killed.*

(6) Finally, there are the isolated remarks made in connection with events or actions calling for no speech activity, such as *Oh, yes!* in response to something that occurs to a person in his stream of consciousness, or *What's that?* when something attracts a traveller's attention outside the window of the train or aeroplane. In illustrating the disconnectness of language in real life, A. A. Milne (*Autobiography*, New York: E. P. Dutton, 1939, pp. 292-3) gives an extreme (made-up) example of a would-be scene on the stage with dialogues like the following:

HUSBAND: Well, what do you think?

WIFE: I don't know. (*Thinks for a minute.*)

HUSBAND: It's for you to say.

WIFE: I know. (*After a long pause.*) There's Jane.

(*Colonel in third row of stalls strikes match to see who Jane is. She isn't in the programme. Who the devil is Jane? He never knows.*)

HUSBAND: You mean the Ipswich business?

WIFE: Yes. (*Telephone bell rings.*) That's probably Arthur.

(*Clergyman in fifth row of stalls strikes match to see who Arthur is. He's not in the programme either.*)

HUSBAND: Monday. Much more likely to be Anne.

WIFE: Not now.

HUSBAND: Well, you anyway.

WIFE: Oh, all right. (*Exit for ten minutes while Husband reads paper.*)

and this goes on for another page, but it is enough to show that language in life is so much a part of life to which it often refers by way of allusion that when the bare "text" is taken alone it hardly makes sense.

§56. Wider senses of "language"

(1) *Metaphorical senses.* When we speak of the beautiful language of flowers, the persuasive language of a nudge, or the powerful language of armed might, we are usually ready to admit that this use of the term is to be taken metaphorically only and not in a strict sense. It is considered metaphorical because there is only one thing in common between, say, the beauty of flowers and the beauty of language as spoken and the structural properties of

flowers and those of language are so disparate that very little can be inferred from one to the other, as is usually the case with all superficial analogies between things.

2. *Quasi languages*. Some forms of communication share some, but not most, of the properties of ordinary language and may be called quasi language. For example, the language of bees, dolphins, or various calls of domestic and wild animals are voluntary actions with functions of communication. When my cat says *Owrl!* loud and low, it means 'Is anybody home?' and if I reply to that, it changes at once to a small high-pitched *ngiaow*, which means 'Hello!' and everybody understands, of course, what *fff!* means in a cat's language (actually ['č:] or ['x:] in terms of the cat's articulation). But the language of animals differs from human language in several important respects. It has a very limited vocabulary; it is common to the species, probably constant to the extent that the species is constant, instead of changing in matter of decades; it is born with and not learned. Parrots, parakeets, and mynah birds seem to be exceptions; these birds learn to imitate sounds so accurately that even the spectrographic analysis (chapter 11) of their sounds are recognizably similar to those of human speech, but they cannot learn the function of such sounds as language. A parrot can learn to say *I am afraid*, but when it is actually scared, it still squawks like any other non-talking bird. But the most important thing about animal language is that all utterances are single morphemes. A parrot that has learned to say *Polly wants a cracker* and *I want a drink of water* will never go from there and say *I want a cracker*, since, as we have seen (p. 9), each of the sentences is an unanalysable morpheme. However, we are already oversimplifying by applying our anthropocentric idea of the morpheme to animal communication. For more on the subject see Thomas A. Sebeok, "Zoosemiotics", *Science*, vol. 147, pp. 492-8, 29 January, 1965 and "Animal Communication", *Science*, vol. 147, pp. 1006-14, 26 February, 1965.

Gestures form another category of quasi language. Though physically less like language than animal cries, gestures share certain important properties in common with language. Gestures are conventional, as words are. It might seem that nothing is so natural as to nod assent and shake one's head for dissent. The

psychologist William McDougall (1871-1938) even explained the shaking of the head as an act of turning away from the food which is given. But in some Arab countries shaking one's head from side to side means yes. Nothing seems so natural as to beckon some one to come here with fingers moving inward with the palm up, but most of the Chinese beckon with the palm down. Gestures are, therefore, acquired and not innate. Furthermore, gestures are made in a limited number of recognizable units and can be combined in different arrangements, somewhat analogous to, though not nearly so systematic as, the phonemes and morphemes of language. In fact there have been recent attempts to set up a system of kinesics and kinemics in analogy with phonetics and phonemics (see also p. 9), so that it will be possible to symbolize them in such a way that anyone who has learned the system can read the symbols and reproduce the gestures without having seen them. In a more directly pictorial representation, such ideas have already been in use in the notation for dancing and gymnastics. But the most important (quasi) linguistic feature of gestures is that they are conventionalized forms of communication between members of a certain "speech" community who "speak" the same language. To be sure, pointing at one's own open mouth is likely to mean eating and making a crying face with fingers moving down from the eyes is likely to mean crying. But for that matter, certain interjections of pain or joy can also be understood by non-speakers of the language, with the proviso, however, that all the apparently natural sounds or gestures are usually mixed with and influenced by conventional, i.e. cultural factors.

In the above discussion of gestures it should be understood that we are considering gestures as gestures and not as signs for language. The sign languages such as the kind taught to deaf-mutes are not gestures in their own right, but substitutes for language proper and thus form a system of isomorphs of language, which is another form of a wider sense of language we shall now discuss.

3. *Isomorphs of language.* Two things are isomorphs of each other when they share certain structural properties, such that from those of one certain inferences can be made about the properties of the other. A map of the world is an isomorph of the earth; a

photograph is an isomorph of that which is photographed; a structural formula of a chemical compound is an isomorph of the structure of the molecule. But an isomorph need not always be either a symbolic or a pictorial representation of something else. Members of the same species of organisms, even when they are not twins or parent and offspring, are close isomorphs of one another. We shall return to the problem of symbolism in greater detail in chapter 12.

The most important type of a language isomorph is of course writing. Writing did not begin nor does it end as a very close isomorphic representation of language. In connection with systems of writing, we already noted the use of the same pictograph for different spoken words (p. 102). And then in recent centuries, writing systems, because of the circumstances of their visual use, always tend to develop in styles of their own, often in manners unsuitable for oral communication. But by and large, throughout most of historical time, writing and language are fairly close isomorphs of each other.

A number of isomorphs of language are of the second or higher order, in the sense that they do not directly represent language but indirectly through being representations of writing. For example, the symbols of the telegraphic code do not represent language as spoken but represent the letters with which the spoken words are written and thus have a lower degree of isomorphism with the language unless the writing is completely phonemic, which no existing system of writing is. The sign language for deaf-mutes, as we have noted, is isomorphic with language to the second order, as it represents letters rather than sounds. So are Braille and similar systems of "writing" for the blind. Most forms of shorthand, on the other hand, are first-order isomorphs of language, since they are mostly designed to represent sounds directly. So are secret languages of the pig Latin type, in which sounds are reversed and extraneous sounds are added by a fixed formula, such as *ladby loyby* for *bad boy*, or *killy-lurky* for *liquor*.

A category of language isomorphs which has become very important in the present century consists of configurations of matter and/or energy usually produced by, and corresponding very closely to, the elements of the actual speech. To be sure, ever since man

began to talk in prehistoric times the sound waves which went from the mouth of the speaker to the ear of the hearer have formed an extremely faithful isomorph of the speech. No reproduction of speech or music is so hi-fi as the production itself. But sound waves are so fleeting that nothing could be done to catch them except through the use of writing. With the advent of phonographic recording, from wax cylinders to discs and magnetic tapes and/or through transmission by electromagnetic isomorphs "over the air" as intermediate stages, we have now a great variety of language isomorphs. While most of such isomorphs cannot be "read" as they are, they can readily be transformed back to the original speech by reversing the recording process. The great virtue of making such isomorphs lies in what is known as time and space uncoupling. In the ordinary use of language, speaker and hearer have to be coupled, that is, they have to be tied down to the same place and time. The invention of writing was a great liberating act in that speaker and hearer (writer and reader) have the benefit of time uncoupling. Through writing the ancients can talk to the moderns. Writing of course also has the effect of place uncoupling, as in the case of letter writing. With the modern methods of sound recording and transmission the uncoupling of time and place between sender and receiver is made as free as can be desired. We shall come back to the problems of symbolic representation and transmission of language signals in chapters 11 and 12.

4. *Extensions of language.* Like other human institutions, language tends to develop and grow into forms beyond its primary nature as direct oral communication. Such extensions of language can take place in one of two directions:

(a) In the first place, various isomorphs, or transforms of language, because of their different make-up, often develop in ways in which language does not or would not develop of itself, apart from the isomorphs. The most important case is that of writing. Linguists are constantly reminding students of linguistics that writing is but a symbol of language and that if language is the symbol of ideas, writing is only the symbol of a symbol. They tell them that there is no such thing as written language, but only language written, and that written language would be a contradiction in terms, since language is that which is spoken. Now this is

a very healthy point of view in bringing home the fact that the proper study of language is language. In days when writers and teachers spoke of letters and sounds as if they were synonyms, the consideration of language as language needed very much to be stressed. But once this is clearly recognized, it is also important to remember both the closeness of isomorphism and the partial divergence between language and writing, with consequent partial autonomy in the development of writing. Writing is more conservative than language and gets out of step with it in history. In practically all the alphabetic systems of writing of the world the present-day orthography represents the language of an earlier stage. The same spelling often represents different sounds, as in English *bough*, *cough*, *rough*, *though*, *through*; I lived in the San Francisco Bay area for ten years before I learned that the street name *Gough* was to rhyme with *cough*. On the other hand the same sound is often spelt with different letters, as in *to*, *too*, *two*, or in French *si six cents six scies scient six cents six cyprès . . .* [si si sã si si si si sã si siprɛ] 'if six hundred and six saws saw six hundred and six cypresses . . .' In systems of writing in which a unit represents a syllable or a morpheme, such as that of Chinese during most of historical time, writing of the so-called literary, or classical style, has diverged so far away from language that much of it is not suitable for oral communication because of homophones. To take an extreme example, there are 116 characters under the syllable *hsi* (i.e. [ɕi]) in Chauncey Goodrich's (Chinese-English) *Pocket Dictionary* (T'ungchow, 1891). It would be possible, even easy, to write a story consisting of nothing but the syllable *hsi* in one of the four tones: ˊ (unmarked), ˊ, ˇ, and ˋ, as follows:

西溪犀，喜嬉戲。
 嵇熙夕ˊ，携犀戲。
 嵇熙細ˊ，習洗犀。
 犀吸溪，戲襲熙。
 嵇熙嘻ˊ，希息戲。
 惜犀嘶ˊ，喜襲熙。

It makes absolutely no sense when read aloud in modern Mandarin, but from the writing a reader of classical Chinese can make out the story like this:

West Creek rhinoceros enjoys romping and playing.
 Hsi (surname) Hsi (given name) every evening takes rhinoceros to play.
 Hsi Hsi meticulously practices washing rhinoceros.
 Rhinoceros sucks creek, playfully attacks Hsi.
 Hsi Hsi laughing hopes to stop playing.
 Too bad rhinoceros neighing enjoys attacking Hsi.

While this is an extreme example (other examples in *Encyc. Brit.* and in *Collier's Encyc.* under "Chinese Language"), it does illustrate the fact of visual reading and the reality of the written language with an autonomous existence on its own account. Whether such extension of language is to be called language, since it has the majority, but not all, of the structural properties of language, is a matter of usage, but popular, as distinguished from linguistic, usage certainly recognizes writing as language.

(b) The other direction in which language is extended is not (necessarily) from its isomorphs, but by way of extrapolation, so to speak, from its own properties. Since there is no natural limit to the number of terms in a co-ordinative construction or the layers of modification in a subordinative construction and since clause can be added to clause to form longer and longer sentences, most logicians and theoretical linguists find it a neater procedure to postulate sentences of infinite length, instead of limiting it arbitrarily to the historically longest known sentence or to the longest sentence that can be uttered in one breath. When length and specialized vocabulary, such as used in governmental and legal writing are combined, we get very much extended forms of language such as:

In order to clarify the nonworkday in the administrative workweek corresponding to Saturday, and to designate Sunday as Sunday regardless of whether it is the first or second nonworkday in the administrative workweek, the determination of the nonworkday corresponding to Saturday in references (a) and (b) is modified to provide as follows:

FOR A BASIC WORKWEEK OTHER THAN MONDAY THROUGH FRIDAY. When Sunday is a nonworkday in the administrative workweek, there is no other day in the workweek corresponding to Sunday. In such case, the first nonworkday other than Sunday shall be the nonworkday in the administrative workweek corresponding to Saturday. (The term 'first nonworkday' is used because it is known that some basic workweeks in the Navy consist of four workdays only.)

(Quoted by Herb Caen in *San Francisco Chronicle*, 19 November, 1961.) While this language is much too involved for oral delivery

and aural comprehension, there is nothing in it that is intrinsically alien to ordinary language as spoken. Such technical language is therefore a distantly extended form of ordinary language.

The language of science is an extension of language both in the sense of developing visual systems and in the sense of extrapolating from ordinary language structure. To the working scientist the written symbol or term is the main thing and the way it is pronounced is almost an afterthought when it becomes necessary to talk about it. In the early days of mathematical logic, Giorgio Peano had a two-dimensional notation for representing logical relations which was never meant to be read aloud. Even with ordinary mathematical formulae, it is often difficult and clumsy to communicate them orally. In the so-called matrices in algebra, which are in the shape of a rectangular array of terms, reading a matrix row by row is obviously a clumsy way of describing what is primarily a two-dimensional symbolism. Witness the great trouble the telegraphic offices had to take in order to transmit some of Einstein's formulae across the Atlantic, as reported in the *New York Herald Tribune* for 31 January, 1929. Such two dimensional symbolisms are more of the nature of generalizations than simply structural extensions of language and will fall under subsection 5 below. But even with linearly structured symbolisms such as are used in most of mathematical logic, the development of its language follows the nature of its own logic rather than directions in which natural language develops as it is spoken by persons in any walk of life. For example, it is very important to distinguish between languages of various orders, such as L_1 for the language about things, L_2 about matters concerning L_1 , L_3 about matters concerning L_2 , etc. To be sure, in ordinary writing one makes some such distinction by the use of quotation marks, and in actual speech the effect is occasionally rendered by pauses, change of tempo, or intonation, but in mathematical logic separate languages are set up, which are certainly not languages in the ordinary sense. (For further discussions on this see pp. 198-200.)

5. *Generalizations of Language.* Finally, there are in various symbolic systems still wider *generalizations* of language than isomorphs and extensions. Isomorphs are paradigmatically the same and extensions are syntagmatically the same as language. But there

are other generalizations which are wider than either, which we shall go into later when we take up the subject of symbolic systems in general.

§57. *Uniformity and variety in language*

The study of language would be simple if it were a constant system from person to person, from place to place, and from age to age. From our brief examination of geographical and historical changes in language it is obvious that languages are changing everywhere and all the time. In fact nothing makes man more language-conscious than differences in language, whereas living constantly in one uniform linguistic milieu, as we have noted, would tend to make a person confuse language with things. The task that a modern linguist sets himself in describing a language is to take one language at a time, a cross section of a language as it is spoken by its speech community. On the working hypothesis that members of a speech community speak the same language, a field worker will find one of them as his *informant* and record his speech and obtain the phonetics, phonemics, grammar, and as much of the lexicon as possible and thus form a general description of the language. But this working hypothesis is pure scientific fiction. There is no complete uniformity in any speech community; there is always mixture of dialects in the same locality; there is class difference; there is difference in speech reflected by different personalities for the same dialect or same class; above all, there is difference in style in the same individual. Thus, the more precisely we pinpoint a language in the speech of one individual at one time, perhaps the neural disposition of his brain at a given instant, the less significant it is for the language as a whole, while the more we include in the account about a language, the fuzzier the picture is, but the more interesting and significant it is. This is very much the situation in what Werner Heisenberg treats as the principle of indeterminacy and Niels Bohr treats as the principle of complementarity, according to which between the position and momentum of a particle greater precision in one entails less precision in the other, a principle which Bohr generalized and applied to other fields when he discussed scientific method in general. We shall now discuss

variety in language from the point of view of personality, style, and dialect.

1. *Personality*. All speakers of the same language do not speak exactly alike and the differences in speech among them form important factors in their differences in personality. Edward Sapir (*Selected Writings*, ed. David G. Mandelbaum, Univ. of Calif. Press, 1949, pp. 533-43) considers five elements of speech having to do with personality traits: voice quality, voice dynamics, pronunciation, vocabulary, and style. Leaving the last to the next subsection, because it also touches wider problems than individual personalities, we shall consider the other factors in succession.

It is a familiar fact that most of the time one picks up the receiver and says *Hello!*, if the other side knows the speaker, he will be able to identify him even though he speaks with the most ordinary expression. One can, to be sure, disguise one's personal voice quality, so that Charlie McCarthy has one personality and Mortimer Snerd another. Everybody knows perfectly well that both those voices come from the same ventriloquist, and yet they give a plausible illusion of different personalities, because they have different voice qualities. Here is then an exception that proves the rule. Apart from such exceptions, the voice is something one inherits, like one's physiognomy, though it is modifiable by training, or in the case of ventriloquism, by straining. Acoustically, voice quality is conditioned by both the anatomical structure and the nervous organization controlling the relative resonances in the laryngeal, nasal, and oral chambers, in that order of importance. Except for the total average of the fundamental pitch, such as the difference between men and women, or between a tenor and a baritone voice, the range of frequencies characterizing voice quality is in the middle thousands and is not a range apart from those for vowel qualities, so that the [i] as in *see* in a muffled voice is really not so [i]-like as that of a metallic voice, and nasalized voice as a personal trait is no different from the overall nasalized quality of some forms of American speech. In a wider sense, voice quality includes not a constant quality but certain accompanying noises such as breathiness or intermittent changes in voice quality such as in a raucous voice.

Voice dynamics includes such things as intonation, rhythm,

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relative continuity or discontinuity, and speed of utterance. Some people, for example, habitually use a wider range of pitch than others. Take the Chinese sentence:

N e^{ng} bu n e^{ng} c h i i lai ?

'Can I get up?' When my granddaughter said it when she was five, it was like this:

N e^{ng} bu n e^{ng} c h i i l a i ?

Her speech had, and still has to some extent, a wider range of pitch, so much so that once Bernard Bloch (Editor of *Language*) asked me, quite seriously, "Does Canta [that is her name] speak the same dialect as you do?" Of course she does. But in her version of Mandarin, every tone and intonation is multiplied by a personality factor. As for the rhythm of speech, some people talk in an even flow of syllables both as to length and stress pattern while others habitually

skip and hop and jump



as they talk. Some speak fast even when they are not in a hurry, some speak slowly most of the time.

Before going on to illustrate the other factors, it is important to separate the individual from the social aspects, a point which Sapir emphasized throughout the passage referred to above. Take the matter of voice quality again. A rough or raucous voice may indicate a certain kind of personality. But if the speaker has grown up in a society in which there is much outdoor shouting and rough handling of the voice, then it is part of his culture and no inference can be made about his individuality. In the matter of voice dynamics, the separation of the individual from the social is even more important, since it often happens that what is personality in

one community is just plain everyday phonemics in another. For example, when someone's speech goes this way:



he is not singing, he is probably talking French. When a hostess asks, *Will you have another cup of t_e^a?* she is not being rhetorical or practicing the Chinese 3rd Tone. The correct inference is that she is probably from Southern England. We were considering the personal differences between those who speak with an even rhythm and those who speak with skips and jumps. But the possibility must be kept open that a very smooth even rhythm may be simply the speaker's Spanish-speaking background which is showing through.

With regard to vocabulary, it is a common trick in fiction and play writing to characterize a person by a favourite word or cliché repeated every once in a while. But here, as elsewhere, one must try to disentangle the individual from the social. Once I heard a girl from Chungking speak of everything that was the least bit troublesome or annoying as *shāng-nāochīn* literally, 'it hurts the brain', and thought that this girl's language was very picturesque. But I soon found out that everyone that came from China during the middle 1940s brought with him the expression 'it hurts the brain', a new idiom which had come into use since I left the country. Consequently there was nothing that could be inferred about the personality of its user.

Besides the personality traits discussed above, there is also the question of the uniformity and multiplicity of personality in the same person. It is easy enough to identify a human organism from cradle to grave, with a largely continuous memory. But if we try to set up a conception of personality, with regard to speech as well as other traits, then it is not so simple a problem, even if we do not consider the relatively infrequent cases of pathological multiple personality. Consider a pair of identical twins. They have very nearly the same set of genes at birth. Suppose further that they have grown up in totally different environments. If personality were completely determined by the set of genes at birth, then one

would have to say that these two very different kinds of persons have the same personality, which would then be a useless conception to use. If, on the other hand, later experience is included as a part of personality, then we are admitting social acquisitions into personality. How far then should one go? On the whole a person's phonetic habits and phonemic system are established during the first three years and the grammatical system very soon after. Vocabulary and idiom grow and change more slowly and various personal features of language as described above grow and change throughout one's life. This is no argument against including later experience as part of personality, since it merely amounts to the truism that one's personality changes with time.

Not only is there difference in the linguistic personality for different times, but also at different places, as William James observed long ago. The same genteel-voiced person at a polite mixed party will have a totally different kind of voice quality at a ball game or a political convention, and with a different vocabulary, too. In the case of bilinguals (about whom we shall have more to say later), especially if associated with different cultures and different sets of persons, the same human organism will turn on or off not only different languages, but also a wholly different collection of speech traits as well as other behaviour patterns, including kinesics, so that one could say that he is a different person living in a different world.

2. *Style*. It is true that the style is the man, but it is also true that a man is of many styles. We already noted the fact that one does not speak the same way in polite company and at a football rally. If we include the style of learned writing, even if it is a political editorial and not an article on fundamental particles, the style will of course be even more different. In trying to render a systematic account of a language, a linguist will naturally try to build as neat a system as possible on the assumption of a monolithic structure of the language. In phonemics, for example, we found that we often had to have either a very elegant table that accounts for practically all the phonetic facts, with a small residue of marginal cases, such as the voiced *h* in English interjections, or else account for all observed facts at the expense of a more complicated system. Scholars of the old tradition tended to use more

formal styles of language, such as recorded in written texts, as the normal subject of study. With modern linguists, especially those who have to do with unwritten languages such as the American Indian languages, the data have to be entirely oral and are more likely to be informal in style. In cases where there are large-scale differences between styles, one practically has to recognize different dialects. For example, C. F. Voegelin reports (in *Style in Language*, Th. A. Sebeok, ed., p. 66) that in the casual style in Turkish, the verb must be at the end of a clause, while in the noncasual style the verb may occur in other positions. Again, in the Changsha dialect of Hunan, one can listen to a man reciting all the *Thirteen Classics* and hear only five tones, but one need listen to only one minute of conversation to be able to count six tones—the half-low level tone does not occur in the non-casual style. A full, or unified account of the language, at the expense of greater complication, should then include both styles.

In linguistics the term stylistics is used in a somewhat different way from the term style as used in the study of literature. Under stylistics one usually includes such problems as relate to speech dynamics, (controllable) voice quality, and various other elements of vocal expression, while the study of literary style has more to do with the pattern and frequency of segmental phonemes, the occurrence of vocabulary items, and the types of favoured grammatical forms, such as nominal versus verbal constructions. This difference between the linguistic approach to stylistics and the literary approach to style is however not so much a difference of kind as a difference of emphasis. There is basically only one study of style. Because of the circumstance that literature in the form of written text does not usually include elements of vocal expression, the study of literary style has come to be more associated with those elements of the language which are more tangible from the text, namely diction, phraseology, etc. Linguists, on the other hand, because they take speech as their primary object of study, find style to depend very much upon elements of voice dynamics and perhaps more so than those of words and constructions. Thus, on the one hand there are philologists who are concerned with the word statistics of Bacon as compared with Shakespeare, while the linguists will be more interested in the intonation patterns of

Richard Burton as compared with those of Forbes Robertson. But in a larger and useful sense, both have to do with style. Drama, as we have just seen, is a field where stylistics, in the linguistic sense, is of central importance in style. On the other hand diction is also an important element in the style of everyday talk. I once asked a workman on the street, through the din and rattling of machinery:

"What's the name of those machines there?"

"Those are stamping machines."

"How much do they cost?"

"I don't know.—Hey, Mac, how much do you have to pay for one of them stampers?"

So I realized that he was talking in one style to me and in a more casual style to one of his associates.

While the dichotomy between the casual and the non-casual is useful and will account for differences of style in perhaps the majority of cases, it is often desirable to recognize more than two grades of casualness or formality. For example, Martin Joos (in "Five Clocks", *Int. Journ. of Amer. Linguistics*, vol. 28, no. 2, 1962) sets up five grades of style, along with grades in other dimensions which are loosely correlated with style, though essentially independent of it, as in Table 5A. The style of written exposi-

Table 5. The "five clocks" of style and speed

A			
AGE	STYLE	BREADTH	RESPONSIBILITY
senile	frozen	genteel	best
mature	formal	puristic	better
teenage	consultative	standard	good
child	casual	provincial	fair
baby	intimate	popular	bad

B		
SPEED	ARTICULATION	(example)
deliberate	mincing	[pə'tɪkjʊləɹli]
slow	clear	[pə'tɪkjʊləɹli]
average	normal	[pə'tɪkɪləɹli]
fast	slurred	[pə'tɪkɪləɹli]
hurried	swallowed	[ptɪkɪ]

tory prose, such as is used in this book (after the editor and my consultants have smoothed out the un-English spots), would be "good standard consultative mature style" on Joos's scale. But from the point of view of stylistics in the linguistic sense, the speed of utterance, with closely correlated grades of distinctiveness of articulation, form two more scales, as in Table 5B. The last form may look very different from the original word as spelt, but when spoken in context, it will not be pickly difficult to understand.

3. *Dialects and standard language.* The term dialect is often popularly used as a pejorative epithet. The speaker of a dialect in this sense differs from that of the standard national language either because he is from a different locality where the dialect is spoken or because he belongs to a different class of society whose members are socially isolated enough from the society at large to speak a separate dialect. An example of the former is the dialect of southern France, where people say *pour quoi* [pur kwe] instead of standard Parisian [pur kwa] or *maintenant* [mɛ̃tənɑ̃] instead of [mɛ̃tɒ̃], using nasal consonants for nasalized vowels. An example of the latter is the Cockney dialect of London in which one says something like *The rine in Spine falls minely in the pline*. Dialects differ also in vocabulary and to a lesser extent in grammar (e.g. *you was* for *you were*, *he don't* for *he doesn't*). Now there is nothing intrinsically inferior in one dialect as compared with another. If an American says *sang a song* [sæ̃ ə sɔ̃] instead of [sæŋ ə sɔŋ], it would sound queer or foreign. Because the differences between dialects and between any dialect and the standard dialect are of the same nature and have to do mostly with phonemics, vocabulary, and grammar, in that order of importance, linguists do not set up dialects as opposed to the standard language, but rather include the standard form of the language as one of the dialects of the country, describable by the same method of analysis as that for any local or class dialect. Thus, one can record and describe the Parisian dialect of French, the Standard Mandarin of Chinese, or the so-called "boarding school English" of Southern England, frequently taken to be the typical form of "Received English", the form of English often recommended for foreigners to learn; the linguistic technique of analysis of a standard dialect (dialect

in the linguistic sense) is the same as that for any of the other dialects.

The prestige of the standard national languages differs considerably from country to country. A Britisher would try to get rid of any Cockney accent he may have grown up with, especially when he meets with foreigners. In China a speaker of Cantonese or the Shanghai dialect may find it an inconvenience not to be able to speak Mandarin when he meets Chinese from other provinces, but he is not ashamed of his inability to speak the official language. Some of the most famous scholars spoke the most outlandish dialects of inland China. The Swedish premier is said to be proud to speak a non-standard dialect which in the mouth of another person might be considered substandard. The French Academy is the established authority on the standard of French. But the famous sinologist Henri Maspero (1883-1945), following what might be called substandard Parisian, pronounced *son* and *sang* alike and *qu'un* and *quinze* with the same vowel. My teacher J. Vendryès, who wrote the first of a number of books called "Language" (*Le Langage*, Paris, 1921), speaks with only one low central vowel [ʌ] for both the front [a] in *moi* and the back [ɑ] in *mois* of Parisian French. In Germany there is no dialect taken as the standard. There is a *Bühnenaussprache*, or stage pronunciation, artificially designed for effective carrying power across the footlights, such as using the tongue trill [r] for the more common uvular trill [ʀ] and final stop sound [k] for the (now) more common fricative [x] or [ç] in words like *Tag* and *Sieg*. Although this artificial form of German is not spoken natively in any place, there is (except for the last two points mentioned) a general approximate consensus of the type of High German (High in the sense of Highlands and not in any evaluating sense) which is commonly taught and spoken to foreigners and used by Germans on public occasions. (For more on this see W. F. Twaddell, "Standard German", *Anthropological Linguistics*, vol. 1, no. 3, pp. 1-7, 1959.)

In America, where there is less variation in dialects over the whole continent than in England alone, it has not been found necessary to set up a standard dialect. In the early post-colonial days, when the new nation still looked toward the old world for things cultural, there was still a feeling for the superior quality of

a British accent, as reflected in the speech used in drama, but the American language had come of age by the turn of the century. For some time linguists spoke of "General American", including such features as preservation of the curled final *-r* and the use of a raised and fronted vowel in words like *half*, *past*. But as the work of the *Linguistic Atlas of America* progressed, under the direction of Hans Kurath, it was found that General American, however defined, was not so generally valid for any actual dialect and the term is now out of use by linguists. Instead, Henry Lee Smith has set up what he calls an "overall pattern" of the dialects of the country, within which the actual speech of any locality will contain certain, but exclude certain other, elements. Theoretically one could speak of the overall pattern of all languages of the world, each of which selects certain elements from the total chart of consonants and vowels, maybe tones, to make up its language. But the overall pattern for American English is not only a much smaller list of phonemes, but also combined in certain limited ways, so that it does give a fairly definite picture of the American language as a whole. At the same time relatively little social implication goes with any form of the dialects, with the exception, perhaps because of racial associations, of a certain type of Southern speech, having more to do with grammar and style than purely with accent. However, one excellent scholar of English literature and linguistics in a small college in the North was unable to hold his job because of his Southern accent, whereupon he was promptly invited by a large university. The so-called Brooklyn accent, which is actually the same as that of certain parts of Manhattan, is sometimes consciously avoided by its speakers, but one former president of the Linguistic Society of America always said *höid a wöid* and was proud of keeping her accent as a New Yorker. On the whole, the dialects of American English vary little from place to place for a country of that size.

In the old countries, dialects differ so much that in communicating with foreigners a native speaker usually tries to speak the standard dialect, whether standardized officially, such as French, or in fact, such as German. A traveller would then get quite a superficial view of the linguistic map by talking with the people. He should not only hear them talk to him, but should overhear

them talk among themselves. Once I drove from Northern France through Belgium, Holland, Germany, Denmark, Norway, and Sweden. I did what tourists were expected to do, spoke French in France and Belgium, English in Holland, German in Germany, and English in the Scandinavian countries. But listening to the way people talk among themselves was an entirely different story. It goes without saying that the Dutch and the Scandinavians speak English as an accommodation to foreigners, but even in France, before I crossed the Belgian border, people began to talk Flemish, which is a Germanic type of language. Few people talked French in the countryside in Belgium. As I drove through north-western Germany, the kind of German I heard when they spoke to each other, the so-called Low(-land) German, or *Plattdeutsch*, though it is actually nearer English than high German, was hardly intelligible to me. To foreigners, these people wouldn't think of speaking anything but high German. Moreover, when crossing the national boundaries there was no noticeable sudden change of language except the language used in talking to foreigners. The impression I got from that trip was very much like that of the gradual change of accent one hears when sailing up the Yangtze from Shanghai through Nanking, Hankow, Shashih, and Chungking. It is difficult to draw a sharp line where one dialect ends and another starts.

The difference between a standard language and dialects is correlated, though not always identical, with the difference between the language of an advanced, controlling culture and the indigenous language of the people. When the affairs of a country are carried on in the standard language, when a body of literature is written in it, then it often exists side by side with the language of the people who will be more or less bilingual to the extent that their own dialect differs from that of the standard. This contrast between the cultural and the indigenous languages is strikingly brought out by A. Meillet and M. Cohen in the maps accompanying their *Les Langues du Monde* (Paris rev. ed. 1952). For example, in their map for China, there are more patches of indigenous languages than for Chinese as a cultural language. For North America, the map of indigenous languages looks very colourful and pretty, but the cultural language, with the same colour as for England, is all in one sheet of pink.

LANGUAGES IN CONTACT

§58. *Foreign language study*

In the last chapter we were mainly concerned with the relations between language and non-language, with occasional reference to relations between dialects. We shall now consider the relations between different languages from the point of view of the user who has to deal with more than one language. We shall consider in turn foreign language study, minority languages and bilingualism, and translation.

1. *The why of foreign language study.* There are various reasons for which one has to or wishes to study a foreign language. In the first place, it is more profitable, and sometimes necessary, to learn the language of the country in which one intends to travel or work. Secondly, one may have occasion to act as interpreter from one language to another, a subject we shall revert to when we take up translation. Thirdly, one learns a foreign language in order to be able to read books in the language for their content or for literary appreciation and be able to translate them into one's own language when desirable or necessary. Finally, a student takes a course or courses in foreign languages in order to satisfy academic requirements, with good grades if possible. Whatever the motive, it is important to realize that an adequate knowledge must begin with a speaking knowledge of the language. For purposes of travelling abroad or oral interpreting, the point is of course obvious. As for the purpose of reading foreign books or periodicals, it is also necessary to acquire fluency in speaking in order to be able to read the foreign language properly. One of the most common fallacies in connection with language learning is to claim: "I want only to acquire a reading knowledge of German", or whatever language is being considered. After two or three years of a foreign language course in school, what one calls a reading knowledge of the language usually turns out to be no more than a dictionary-hunting knowledge and understanding of the language consists

essentially in saying the material being read in one's own language, sotto voce, if not aloud. Now, in the normal process of reading, one does not read word by word, nor even phrase by phrase. Before finishing a sentence a reader usually anticipates how the rest of the sentence is going to go, which may take the form of innervations for articulations or attitudes of parts of the body, standing for an adverbial phrase, a relative clause or what not. To be sure, a writer may make an intentional unexpected turn of phrase or wording for a special effect. But it is because the reader does expect something, if only in a general way, that he can expect the unexpected. If every item in the linear elements of the text comes as completely new information, then the effect of surprise will be lost. If everything is a surprise, nothing will be surprising. The conclusion, then, is that to be able to read normally in a foreign language, one should also be able to speak it. And since much writing is in a style different from that of speech, one should also learn to compose in it. There used to be a certain amount of composition work in the study of Latin, which is done less nowadays, though texts like Walter Ripman and M. V. Hughes, *Rapid Latin Course* (E. P. Dutton Co., New York, 1923) are in the spirit of treating a dead language as a living one. As to classical Chinese, it is not even a completely dead language, since it is still being written here and there all the time, though readers speaking different dialects pronounce it differently. In my school days, we even practised speaking it for fun. All this seems to go against the modern technique of rapid visual reading which does not have the drawback of being slowed down by the articulations necessary for saying the words. But in practice, no experienced reader fully articulates what is being read: the essential thing is to carry the general tune of the grammatical structure and this takes no more time than it takes for the eye to perceive.

Foreign language teachers often urge students to learn to "think in the foreign language", and it is often assumed that after translating the foreign language for some extended period of them, the student somehow acquires the ability to understand it directly without having to go through the intermediate stage of his native language. This is what can and does happen and the psychology of it is not unlike that of visual reading, which begins with audio-

lingual reading and ends with partial shortcircuiting of the audio-lingual stage. There is however an important difference, which will be of pedagogical relevance here. While visual reading follows substantially the same structural patterns of the language (except down to subsyllabic units in the case of syllabic writing such as Chinese—and nobody stops to read even syllable by syllable, not to say letter by letter), the reading of a foreign language follows quite different structural patterns from those of the reader's native language. When, therefore, a reader of a foreign language dispenses with any translation into his own language, he is not only throwing away his crutches, but actually being freed from his fetters. That is one of the main virtues of the so-called "direct method" of foreign language teaching, on which we shall have more to say later.

On the whole, then, the objective of using foreign books for the purpose of understanding their contents is best achieved through learning first to speak the language and then composing in it. Too often in the practice of graduate studies in the universities, a student starts to learn to "read" in the required languages late in his course of study, and by the time he passes his foreign language requirements by being able to translate a couple of pages, often with the permitted use of a dictionary, he is almost ready with his thesis and it is too late for him to make much use of foreign language references. For it is a fact that unless a person has a speaking knowledge of a foreign language, he has no appetite for reading reference books in it.

There are perhaps minor exceptions where the use of writing does not require a full control of the language. On one occasion I had to consult an article on mathematics in Italian before I had any contact with the language. By guessing from Latin and French, by using a dictionary, and by studying the mathematical symbols, I was able to "read" the article without too much difficulty. The article had so much mathematical symbolism that was already "in English", so to speak, that it hardly needed to be translated. Another exception is the lazy practice, almost universal among Chinese students of Japanese, of pronouncing the Chinese characters, or *kanji*, in a Japanese text with Chinese pronunciation. For example, in a sentence meaning 'Today is fine weather', the written and spoken forms are somewhat as follows:

Written:	今日	は	良い	天気	です
Real Japanese:	Konnichi	wa	yoi	tenki	desu.
Chinese student's					
Japanese:	Chīnjih	wa	liáng-i	t'iench'i	desu.
Literal translation:	Today	wa	fine-i	weather	desu.

of which the second line would be complete gibberish to the Japanese ear.

If the primary interest is in literary appreciation, a speaking knowledge is of course all the more important. Even if ancient literature is the subject of study, reading it in modern pronunciation, as one usually does Chaucer or Shakespeare, will still render most of the original qualities. To be sure, the T'ang (618-906) poems read in modern Mandarin, as they usually are, will lose the rhymes in many cases, but most of the sound effects are still there. As the saying goes, if you have learned well the *Three Hundred T'ang Poems*, even an unversed person will become well versed. It is often claimed that only a passive knowledge is needed for reading literature. But as we have indicated above, there is no such thing as a purely passive knowledge. Without an active knowledge there is no adequate passive knowledge and this is all the more true for literary appreciation.

For purposes of translation it is often assumed that only a passive knowledge—the so-called reading knowledge—of the source language is required. But even here, though there may be some difference of degree, a good command of both languages is still needed. Yen Fu (1853-1921) the first translator of Darwin's *Origin of Species* into Chinese, used to set up three requirements for translation: fidelity, fluency, and elegance. But the last cannot really count, since suppose, say at a court trial, a person is accused of having said, in a foreign language, something like: *You are a damn fool*, and an interpreter renders it as: *You are an extremely unwise person*, the translation has gained in elegance but will certainly not be a faithful translation of the original and might even affect the legal outcome. As for fluency, it is generally a desirable quality, as when an interpreter translates for the doctor the inarticulate or incoherent speech of a sick or injured person. But here, again, if a novelist is depicting differences in personality by the differences in expressiveness in the speech of his characters, it

will certainly not do to translate all the dialogues into crystal clear direct, expressive speech.

There are two ways of testing the fidelity of a translation. One is to ask whether there is another expression in the source language which fits the translation even better. If, for example, after one has translated *Dummkopf* as *unwise man*, another expression in German *unkluger Mann* is found to be closer to the translation, then the English is not the best fit for the original. The other test is to ask whether there is another translation which is more like English, for example, *blockhead*. The second test is really a test for fluency, and in this instance it happens that a more idiomatic translation also has a higher degree of fidelity. Whichever test one chooses to follow, the presupposition in either case is that the translator has full control of both languages, since he will have to have within recall a constellation of all the near synonyms of what is being translated and of all the near synonyms of possible translations. We shall come back to the problems of translation in greater detail in a later section (§ 60, pp. 148 ff.).

Taking up now the study of languages for the purpose of acquiring credit or satisfying requirements, which may not seem a worthy motive to consider, the desirability of studying the language as language is still valid. I remember when I took my second-year German, which was taught by a professor from Germany, we hardly heard a complete sentence of German for a whole semester. He simply followed the then almost universal practice in American colleges and let the students translate the text into English, sometimes not even reading aloud or making the student read aloud before translating. When the translation was inaccurate or wrong, he would correct us and explain the grammar or idiom in English. But I didn't care too much about what was going on and just went ahead, in my homework, with reading aloud over and over again the German text. I did not do it on any modern principle of language learning but simply as a carry-over of the old traditional habit in reading the Chinese classics, which happened also to be the way I was taught and learned English. When the final examination came, which also took the form of translation from German into English, I did the best I could to translate my third into my second language and my grade turned out to be no worse (it was

an A) than those of the other students who were translating from their second into their first language.

2. *The how of foreign language study.* Coming now to some practical details of foreign language study, it is of prime importance for the teacher and student to realize that, since language is a set of habits, the acquiring of a new language consists essentially of acquiring a new set of habits, and for one who has already acquired a set of habits for his native language, it will be necessary to change many of these. Let us consider in turn the three constituent elements of language which a foreign language student has to deal with: (a) pronunciation, (b) grammar, and (c) vocabulary and idiom.

(a) Pronunciation is the most basic but also most difficult. It is the most basic because the very stuff of language is sound. If the sound is wrong, both the grammar and vocabulary may be wrong. A foreigner who cannot distinguish [i:] from [i] or final [s] from final [z] will not be able to distinguish the singular form *basis* [beis] from its plural form *bases* [beisiz], thus leading to grammatical confusion. He will also be unable to distinguish the latter from its homograph *bases* [beisiz], the plural of *base* [beis], thus leading to a confusion between different vocabulary items. It is a well-known fact in the psychology of language that a difference in sound which makes a difference in a language (i.e. a phonemic difference) will sound clearly different for the speaker of that language, but will be hard to perceive for the speaker of another language in which the audio-acoustically perceptible difference is hard to catch if it makes no phonemic difference. For example if a language, say Japanese, has only one kind of /i/, then the difference between *seat* and *sit* seems to be an extremely fine one. So is that between /e/ *set* and /æ/ *sat* for speakers of most languages of continental Europe. That this is purely a matter of habit and not a matter of actual difference in sound is seen in such cases where the actual difference in sound is a very gross one acoustically and physiologically and yet is very "hard to hear" if it makes no difference in the hearer's language. Thus, in a non-tonal language such as English, a word, say *my*, seems to have exactly "the same pronunciation", whether it is said with a low-dipping or a high-falling pitch of the voice. No speaker of English will notice any

difference until his attention is specially called to it, though to a Chinese ear one will be heard as the word 'to buy' and the other as the word 'to sell'. Moreover, the difference in tone is a difference in the frequency of the fundamental pitch, in other words, the gross difference in the sound waves which would be most obvious to the eye if exhibited on any kind of graph, be it a time-pressure graph or time-frequency graph, or what not. Sometimes a phonemic distinction exists between sounds in certain positions but is lost, and said to be "neutralized", in other positions, such as /s/ and /z/ in German, in which there is no final /z/. A German student of English should therefore learn to change his habit of unvoicing final consonants. He is quite capable of producing sounds such as *b, d, v, z* in other positions as in *Bade* and *Wesen*, but must acquire the habit of also making such sounds as in *rib, bed, love, and is*, which is contrary to his habits with sounds in German words. Again, with many Chinese learners of English, *l* can occur only before vowels, and *r* only after vowels. Thus, one lecturer, in trying to say *Rice grows near the river*, came out with *Lice glows near the liver*. The problem of pronunciation is thus not only concerned with the learning of unfamiliar sounds but also with the change of habits in making familiar sounds in unfamiliar surroundings.

One consoling fact about the learning of foreign sounds is the extremely small total number of phonemes one needs to learn in any given language. No language is known to have an inventory of as many as one hundred phonemes. In some languages, there are as few as only about a dozen. Thus, *Merry Christmas* in Hawaiian comes out as *Meli Kalikimaki*, there being no /s/ in the language. Certain sounds, however, occur in most languages, such as *k, t, p, n*, and there is usually some low vowel of the [a]-type, some high vowels of the [i]-type and [u]-type, some mid vowels of the [e]-and/or [o]-type. Since any given language has only about a few dozen phonemes and about half of them have good enough near equivalents in the learner's own language, it remains to worry about the other half. Therefore, I always warn my students that the first task in beginning the study of the sounds of a foreign language is to pay special attention to "one half of a few dozen".

A corollary of the usual paucity of phonemic inventory in most

languages is a corresponding distinctive importance in each phoneme. Since no language has as many as one hundred phonemes the failure to pronounce or distinguish a phoneme correctly would mean an error of more than 1%. It may seem a reasonably good performance to have 75% of the phonemes right and it should rate a grade of C. But if a learner does 75% of his grammatical work right, the end result will be 75% of 75%, or only about 56% right, which should then rate as a failure. No effort should therefore be spared at the early stages to get the phonemic system right and the aim should be, not 80% or 90%, but 100%. To be sure, individuals differ greatly in their ability to imitate sounds and notice differences. But the aim of a 100% performance in acquiring the phonemics of a foreign language is not necessarily the same as trying to acquire a completely native-like accent. If one can learn to talk like a native, well and good, but the essential thing is to be able to make all the distinctions that make a difference. In this respect Europeans are the best students of languages. They usually have all the necessary distinctions under control, even though they may make each sound slightly off, but not enough to be confused with the next near phoneme. They articulate so well that they are often said to speak better English than Englishmen or Americans. This however has more to do than their use of a more formal style of speech under circumstances where a native speaker of English would use a more casual style, including pronunciation. So far as minimum and sufficient conditions are concerned, my formula for students is: "Make different things different and same things the same."

(b) Grammar in foreign language study operates also in a multiplicative manner and should therefore be put on a firm basis in the early stages, from a few weeks to a year, depending upon the language and the intensity of the programme. It cannot be emphasized too strongly that to understand a point of grammar is not the same thing as to have a practical knowledge of it. It is easy enough to understand that *he*, *she*, and *it* are the masculine, feminine and neuter genders, respectively, of the third person singular pronoun and that *they* and *them* are plural forms for all genders. But it takes a Chinese student of English two, three, or five years, or forever, to learn to say *them* in referring to inanimate objects. Instead, he

will keep saying things like: *These oranges have spoiled, throw it away!* or *These shoes are all right, I'll wear it now*. He could pass a theoretical test any time with a perfect score, but will keep using *it* for a plurality of things because in Chinese one says *ta* instead of the plural form *tamen* when referring to things (cf. similar use of *το* in Greek). It is therefore one thing to understand these points of grammar but quite another to be able to apply it—I mean them! I often use the analogy of language learning and photography. Before taking a photograph the view has to be brought into the right frame; the distance focused and the exposure adjusted. This is the theoretical part of language study, which at an early stage may even be done more efficiently in the student's native language than in the language being learned. But when the point is understood, the task of learning is only begun and not, as is the practice with some teachers and students, to be considered done. The main task of learning still consists of repeated practice with the language itself. This, then, is the exposure part of my photographic simile. Having understood that *they* and *them* are pronouns for things as well as persons, the student must practice with many spoiled oranges and throw them away, many pairs of shoes and wear them now, and many other things and treat them as they should be treated, grammatically. To stop with a purely theoretical understanding of the point is like having the camera ready for everything, including the setting for the exposure, without actually releasing the shutter.

(c) The learning of the vocabulary and idioms of a foreign language is both easier and more difficult than the learning of its pronunciation and grammar. It is easier because the requirement for good performance is not so critical. If a word is said or understood in the wrong sense it usually affects only the sentences in which it may occur instead of affecting thousands or, in the case of a frequent phoneme, millions of instances in the life of the language to be used. In other words, the effect of vocabulary is additive and not multiplicative. It is more difficult because one never graduates, as one does with the learning of the pronunciation and grammar of a language. Not only is there an enormous amount of relatively unrelated items to be added one after another but each item, in order to be properly learned, has to be taken in context,

since meaning depends very much upon the context of use, as we have seen (chapter 5), and cannot be learned from the necessarily sketchy and summary treatment in dictionaries. It is often objected that learning the meaning of words in context would involve the hearing or reading of tens or even hundreds of thousands of phrases or sentences instead of a few thousand words to be learned. The answer is that it simply cannot be helped. Words are not really learned except in this way. This is the way children learn to talk and grown-ups learn to read and write. The most a direct translation from a good bilingual dictionary can do is to give a good start, the rest of the learning comes only from use.

The so-called language laboratories which have come into general use in language schools and language departments have given a great practical impetus to some of the principles of language learning outlined above. If a teacher has only so many class hours a week to explain the material clearly, he will not have enough time to let the students practice and correct them when necessary. I was therefore not being quite fair to my German professor of second-year German, who had only two hours a week in which to wade through a novel and a play in one semester. With the aid of recordings on discs and tapes, the actual contact hours are not only greatly increased but one also achieves what we called time-uncoupling between teacher and student, which is a great practical advantage. The use of recordings is, to be sure, as old as "His Master's Voice". But recent refinements in mechanical aids have moved in the direction of automation of not only the exposure part of language learning, such as spaced recordings for the student's repetition, but also some of the focusing part, as in the teaching machines in which a student's answer is matched and "corrected" by the model. The chief advantage however is in the greatly increased amount of contact hours approaching, though not nearly reaching, those of a child's contact hours with the language. Parents and teachers like to feel that they have done a great deal in teaching children how to talk properly, but long before they do much direct teaching in the didactic sense, children have acquired through exposure the basic and most difficult elements of the language, namely the phonemic and grammatical structure, subjects which few parents or even teachers know how to teach.

§59. *Minority languages and Bilingualism*

1. *Bilingual situations.* In problems of foreign language study we were considering primarily monolinguals who have occasional contact with other languages. A minority language is the language of a group, often identified by national or racial origin, who speak a language other than the language used by the majority, usually including those who run the affairs of the country. Such minority groups range from a very small colony of recent immigrants to America from Mongolia, to the thousands of speakers of Yiddish and Pennsylvania Dutch, both being German dialects. In a country like Switzerland where the speakers of French, German, and Italian are comparable, if not equal, in number, there is no point in calling Italian a minority language, even though the number of its speakers is the smallest of the three. In Belgium, although more people speak Flemish than French, the latter cannot be called a minority language in the usual sense, as it is the language in which the government communicates with other countries and in which the greater part of the cultural activities are carried on. The typical cases of minority languages are those in which there is a colony or colonies large enough for the language to be spoken at home in the midst of a large community which speaks the language of the majority. If three generations live together in such a family, as often happens with immigrants from the old countries, the grandparents often speak only the language of origin, the parents speak it at home to the children, but speak the majority-type language to the general community. The children being second generation immigrants, or *nisei*, to generalize a term used for second-generation Japanese, either do not speak the minority language at all, or only understand it when spoken to. In such a situation, a certain degree of tension usually exists among the generations. The older generation laments the loss of contact with the old country through loss of the language while the younger generation is eager to conform and acquire a sense of belonging and is often ashamed to be heard speaking the minority language. The parents often make heroic efforts to keep up the old language at home, but three hardly make a speech community and it always seems so artificial and unreal when the parents themselves can

speak the language of the world outside. In the special cases of a very large minority-language group such as the Chinese in San Francisco or the Japanese in Honolulu, the minority language is a going concern and bilingualism seems to be what engineers call a "steady state". In such cases the problem is rather how to teach the children to speak better English.

2. *Practical aspects of bilingualism.* While bilingualism is a social fact, some educationists claim that it is a hindrance to the child's mental growth, as it hinders the development of one consistent system of verbalizing. This is no doubt true when a child changes from one language into another and forgets all the things he has learned along with the discarded first language in which they were learned. But if a second language is added without breaking the continuity of the first language, then no such loss will be entailed. To be sure, from the point of view of a citizen of the majority-language country, say a Chinese American, there is no reason why he should not start early with the language of any major culture of the world instead of Chinese, since from his point of view, one cannot appeal to his patriotism, as he will ask patriotic to whom? The most important practical advantage is that the child has the advantage of being able to learn the language of a major culture without effort or expense. Since the opportunity is there, he might as well capitalize on it. In large communities with minority languages, there is usually no problem; the children grow up bilingual anyway. But in small families in isolated places, where there is hardly any speech community to speak of, it is much more difficult. However, since most of the difficulty is social and emotional rather than linguistic, it may be worthwhile to offer some practical suggestions for those who may be interested to profit by them.

Suggestion 1: Watch out for the tyranny of *interpersonal language-patterns*, that is, the use of a language or languages two persons have got into the habit of using. If, for example, two Americans, who are of course in the habit of speaking English to each other, meet at a party in France and feel it necessary to speak French to each other out of politeness to the rest of the company, they will feel that they are somehow not really talking to each other. The application to our problem is in the commonly found pattern

between parent and child in which the parent speaks the minority language and the child is allowed to answer in the language of the larger community, and, once the pattern is established, it is very difficult to change. But by being gentle but firm, the parent can break the pattern by refusing to understand the child unless he uses the language he already understands and a new pattern can be established. Above all one must not of course laugh at the child for errors in pronunciation, in the use of words, or in grammar. Simply say the right forms, repeating them if necessary, but without any distorting intonation, implying 'You are wrong!' For the child needs every sympathetic encouragement in his hour of embarrassment, since a change in the interpersonal pattern is always accompanied by the feeling that you are not talking to the same person, a feeling which it takes time to outgrow.

The tenacity of an interpersonal pattern can of course be very desirable when it is the pattern one wants. I used to have a neighbour from Denmark who married an American. He has consistently spoken Danish to his daughter from the beginning and his wife has consistently spoken English to her. The girl has grown up and has been consistently speaking Danish to her father and English to her mother. After they returned to Denmark, the minority language became the majority language and the majority language the minority language, and the same two interpersonal patterns have been kept going.

Suggestion 2: Watch out for the fixity of *inter-group language patterns*, that is, the association of certain groups with certain languages in the eyes (ears) of other groups. The story is told of European missionaries in Canton who spoke perfect Cantonese to the country people but were met only with a stare. When finally one of the country people realized what they were saying, he exclaimed, "How strange, I never studied English before, how come I can understand this man's English perfectly?" This story must be apocryphal, since it has been attributed to various persons and places. According to another version, Pearl Buck is said to have visited a country district and stopped at a teahouse. When the waiter brought out the tea and she thanked him in perfect Southern Mandarin, the man dropped the pot and cup on the floor, being so astonished that he could understand English without ever having

studied it before. Like the interpersonal patterns, inter-group patterns can also be changed. For example, my granddaughter Canta, who grew up with us, was monolingual in Mandarin Chinese, until she went to the nursery school, when she became bilingual after a few weeks. Since in our locality there were only two or three families in which the children spoke Mandarin, she quickly made the following (subconscious) generalization: (1) Grown-up Chinese speak Chinese. (2) Grown-up Americans speak English, (3) all children speak English. She would never speak Chinese to her Chinese friends who in her presence would speak Chinese to their own parents and turn around and talk English to her. Somehow, to her mind, children are English-speaking beings. This was in California. When however, Canta went later to Cambridge, Mass., to stay with her parents and we saw them after a few months, we found her narrating stories of Cinderella and the Three Little Pigs in Chinese to a group of children, since meanwhile the spell of the first inter-group pattern had been broken by the relatively large number of Mandarin-speaking children in that area.

Suggestion 3: *Eschew skipants*. A skipant is a borrowing from a majority language into a minority language, a phenomenon which is observable in the speakers of all the minority languages in a large country. The term *skipants* was a bit of family cant for words in English that the minority language has an equivalent for but the speaker is too lazy to use, commonly because of its infrequency of occurrence. Once an American student of Chinese was listening intently to a lively conversation in Chinese between two of my daughters and was suddenly startled by the mentioning of the word *skipants*. Subsequently the word became temporary college slang on the Radcliffe campus in the sense of borrowings from English in speaking one of the minority languages. Such borrowings are not the same as ordinary linguistic borrowings, which are relatively few in number, more permanent as a part of the borrowing language, and spoken usually in the phonemic system of the borrower, such as French *fiveoclock* [fivɔ̃klɔ̃k] 'afternoon tea' or *weekend* [vekā]. A skipant, on the other hand, is usually in the phonemics of the majority language and can be drawn from its main lexicon without limit whenever the speaker does not want to bother

with using the equivalent in the minority language he is supposed to be speaking at the moment. Sometimes, when a speaker feels very relaxed and goes into skipants whenever an important word occurs, a person who knows only English can get a pretty good idea of what is going on, whether it is a conversation in Italian, Yiddish, or Norwegian. There is nothing morally or practically wrong in thus mixing languages and similar processes have formed an integral part in the history of languages in contact. But if the explicit purpose of parents is to keep their children truly bilingual, it will be necessary, at least in the earlier years, to eschew skipants when they speak the minority language.

Suggestion 4: Remember that the language is more basic than the writing. It is also more easily and pleasantly acquired by children. Not that the writing system is not useful or important but it is a different kind of study and the study of writing is not the study of the language, a point which is often missed by teachers and organizers of classes for the minority languages. To sum up, then, if for cultural or practical purposes, it is desired to make a go of a minority language with children of the second generation, beware of the tyranny of interpersonal language-patterns, look out for the tenacity of inter-group language patterns, eschew skipants, and always remember that speech is more basic than writing.

§60. *Translation*

Translation is as old as Babel, and plays a greater part in languages in contact than either foreign language study or bilingualism, though these latter aspects are usually involved in translation. It is often assumed that for any given text—text in the linguistic as well as graphic sense—in one language there is one correct or best translation into another. This assumption is often made both by experienced translators as well as by amateurs and its untruth originates from the common attitude of treating language as something apart from life instead of, as we have emphasized repeatedly, a part of life. If something is said in response to a situation, and it has to be translated into another language, the translation should also be such as will be appropriate to the situation. Thus, translation is not a simple two-term relation between two languages or

two texts but a three-term relation, in which the situation of use becomes one of the terms, if, for simplicity, we include the identity of the speakers (or writers) as part of the situation. If this multiplicity of relation is granted, then a multiplicity of standards of translation will also result, as we shall consider below.

1. *Purposes of translation and types of materials.* In a previous context we mentioned the three requirements of fidelity, fluency, and elegance for translation, with special emphasis on fidelity. Taking now into consideration the purposes of translation and various types of materials to be translated, we shall find that there will be as many translations as there are purposes even for the same material. One essential factor is the original intended effect on the intended hearer or reader. Even a soliloquy or a monologue is intended for some audience. In the limiting case of diaries or an autobiography not intended for publication, the translation should of course also render the same effect of being addressed only to oneself. In some diaries the writer often addresses himself as *you*. For a special effect, as in *The Education of Henry Adams* (Boston and New York, 1927), the author may always refer to himself in the third person, even though it is an autobiography.

The translation of live speech in practical situations is linguistically interesting precisely because it involves extra-linguistic or marginal factors, such as voice quality, intonation, gesture, etc. If the same desired effect is to be attained, sometimes a word or sentence in one language may have to be "translated" by a gesture, such as English "I don't know" into a French shrug of the shoulder. On one occasion, when I gave a lecture in Chinese and punctuated the ends of my paragraphs with pauses, my interpreter into Japanese translated the pauses into *sh*—, that is, a sort of *s* or *sh*, with the air drawn in. For legal and political purposes, oral translation will of course depend very much upon the exact style in which it is done. We have already seen that an inelegant expression must not be rendered with inappropriate elegance. In the simultaneous translation set-up at the United Nations, the majority of the interpreters are quite good in rendering the right effect. It was not recorded, however, whether when a certain delegate emphasized his point by putting his shoe on the table the interpreter also put *his* shoe on the table.

On the whole, the major concern of most translators has to do with written documents, especially those of permanent or long-term importance: the Bible, the Chinese Classics, the Classic Classics, Shakespeare, the American Constitution, the UN Charter, and so on. In written translations the translator has time to weigh the relative importance of various aesthetic and practical factors, so that any document of long standing will have had more than one version even in one language. A Greek tragedy translated for the study of Greek antiquity need not be in the same form as a translation suitable for performance on the stage. In the translation of poetry and song the sound effects are of course more important than in other types of text. (For examples see below on sound effects.)

A specially easy class of materials for translation is where there is close isomorphism of vocabulary because of isomorphism of culture. The two most important fields in which this exists are modern science and current events. There are to be sure many cultures in which there was or even still is no science and therefore no terminology for science. I remember that when I was assistant editor to Yang Ch'üan of the Chinese magazine *Science* in 1915, I felt that the Chinese language was not suitable for natural science. But once equivalences have been set up, translation of science is so easy that more than one centre in America has started with scientific Chinese as one of the languages to try first in their programmes for machine translation. Social science is a little more difficult in this respect, but there are more and more recognized equivalences in journalistic, if sometimes barbarous, styles, and that is one of the reasons why the news sections in current newspapers are easier to translate than the literary sections.

Finally, a purpose of translation almost as unworthy of consideration as the study of foreign languages for school credit is the use of translation as a form of teaching or recitation in a foreign language class. As a phase of what I called the "focusing" stage of language study, translation is a useful process if it does not usurp the place of practising with the language itself. When so used, the translation should then emphasize the structural relationship of the parts of a phrase or sentence and if a fluent translation of the whole is to be used, the teacher and student should make sure that structural analysis is well understood beforehand. For example,

défense d'afficher is to be analysed structurally as *prohibition of affixing* (signs), but to be translated as a whole as *stick no bills*.

2. *Size and structure of units of translation.* There is practically no upper limit to the size of a unit to be translated, from a speech, an essay, a play, a novel, or a treatise, to a whole encyclopedia. But for purposes of studying the nature and technique of translation, one need not go beyond what can be called a discourse, which may only be a single remark or usually not more than a paragraph or a poem.

At the other extreme it might seem that the smallest unit to translate would be a morpheme, such as *-ly*, which could be equated to German *-lich*. A discourse however, is at least of the size of an utterance and an utterance is free, but a bound morpheme cannot be an utterance and is therefore not a suitable unit for translation. That one does not and cannot very well translate a bound morpheme is not simply because it is too short, but because it is ambiguous out of context. For the proper subject of translation is a text in context and a bound morpheme or even a word or a sentence out of context is ambiguous and therefore not susceptible of translation. That is in fact why practically every dictionary entry has more than one definition, since which definition is applicable depends upon the context, including non-linguistic context, in which the word occurs. As I. A. Richards has observed, it is a fairly good guide to tell whether a word is to be translated by the same word or by different words if you note whether it comes under the same numbered definition in a monolingual dictionary.

The most specific kind of context in which a word or a sentence occurs is that of an actual instance of occurrence in a situation, which then constitutes a token of the word or sentence as a type. We noted before (§ 6) that philology might be characterized as the study of tokens and linguistics as the study of types. Translation of a historical text is then the translation of a token and should, after adequate research in the context, yield a definitive translation of the original. This is however only true so far as the interpretation of the original is concerned. Since the user of the translating language and the hearer or reader may vary as to background and as to the circumstance of hearing or reading, there may still be differences in the translation even for a specific text. Hence the

controversies over the old and new versions of the Bible, since to the older generation the Authorized version or the Douay-Rheims version will have very definite associations and overtones which they miss in the modernized version. But the new generation may possibly get better approximations to the effect of the original from a modern version, so their defenders claim, than from an old version, since they did not grow up with it.

The size of unit of translation never goes below that of the morpheme, as we have seen. For very closely cognate languages or dialects one may set up regular equivalences of sounds according to phonetic law as in English *good*, German *gut*; E. *blood*, G. *blut*, etc., so that a final *-d* can be equated to a final *-t*, but this is not strictly translation, on which see subsection (4) below. From the size of a morpheme up, the translational unit may be of all sizes. There may be morpheme by morpheme translation, word for word translation, and a proverb may be translated by a proverb, which in a minority of cases may even be nearly word for word. In extreme cases a book in one language may be put into another language with little regard to the words or even sentences in the original. For example the "translations" of dozens of eighteenth and nineteenth century English novels in beautiful Classical Chinese, by Lin Shu, in which I did most of my reading of Western fiction, was done through the oral story-telling by Wei Yi, since Lin knew no English and so simply retold the stories in his own words. Thus, instead of the usual dichotomy between a literal and an idiomatic, or free translation of a text, there can, in general, be a whole spectrum of literalness and idiomaticity with regard to the constituent elements for translation. The difference may better be described as fine-grained and coarse-grained translation. The so-called literal translation, incidentally, is a misnomer, since, as we have seen, translation does not begin until letters (phonemes) combine to form morphemes and words. In most cases, when one speaks of a literal translation, it is usually word-for-word translation which is referred to. But besides the matter of size, there are other dimensions to consider, which we shall now take up.

3. *Dimensions of fidelity.* A distinction is often made between *semantic* translation and *functional* translation. For example, the sentence: *Ne vous dérangez pas, je vous en prie!* can be given

a semantic translation as 'Do not disturb yourself, I pray you!' or functionally as 'Please don't bother!' The translation is functional because that is what one would say in English under the same circumstances. But if we look closer at the constituents being translated in this and all other materials for translation, we shall find that the difference of semantics and function is also a matter of degree. To be sure, there is no point in equating *dérangez* to 'derange' since that would be giving the etymological cognate and not translating. But a close semantic translation could be 'disturb yourself'. On the other hand, 'I request you' for *je vous en prie* is closer semantically, while 'please' is functionally what one would more likely say in cases where one would say *je vous en prie*. But isn't the meaning of a word in a context, or in fact of any linguistic form, that which one would normally say under those circumstances? If so, then the best semantic fit in a translation would have to be also functionally the most suitable to use. The idea of semantic translation, however, is not completely without meaning. It usually refers to the most commonly encountered meaning of a morpheme or of a word as given in a dictionary, and, other things being equal, to the etymologically earlier meaning. This is again a matter of degree, since all semantic meaning is functional. Even as simple a meaning as that of *water*, since "it is water", has a most vivid meaning when Helen Keller realized for the first time in her life that the heretofore meaningless motions of her teacher's hand in her hand spelling out *w-a-t-e-r* meant the cool, refreshing thing that flowed out from the pump (as told in her *The Story of My Life*, New York, 1924, pp. 23-4).

Correlated highly, though not identical, with the above is the dichotomy of *literal* vs. *idiomatic* translation which we found to be essentially a matter of fine-grained vs. coarse-grained rendering and since function is an important constituent of meaning, a fine-grained translation need not be a highly faithful translation unless there is also a high degree of functional fidelity. The reason that the so-called literal translation is often considered basic and somehow more faithful is that a dictionary equivalent apart from context of use, even allowing for multiple glosses under each single entry, is more constant than if actual context is taken into account. A literal translation is therefore simply a lazy man's translation.

A very important dimension of fidelity which translators often neglect is the *comparative degrees of frequency* or familiarity of the expressions in the original and the translation. Too great a discrepancy in this respect will affect fidelity even though the translation is accurate in other respects. To be sure, the very thing one talks about may be a familiar everyday thing in one culture and strange and exotic in another. In such a case, if the thing is the main topic of the discourse, it cannot be helped. An account of a game in the World Series can very easily be translated into Japanese, but would make poor reading in Chinese, in which terms about soccer are heard every day, but not those of baseball. On the other hand, if a familiar expression is used casually as a figure of speech, then sometimes a translation by a different figure of speech of the same import and equal degree of familiarity will result in a higher degree of total fidelity than an apparently faithful translation which is very unfamiliar. For example, to speak of reaching the third base had better be rendered, in Chinese, as reaching the "listening stage" in mahjong, where the apparently "free" translation has greater fidelity, because of being a better functional translation. My former colleague at Tsing Hua University Tschen Yinko used to say that what sounds familiar must sound inferior (based on a pun in his dialect where *sóu* is a homophone meaning either 'familiar', Mandarin *shú* or 'vulgar', Mandarin *sú*). But, as we have seen, what is vulgar, according to the criterion of fidelity, should be translated by the vulgar and not by something elegant.

Most languages have so-called *obligatory categories* and translating such categories explicitly into a language in which they are not obligatory will lead to overtranslation. A cousin in Chinese has to be either male or female, on one's father's side or on one's mother's side, older or younger than oneself. A friend in German has to be either male or female. A noun in English has to be either singular or plural, a verb either present or past. When the obligatory distinction, whether lexical or grammatical, is not relevant in the context, it need not be translated. For instance Chinese *piāomèi* can be undertranslated as 'cousin' if the obligatory distinctions involved do not matter, otherwise one would have to say things like: "Good morning, my female-cousin-on-mother's-or-paternal-

aunt's-side-younger-than-myself!" Sometimes a translator uses a form in the original without noticing that it is superfluous because it is obligatory. Thus a sentence like: *I put on my hat and went on my way* is translated by many inexperienced translators by including the possessive pronoun *my* into languages where it is not used except for explicit distinction of possession. Of course if such overtranslation is done repeatedly on a large scale, it can establish a new usage, at least for a particular style. Thus, starting with an imperfect knowledge of the uses of tense in English, Russian, or whatever, a Chinese translator adds mechanically the suffix *le* whenever he sees a verb in the past form even though in his own talk and writing he uses no *le* in many instances of reference to the past. Similarly, he uses a preposition *pèi* 'by' whenever he sees a passive voice in the original verb, forgetting that Chinese verbs have no voice and the direction of action of a verb works either way, depending upon context. Once this sort of thing is done often enough, it gets to be written in originals, even where no translation is involved, thus constituting a case of structural borrowing. Such "translatese" is still unpalatable to most people and no one talks naturally in that way as yet, but it is already common in scientific writing, in newspapers, and in schools.

Besides the translation or omission of obligatory categories, there is also a common tendency, unless one is on guard against it, to translate the *form class of an expression* into one of the same or similar form class: noun for noun, verb for verb, etc. Other things being equal, this will of course be a contributing factor for fidelity. But since other things are never equal, they must not be given more than proper weight. For example, *quelle merveille!* is a nominal expression, but the translation into English should be *how marvelous!* an adjectival expression, and not *what marvel!* which would be too strong and not comparable in frequency of occurrence. Sometimes even different categories of linguistic elements may be the best translational equivalent, as when a double circumflex intonation in English is translated into a repeated verb with an inserted verb *to be* in between, e.g. *It's good* ∩ (but) = Chinese *Hǎo shìh hǎo*, which structurally means '(As for being) good, (it) is good'. In extreme cases language is even translated by non-language, such as a gesture, as we have seen above (subsection 1).

Style as to the period or age of the language is another dimension in which too much discrepancy will affect the fidelity of translation. One may jazz up the classics as parody, but it would not be translation. Contemporary style in one language can of course best be translated in contemporary style in another, especially if the subject is one which is being talked or written about now. For a text of a past age, the translation leads to problems. We have already considered the problems of translating the Bible, and whole books have been written about them, such as Ronald Knox, *Trials of a Translator* (New York, 1949). There is no great virtue in trying to match original and translation period for period, as for example *The Divine Comedy* in the language of *Canterbury Tales*, except when such a translation already existed in its own right. Moreover, what if the text to translate, such as the classics, was written long before the age of the translating language, say before the formation of what might be called the English language? The wise course in such a case, as has been adopted by most translators of the older texts, is to write in as timeless a style as possible, which may involve a loss of colour and life, but is at least free of suggesting the wrong colour. In the long run, to be sure, what seems timeless to the translator of one time will eventually be dated and that is why there have had to be re-translations of important works, as in the case of the Bible. But in handling older texts one should at least avoid the use of local colour and narrowly dated expressions. For nothing gets so easily off colour as that which is full of local colour and nothing gets so quickly out of date as that which is right up to date.

Finally, a very important but often neglected dimension of fidelity is what might be called the *sound effects* of the language such as length, symmetry, and, in the case of verse, metre, rhyme, and other prosodic elements. Since the semantic range of words and the obligatory grammatical forms of two languages never coincide, if all that is in the original has to be accounted for, the translation will necessarily be longer, but in trying to include all that is in the original, the translation will unavoidably add extraneous elements because of the overlapping semantic range and the obligatory grammatical categories in the translating language. In practice, therefore, a translator will have to make a compromise between

the sins of omission and commission, taking into account all the factors of fidelity, including that of aiming at comparability in length.

In translating verse, the sound effects will loom large and thus require allowances in the other dimensions. An example of sacrifice of sound for the sense is the usual type of translation of Classical Chinese verse by James Legge and Arthur Waley, in which the number of syllables is anywhere from twice to four times that of the original. At the other extreme, at the sacrifice of sense for the sound, I have retained all the rhyming schemes and nearly the same metres in all the verses in my Chinese translations of *Through the Looking-Glass and What Alice Found There*. In rendering all the plays on words, such as *hare*, *ham-sandwich*, *hay*, etc., with Chinese words all beginning with *h-*, I have had to be satisfied with words with the same general sense in the sentences, instead of sticking close to the dictionary equivalents. Even in prose, a closer sound effect sometimes gives a better total effect, for example, translating *Sturm und Drang* as 'storm and stress' than the literally closer 'storm and pressure'. Similarly, French *et patati et patata* will sound weakish if rendered simply as 'jibberish'; *yak yak* is better, but still too short, while *yakety yakety* would give a closer sound effect for commensurateness as to length. Proverbs are often equatable between one language and another, preferably with similar rhythmic effects, as in translating *As ye sow, so shall ye reap* into Chinese *Chùng kuā té kuā, chùng tòi té tòi* 'Plant melons (and you) get melons, plant beans (and you) get beans'. In translating songs to be sung in the same melody, the requirement of sound effects is even more strict and sometimes the result can hardly be called a translation, as one can easily see when opening any page of a bilingual version of say a volume of Schubert's songs.

It can readily be seen that the various dimensions of fidelity discussed above are not completely independent, as dimensions in the mathematical sense are supposed to be. We are far from reaching a workable quantitative definition of each of the dimensions, not to speak of formulating a function with a view to maximize its value. But even so, it will be helpful just to be conscious of those dimensions in translational work. At the present stage one is still

not far beyond the general idea, as stated by J. P. Postgate in his *Translation and Translations*, p. 3 (London, 1922): "By general consent, though not by universal practice, the prime merit of a translation proper is Faithfulness, and he is the best translator whose work is nearest to his original." But since nearness is a matter of degree, we are back to the problem of measurement of fidelity again. One useful test is to retranslate the translation into source language and see how well it agrees with the original. Although Mark Twain has shown what funny results can come of such experiments, such a test can sometimes be a useful check on fidelity, as we have seen (p. 138). This is to be sure only a testing procedure and the problem of multi-dimensionality of fidelity is still with us.

4. *Isomorphs and translations.* There are translations and translations, but some isomorphs other than simply different physical forms can be called versions, but not translations. Transliteration of one form of written text into another, or transcriptions of spoken sounds in some form of phonetic notation are of course simple isomorphs, as we have seen (p. 117 ff). When an ancient text is read, as it usually is, in a modern pronunciation, it is still only being changed into an isomorphic form. Take the practice of reading Latin aloud in the liturgies in Italy, in France, in England, and in America. They sound so different from one another, that they are virtually different modern dialects of Latin. For they use phonemes of each of the languages (in the American usage, a half-way approximation is made toward the original), but in no actual usage does one follow the scientifically reconstructed forms as given by E. H. Sturtevant in his *The Pronunciation of Greek and Latin* (2nd ed., Philadelphia, 1940), according to which, for example, a final nasal would assimilate to a following consonant, not only within words, as seen in English borrowings such as *irregular*, but also between words. For example, *in re*, according to Sturtevant, was actually pronounced, in the time of Cicero, as *ir re*, or *cibum amō* as ['kibū 'amo:] (cf. p. 77). Apart from fine points of reconstructions, such diverse modern readings constitute almost dialect forms of borrowings.

Somewhat similar to the case of Latin is the isomorphic forms in which Classical Chinese, as it is still being composed, is read in

dialects so different from each other that reading in the pronunciation of one locality will often be unintelligible to the speaker of another locality, even though the latter could understand it if read in his own dialect. The usual manner in which such a situation is described is to say that there is one common system of writing for readers who speak diverse dialects and pronounce them differently, and that since each character means the same thing no matter how it is pronounced, it is the writing which is the common denominator. This is all true as far as it goes. But to stop there would be to leave out of consideration the most important element in the situation, namely that the classical language is a language which has a vocabulary and grammatical structure of its own and is still not only read aloud, but also composed all the time, by each in his own system of phonemics, and not in the theoretically classical pronunciation, such as reconstructed by the famous Swedish sinologist Bernhard Karlgren. In the terminology of modern logic, the nature of the existence of this language consists of the class of all these dialectal forms. Comparing this situation again with that of Latin, the word *Cicero* is not so much the reconstructed value ['kikero] as a class of all the several present-day national forms in which it is read: ['sɪsə'jou], ['tsɪtsɛro], [sɪsɛ'ro], ['tʃɪtʃɛro], etc. It is none of these in particular, but the class of all these forms as a whole. The modern Classical Chinese language therefore does not exist primarily as a system of visual symbols, though its visual nature permits greater use of homophones (cf. p. 120); it exists just as much as a system of audio-lingual elements as any spoken dialect and is learned by its users as much by the usual audio-lingual methods of learning as any other language is learned. To a lesser degree, though following exactly the same logical pattern, the standard dialect Mandarin is being learned and used by speakers of other dialects with more or less heavy local accents and is more truly a class of all these forms than a pure dialect of one relatively small speech community.

Thus, starting with the case of translation between totally different languages, involving multi-dimensional factors of fidelity, we find in the lower limiting case what are apparently very divergent dialects, but essentially isomorphic variants of the same language. On isomorphs of language in general see pp. 117-9.

LANGUAGE TECHNOLOGY

§61. *Articulatory phonetics: the kymograph*

The study of language used to be part of the humanities, especially when it was concerned with historical texts, the study of which constituted philology. People talked about philology long before there was such a subject as linguistics. When at the turn of the century the physiology of speech was studied instrumentally in the laboratory, there began the study of experimental phonetics, thus bringing the study of language closer to the natural sciences. The progress of experimental phonetics, for reasons we shall see below, became stagnant for a time, or at least was not fast enough to catch up with the rapid advances made in the survey and analysis of languages by the methods of direct study of the speakers' utterances, especially of unwritten languages, such as those of the underprivileged cultures; thus linguistics, which became a recognized branch of study in the middle of the first half of this century, has been more or less associated with the social sciences, especially with anthropology. Experimental phonetics however never became obsolete and, with the advent of the electro-acoustic technique of handling speech sounds, it has acquired a vigorous new lease of life.

Early phonetics, whether experimental or not, was mainly concerned with the physiology of speech articulation. The most important instrument of research for it was the *kymograph*, which was and still is used in physiological experiments. It was l'Abbé Jean Rousselot (1846-1924) who first introduced its use for the study of speech at the Sorbonne in Paris. It consists essentially of a revolving drum covered with smoked paper on which a stylus traces curves according to the movements arising from the production of speech sounds. The tracing end of the stylus has a soft point and the other end is attached to the centre of a 1-inch diaphragm, the movement of which actuates the stylus. To the rubber tubing of the drum may be attached pieces for the mouth,

§61. ARTICULATORY PHONETICS: THE KYMOGRAPH

the nose, the lips, the throat, etc., though of course they cannot all be used at the same time. Crude as such set-ups are, there are a number of important features of speech sounds which, up to that time, had not been recorded as accurately otherwise. In the first place, the relative time occupied by sounds in succession can be fairly clearly measured on a kymograph. Much of the manner of articulation such as voicing and aspiration is also discernible in this way. Thus, even though the speaker is so literally harnessed up that he cannot feel that he is speaking nor can he actually produce the normal speech sounds being studied under such hampering conditions, much important phonetic information can still be obtained. On the other hand, the place of articulation of consonants and vowel quality are not suitable aspects of sounds for study with a kymograph, but the pitch of the fundamental, on which tone and intonation chiefly depend, can be studied fairly well with such a setup. In fact the first experimental studies of the Mandarin tones were made by this method in 1916 by C. B. Bradley of University of California, Berkeley, and, apparently independently, by Liu Fu at the Sorbonne in 1924. Besides the use of the kymograph, there were other experimental methods such as painting the tongue or the palate to show the points of contact for dental, palatal, and velar consonants, and the use of the X-ray to determine the tongue position for the vowels and the action of the vocal cords during speech. On the whole the experimental study of physiological phonetics has dropped to a position of relatively minor importance since the advent of electro-acoustic technique in the treatment of sounds in general as well as speech sounds in particular.

§62. *Acoustic phonetics*

1. *The sound spectrograph.* In acoustics it is usual to portray sound waves as changes of the state of air particles as to (1) position, or (2) velocity, or (3) pressure, in all cases plotted as functions of time, usually pictured as simple or complex sinusoidal curves recorded on a graph paper or displayed on the screen of an oscilloscope. Now from the point of view of representation of the phonetic qualities of speech sounds, the great drawback in any of those three

forms of visual representation is that there is no regular 1-to-1 correspondence between sound and graph. The same graph (or the same groove in a phonograph record) to be sure will represent the same sound, but the converse is far from true. Take for example the sound of a flute. That a flute sounds like a flute and not like a clarinet or an oboe or a violin is because besides the fundamental pitch (the broken-line graph *a*, Fig. 4A), which usually gives the

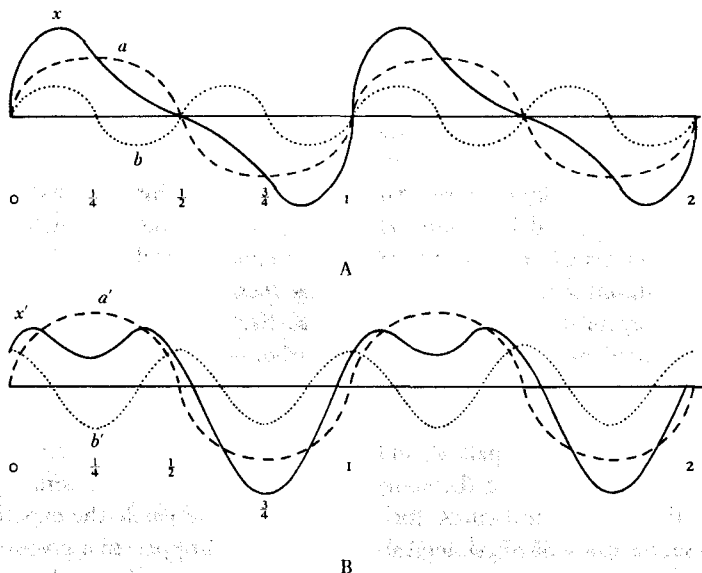


Fig. 4. Flute note.

note, there are overtones, or harmonics in certain characteristic proportions of strength; in the case of the flute the second harmonic, an octave higher, with half of the wave length or period (the dotted-line graph *b*, Fig. 4A), then the other even-numbered harmonics in lesser strengths, which for simplicity are not pictured in Fig. 4A. The actual sound waves are the result of the algebraic additions of these frequencies. For example, at points between 0 and $\frac{1}{4}$, both *a* and *b* are positive and the result is a higher part of the resultant wave (the solid-line graph *x*, Fig. 4A). Between $\frac{1}{4}$ and $\frac{1}{2}$, *a* is positive and *b* is negative and the result is an arithmetical subtraction, so that the solid line *x* is below the broken line. Thus,

after a complete period of the fundamental, which means two complete periods of the harmonic, we have a period of the resultant graph as in x , between points 0 and 1, which in the case of a middle C occupies approximately $1/256$ of a second.

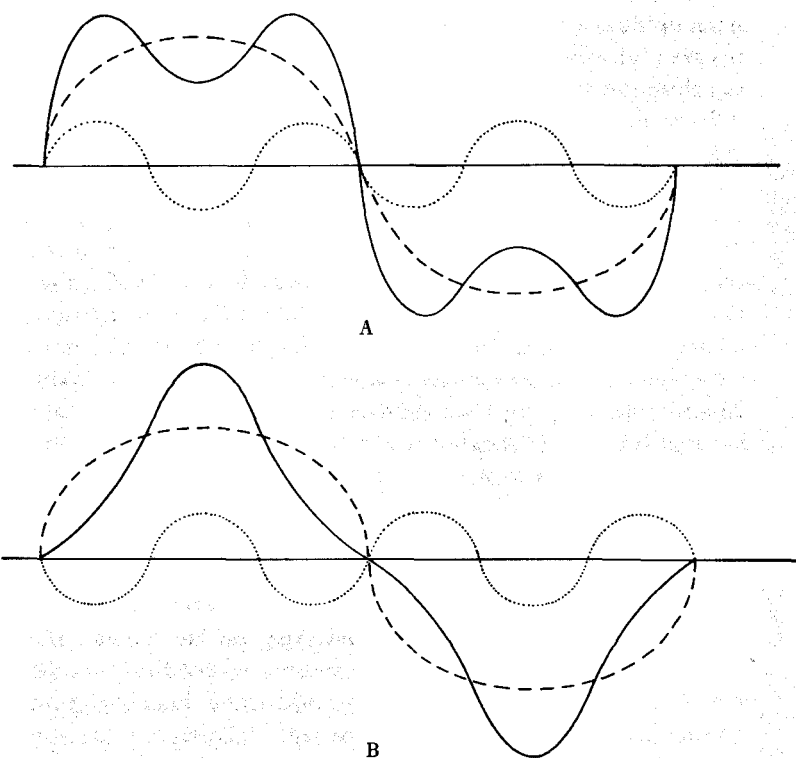


Fig. 5. Clarinet note.

In the preceding case of the flute note we had assumed that the fundamental and the harmonic started at the same time, or "in phase", the phase of a period being the point of the period in relation to the whole, usually reckoned in terms of 360° . The ear does not notice the phase of sound waves except that phase difference of sounds reaching the two ears give clues to the perception of direction. Now there are any number of phase relations between the various components of a complex sound and most sounds are

complex. Suppose that the harmonic starts at a maximum value when the fundamental is at zero and we proceed to add the two components as we did in the first case, then the resulting graph (x' from $a' + b'$, Fig. 4B) will look totally different from that of x in Fig. 4A. The two will in fact be the shapes of the grooves if the note produced under those two conditions are recorded on a phonograph disc. Likewise, if we take a clarinet note, in which the third partial is the strongest in giving its characteristic tone, differences of phase between the fundamental and the harmonic will result in differently shaped waves as in Fig. 5A and 5B, with no difference in tone quality. Now the crucial point about such situations is that the ear will hear exactly the same quality of the flute (or the clarinet) even though the sound waves are apparently radically different. That is because, so far as the *quality* of sounds is concerned, the ear neglects the differences in the phase relations among the component frequencies, but analyzes, in the manner we have seen, the components and combines the reports to the brain. The trouble with direct portrayal or recording of sound waves is not that it tells too little, but that it tells too much. That was one of the chief causes of the stagnation in the progress of acoustic phonetics.

The breakthrough of this situation was the development of the *sound spectrograph* by workers in the Bell Telephone Laboratories, as reported by R. K. Potter, G. A. Kopp, and Harriet C. Green in their book *Visible Speech* (New York, 1947). Like the ear, the spectrograph is an instrument which records against time, not the sound waves, but their frequency components. Fig. 6 gives a schematic diagram of such an arrangement.

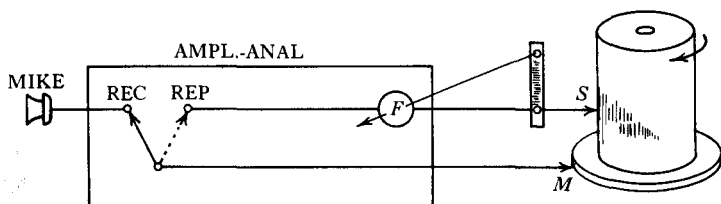


Fig. 6. The spectrograph.

The speech input at "MIKE" at the left is first connected to the amplifier-analyser at "REC", with the switch connected at the left

(solid arrow). The amplified speech is recorded at *M* onto a magnetic rim revolving clockwise once in $2\frac{1}{2}$ seconds, so that the last part of the speech will be left on the base of the drum after the recording is disconnected. Allowing for space for the demagnetizing (erasing) contact, there will be 2.4 seconds of speech material recorded. Then, with the switch connected to the button marked "REP", the recorded speech will be amplified and made to burn marks (*S*) on a specially prepared paper on the revolving drum. The recording is not transferred to the paper all at once, but only a small band of frequencies is amplified and filtered through with each turn of the drum. As the frequencies that are transmitted to the paper are changed from the lowest to the highest by the frequency control *F* marked with the slanting arrow indicating variation, the burning stylus is moved gradually from the bottom to the top of the paper. This whole scanning procedure and the accompanying recording of the speech material on paper will take about one minute. The intensity of darkness burned in the paper corresponds roughly to the intensity of the frequencies being transmitted. This whole set-up is known as the sound spectrograph, of which the trade name of its earliest manufacturer is Sonagraph. Each pattern of speech as burned in the paper around the drum is a (sound) *spectrogram*.

What have we gained after going to all this trouble to record on magnet and re-record on paper a stretch of speech no longer than *Mary had a little lamb*? The answer is that we get a visual portrayal of speech which has a two-way correspondence with what the ear hears, instead of the one-way correspondence between sound waves (or phonograph grooves) and hearing. On a spectrogram the horizontal dimension is still time, but in the vertical dimension are shown the relative strengths of various frequencies heard. For purposes of speech analysis the range will start from under 100 to several thousand cycles per second, 6 or 7,000 will be adequate for most purposes for phonetics.

Before going into further details in the spectrographic analysis of speech sounds, we must first note an important difference between the nature of the tone quality of musical instruments and that of speech sounds. We were considering the nature of the flute tone in terms of the harmonics which accompany the fundamental.

A middle C on a flute has a fundamental of 256 cycles per second (to use the figures used in physics for simplicity), with a strong harmonic of 512 cps, and others in various proportions; the D next above it will not only have a fundamental of $\frac{9}{8}$ of 256, i.e. 288 cps, but also a harmonic of $\frac{9}{8} \times 512$ or 576 cps, and so on through the other harmonics which together give the characteristic flute quality. Now it was thought for years, after the great German

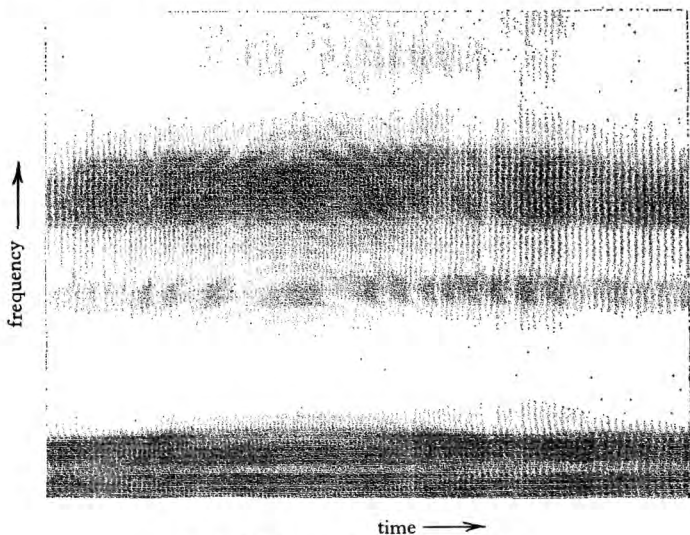


Fig. 7. Wide-band spectrogram of [i].

physicist and physiologist Hermann von Helmholtz (1821-94), that vowel quality was of the same nature, such that a vowel [a] sung at one pitch will have a certain characteristic proportion of various harmonics and, when it is sung at another pitch, not only will the frequency of the fundamental be different, but all the harmonics, in the same proportions, will be changed by the same factor as the fundamental, like the case of the flute or the clarinet. This view was by no means universally accepted, but a positive alternative theory had never been worked out in detail until the advent of the spectrograph. It is now definitely established that the quality of a vowel or of a sonorant consonant such as *l*, *m*, or *n* does not, as in the case of musical instruments, depend upon a

certain combination of multiples of the fundamental frequency which move up and down with the pitch of the fundamental, but upon a certain combination of fixed frequencies, that is, a certain combination of frequencies in absolute pitch, irrespective of the pitch of the fundamental. That a vowel has the quality of [i] as in *eat* is conditioned primarily by its containing four regions of strong frequencies, one in the lower hundreds of the first 1,000, two between 2,000 and 3,000, and one between 3,000 and 4,000. Whether the word *eat* is spoken at a (fundamental) pitch of small C (128 cps), small G (192) or middle C (256), or at a sliding pitch up and/or down, only those harmonics of the vibrations of the vocal cord which are around those four regions of resonance will be reinforced and come out into the air, as shown in the spectrogram in Fig. 7. In terms of physiological phonetics again, the vocal cord vibrates in such a complex form as to contain a rich variety of harmonics. Depending upon the shape of the articulating organs, this and that frequency will be reinforced and others absorbed. Since the tongue and lip position for the vowel [i], that is, high front unrounded, is more or less fixed, the resonant frequencies of the chambers and nooks in the mouth, like those of a seashell, will also be more or less fixed. If, say, a frequency component of a vowel is 2,000 cps and the vowel is uttered at a pitch of 200, then its tenth harmonic will be reinforced. If the same vowel is uttered at a pitch of 300 (a fifth higher), then its sixth and seventh harmonics are near enough to be reinforced. Thus we can get moving pitch with constant vowel quality, as shown in Fig. 8 for the vowel [i] with a circumflex rising-falling pitch.

Strictly speaking, the spectrograms of what seems the same vowel quality are not quite the same in absolute pitch for men, women, and children. They vary to a slight extent, but a hearer makes allowances and adjustments in placing the vowel. But the difference between the resonance of a child's vocal cavities and those of an adult is not as great as is sometimes assumed, since a child's head is disproportionately large compared with his body, as Otto Jespersen noted in his chapter on children's language in his *Language* (p. 104).

Now what is going to happen if the fundamental of the voice goes above the lowest component, or *formant*, of the vowel quality?

The answer is simply that such vowels cannot be uttered. Sopranos found this out long ago and used to complain that they could not sing words like *true* (with [u]) or *see* (with [i]) when the composer made them sing such words at a high C (1,024 cps, or even more at concert pitch). A singer would make the usual articulations for these vowels, but no [i] or [u] came out when sung at such high notes, since some of the important formants in those vowels were

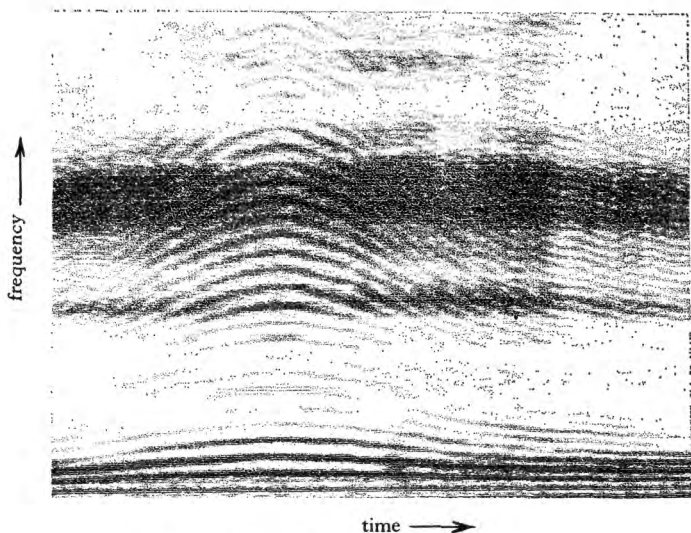


Fig. 8. Narrow-band spectrogram of [i].

not in the voice to start with. Experienced composers learned how to avoid such impossible combinations of sound and tune, but the physical and physiological reasons were not clearly understood until recently.

While vowels have their characteristic sets of resonant bands (or formants), consonants, on the other hand, are usually noises rather than tones and do not have clearly marked formants; nevertheless they also have their characteristic distributions of frequencies. Thus, a hiss will have definitely higher frequencies than a shush, even if they both appear as diffused striations over a wide range of frequencies. The difference between a voiced and a voiceless consonant can be seen from the presence or absence of a voice

band at the bottom, since the voicing of a voiced consonant is always at a very low pitch. What about voiceless stop consonants? One could look at the lips of a person who is "pronouncing" an unaspirated voiceless [p], but a look at the spectrogram for [p] would yield nothing but blank paper. For that matter no one can hear a [p] as anything different from a [t] or a [k] out of context. In actual speech there is usually audible context and it is the transitional glides that give the cue both to the ear in hearing speech and to the eye in interpreting the blank spaces before and/or after stop consonants in a spectrogram. Thus, in hearing *sap* [sæp], *sat* [sæt], and *sack* [sæk], when these words are pronounced without audible release, the transition will go through grades of [β]-like semi-vowels before a final [p], [z]-like or [ɹ]-like semi-vowels before a final [t], and [j]-like or [w]-like semivowels before a final [k]. Hence the spectrographic formants of vowels usually bend up next to velar consonants and bend down next to labial consonants, thus giving the cues for their identification, which fits very well such historical relationships as in *lex:legal:lawyer* and *rex:regal:royal*, where the velar consonant [k] or [g] readily interchanges with the palatal semivowel [j].

The spectrographic analysis of vowels furnishes an unexpected confirmation of the traditional classification of vowel according to tongue height and front and back position. When tongue position was studied and the vowel quadrilateral was determined by Daniel Jones with the aid of X-ray photographs of the tongue resulting in the shape of a trapezium, it was the highest point of the tongue that was recorded and not the tongue as a whole. It would seem that the whole of the various resonant chambers should make a difference in the strengths of the various frequencies. However, the high point of the tongue does serve as a rough dividing point between the front and rear resonant chambers, so that when for example it is high and back, so as to have large chambers of comparable sizes both before and after, a vowel of the [u]-quality is the result and its spectrogram has two formants close together while if the high point is in the front there will be chambers of more disparate sizes and the formants are farther apart. Now the surprising aspect referred to above, as discovered by Martin Joos, is that when the two lowest formants are plotted as variables in a graph, the result

will be more or less like the traditional vowel quadrilateral, except that it is upside down. However, if instead of the usual way of plotting the variables from left to right and from bottom up one starts from the upper righthand corner and plots the first formant downwards and the second formant leftwards, then, except for a slight difference in the proportion of the sides, it is simply the old familiar quadrilateral (Fig. 2) again, as shown in Fig. 9, as demonstrated by Martin Joos in his *Acoustic Phonetics* (Baltimore,

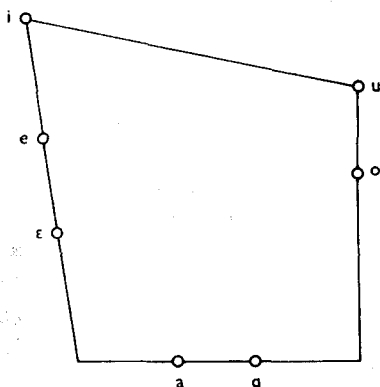


Fig. 9. The acoustical vowel quadrilateral (after Martin Joos).

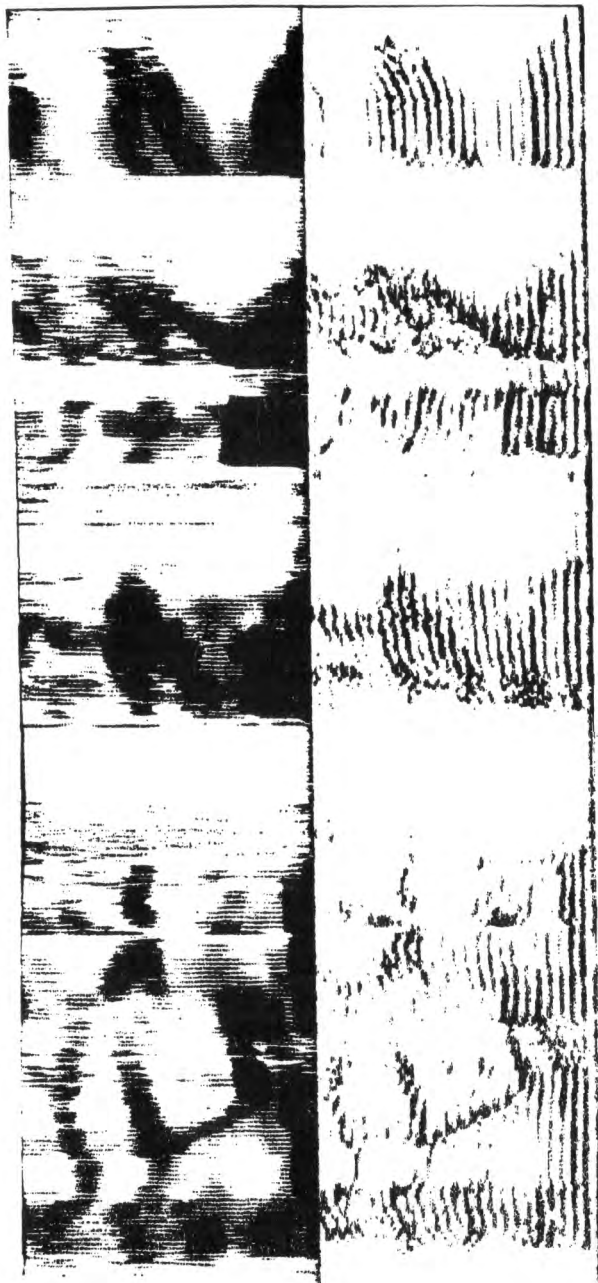
1948), which is more nearly square than that in Fig. 2, which was based on Daniel Jones's X-ray photographs.

The spectrograph is like the kymograph both in being good at registering the manner of articulation and being poor at distinguishing places of articulation. Although phonetic tradition has made much of sounds being labial, dental, guttural (= velar, pharyngeal, or glottal), etc., that is mainly from the articulatory point of view. Although the speech organs feel the places more clearly, the ear is more like the acoustic instruments just described in being better at analysing the manner of articulation. Once over the telephone I asked Robert W. King, with whom I had studied physics at Cornell University: "Pam you ungelfpangg thob I fay?" and he answered promptly: "Yes, I understand you perfectly, but you talk as if you had something in your mouth." Subsequently I recorded on the spectrograph the sentence I said

to him (Fig. 10A) and the sentence I wanted him to think I said (Fig. 10B) and the visual resemblance between the two was as close as they sounded to Dr King over the telephone. (The upper half in each of the spectrograms was scanned by a wide filter over bands of 300 cps to show better the general regions of the resonances and the lower half scanned by a narrow filter of 45 cps to show the individual harmonics separately and the course of the intonation.)

2. *The cathode-ray translator.* A similar scheme of visual portrayal of speech sounds developed at the Bell Laboratories at about the same time was the *Cathode-ray translator*, or Translator for short (everybody at the Labs pronounced the word for the instrument '*translator*', as distinguished from the word for 'one who translates', which is called a *trans'lator*, at least by persons of the older age groups). While the spectrograph is a permanent detailed record of a short piece of speech (2.4 seconds) obtained during a much longer scanning time, the translator is a temporary visual display of any length of speech shown instantaneously with the speech itself. Like the oscilloscope, the translator also shows forms from a cathode-ray shining on a sensitive revolving drum, but, instead of showing sound waves (which we found to have only a many-to-one correspondence with sound quality) as does the oscilloscope, the translator displays the strengths at various frequencies as does the spectrograph and its pictures are pretty much the same as the spectrograms except for being less detailed and less permanent, lasting about the time the drum turns around in time for it to be ready to receive and show new material.

The translator involves nothing new in principle, but its practical convenience made it a possible instrument for visual reading of speech. Great hopes were entertained for its use for the rehabilitation of disabled veterans of World War II, who could be trained to use such a "hearing aid". As an experimental trial, office girls in the Bell Telephone Laboratories were trained to learn the patterns of various sounds and their combinations, such as the shape of a leaning tree representing the word *we*, the shape of a tropical storm representing the word *machine*, and so forth. Since it would make too slow and too uncertain reading to spell words sound by sound (which, as we have seen, one does not do in normal



p a m y o u n g g e l f p a n g g t h o b I f a y

Fig. 10. A. "Pam you ungelpangg thob I fay?"



c a n y o u u n d e r s t a n d w h a t I s a y y

Fig. 10. B. "Can you understand what I say?"

reading anyway), the girls had to learn the typical shapes as vocabulary units and in the space of about a year a vocabulary of two or three hundred words could be learned for instant recognition. An interesting special case was that of a member of the scientific staff, Mr N. R. French, who was one of the group who developed the visible speech programme. He was born congenitally deaf and although he could do lip reading, and learned to talk as deaf persons do, he had usually had to converse in writing. He volunteered to join the translator training programme and, after having learned the system, he could not only talk by using the translator but actually became the first deaf person to have used the telephone, by hitching the receiver to a translator. The hope was to bring the size and cost of the translator from 50 or 100 lb at a cost of more than one thousand dollars to a portable size at a price within the means of veterans. That the translator has not come into general use is not because it does not work in principle, but because it is still too bulky and too expensive. A sidelight on this development is that when the patterns on the translator by the deaf speaker are compared with those of ordinary speech, the learner can correct himself, a thing deaf persons hitherto could not do. As a result of this difference, Mr French's speech actually improved noticeably after the use of the translator.

§63. *The phonograph and its successors*

On pp. 117 ff, we mentioned various visual representations of language, of which the kymograph pictures and spectrograms we have just been discussing are special cases. We also mentioned the reconstituting of the original speech sounds from their isomorphs, which we shall now take up in more detail. The simplest and most direct way of reconstituting speech is that of the phonograph record, which is essentially a somewhat permanent physical trace of the sound waves which later through some mechanism can act on the air so as to reproduce the pattern of the original sound waves. In its earliest and simplest form, when Thomas Edison first invented it, the original sound wave moves a needle so as to cut grooves on a revolving wax cylinder, and when later a needle is made to retrace the grooves while the other end is attached to a

diaphragm connected with a horn, the air is agitated in the same pattern as the original sound and this constitutes the playback of a phonographic recording. In practice the procedure, even in the early days, involved many complications. The sound of the speaker or the musician had to be concentrated from the large end toward the small end of a horn, where a diaphragm is placed to actuate the recording needle. In order that the relatively weak mechanical energy of sound could cut the wax, the sound had to be quite loud to make an impression. Every violin had to be equipped with a horn of its own to face the recording horn during recording. When I made my first set of Chinese National Language Records in the 1920s, I had to shout into the horn, which made my speech very unnatural. In recording the wax had to be soft. But in playing back the grooves had to be hard, in order not to be worn down after a few playings. Thus, the recorded master—later it was on disc instead of cylinder—could not be played in order to check for mistakes, but had to be processed by electrolytic duplicating methods, which we need not go into here, finally resulting in a more or less permanent, or at least abrasion-resistant, finished record. The earliest form of the groove consisted of variations in the depth of the cut, forming what has been known as the hill-and-dale cut. At present the general practice is to have the recording and the playback needle move sideways in a groove of the same depth. This is the lateral cut. In very recent times, there has appeared a groove with two slightly different cuts on two slanting sides, pushing the needle from two slightly different recordings, one for the right ear and one for the left ear for stereophonic effect, which we need not describe here.

The most important point to note in all these forms of recording is that there is only one needle moving at one speed at one position at any given instant of time. With this strictly linear change in time, whether it corresponds to the original change in speed, position, or pressure of the air against the recording diaphragm (those variables are on the whole translatable into one another), different things can be heard as going on simultaneously. From that short stretch of the single groove you can hear Mrs Smith talk, Mrs Jones talk at the same time, the Smiths' boy cry, and the radio turned on full blast, with a quartet singing, accompaniments and

all. When such things are heard going on in a real room, one might think, as is sometimes popularly assumed, that some particles of the air vibrate in such a way as to represent the soprano's voice, others the alto's, still others the baby's crying, etc. As a matter of fact, every part of the air represents all the sounds in the room and that is why it is possible to have one needle in one groove to record and reproduce all the different sounds going on at the same time.

Now how can the ear hear the different sounds back again? That is because the ear is both an analysing and a synthesizing instrument. When the sound waves impinge on the ear drum, there is no difference between this situation and that at the recording diaphragm. But when the vibrations are transmitted to the organ known as the cochlea, which is essentially a tiny harp curled in the shape of a snail, the various "strings" (fibres) will resonate to the various frequencies of the incoming complex sounds and report them to the central nervous system. This is the analyzing part of the ear. At the same time, the brain has already been conditioned through previous experience to associate certain combinations of frequencies in certain proportions with certain qualities, a high clarinet note, a girl's neutral vowel [ə], perhaps with a whining quality, or what not. This is the synthesizing aspect of hearing.

Recent advances in the technique of recording consist primarily in improving the fidelity with which the original sound waves are transformed into some permanent physical configuration, or more importantly, in making this physical configuration so actuate the air as to reproduce faithfully the original sound waves. When the degree of faithfulness is high, the system is said to have high fidelity, popularly known as hi-fi. The most important physical factor in these advances is the utilization of electronic amplification of energy to overcome the defects of mechanical resistance and inertia of ordinary acoustic methods of recording and transmission. Without going into the engineering aspects, which are not our concern here, it suffices to note that it is now possible to amplify sound energy, without distortion, to practically any desired degree and consequently it is possible to record natural speech without shouting and associated *linguistic* distortion. When in still more recent years the final form of the records is made into patterns of changes of magnetization of a coated strip of plastic tape, which

can be played back by rolling it over a magnetic pickup head without friction, the only thing left that is mechanical is limited to no more than the two ends of the whole system: at the microphone end during recording and at the loudspeaker end during reproduction.

Besides the desideratum of fidelity in the recording of speech there is also the desideratum of permanence. Records of hard clay replaced records on wax because they wear longer, but eventually repeated playing will wear out even the hardest material. The magnetic tape suffers no abrasion when played, but no magnetic recording is permanent. Since the invention of the tape recorder, it has been noticed that some of the early taped orchestral music has already lost some of its original brilliance through slow demagnetization, especially in the higher frequencies. A compromise method which will prolong the life of a recording is to have a master disc record on hard material, to be used only for the purpose of making re-recordings on tape, but not for playing, which is to be done on the taped copies only. This will of course help make the hard record last longer, but not indefinitely, since even using it as a master will still wear some of it and eventually wear it out.

The solution to the problem of the permanence of speech records must lie in quite another direction, in fact in a direction which is rather akin to the nature of writing as a record of speech. We noted that speech is a more or less continuous flow of mostly gradual changes of sounds, but so far as linguistically relevant distinctions are concerned, a fully phonemic notation consisting of a set of a few dozen discrete units will be adequate for any given language. If we add non-phonemic elements, such as voice quality, absolute pitch, tempo, and other elements of expression, many more elements will have to be accounted for, but they are not infinite in number. By analysing sounds into a discrete number of steps in a limited number of variables, it is possible to resynthesize speech, not by using discs or tapes, but by putting together recipes for the ingredients of sounds. Much work is being done along these lines in this country, as for example at M.I.T., the Bell Telephone, and the Haskins Laboratories, and in Europe, especially in London, Edinburgh, and Stockholm.

§64. *Speech synthesizers and the speech writer*

1. *Speech synthesizers.* Because it is expensive to transmit or reproduce the full richness of all perceptible qualities of speech over what engineers call channels of communication, it will be good economy to include only such aspects of speech sounds as will be linguistically distinctive. For the purpose of distinguishing the phonemes of one language it is sufficient to use only a relatively few of a limited number of possibilities. Even allowing for some expressive elements, such as the distinctive aspects of intonation, the demands are much less exacting than for transmitting or reproducing the richness of a full orchestra. One approach is to simplify the combinations of the fine-shaded formants of various phonetic qualities from the spectrographs and use standardized broad solid bands to reactivate through photoelectric or similar means the original sound waves. Another approach is to take samples of sounds from words, say every tenth part of every fifth of a second and fill the missing parts by expanding the sample ten times. The result will be close enough to remake the original speech, but it will leave the other nine tenths of the time free for other uses. If it is a telephone line, then it will be able to carry ten conversations at the same time and if it is radio telephony, the same radio frequency ("channel") will be able to carry ten different conversations. A distinction should be made here between making speech and remaking speech. The latter is based on the use of the physical traces of actual speech, of which the phonograph, whether mechanical or electromagnetic, is a special case. The latter, from Sir Richard Paget's talking hands of the 1920s to the latest forms of speech synthesis from schematic formants, is concerned with the creation of speech anew.

The remaking of speech first took the form of what is known as the *Vocoder*, short for "voice coder", first demonstrated at the Harvard University Tercentenary in 1936 by Homer Dudley of the Bell Telephone Laboratories. Its first stages are like those of electric recording, broadcasting, etc., but at the audio-frequency stage, i.e. at hundreds and thousands of cycles per second, the various components, with their various relative strengths are automatically analysed by filters, etc., into speech patterns of what I

call talkio frequencies in electric form (paralleling those of the speech articulations) and these patterns then reactivate an acoustic output so as to produce the original speech, as in a telephone. All this trouble taken in changing audio frequencies and talkio frequencies back and forth has two advantages. One is the possibility of modifying independently various factors of speech, such as main pitch, voicing, etc. For example, a narrow-range half-hearted "How do you do?" can be changed into a cordial greeting by widening the pitch range. More importantly, the transmission of the controlling currents takes less equipment than for the sound waves, which can be remade at the receiving end. Or, what amounts to the same thing, with the same outlay in equipment, more messages can be sent in the same time. One trivial commercial application of the dissociation of various controls is the possibility of combining the sound qualities of things with phonetic elements of speech, so that the noise of a train can say "Bromo Seltzer, Bromo Seltzer, . . .", etc. There is a nickname given to this kind of setup by those who worked on this. Since the vocoder used in this way gives the illusion of things talking like people, they call it the "vokidder".

The *Voder*, short for "voice operated demonstrator", first demonstrated at the 1939 World's Fairs at San Francisco and New York, also by the Bell Laboratories, differs from the vocoder in that the coding into phonetic elements is done by artificial physical controls. It is therefore a form of making speech instead of re-making speech.

A special form of speech synthesizer is the speech stretcher-compressor, developed in Germany and at the University of Illinois. The idea is to record speech on magnetic tape and then re-record it by intermittently repeating small portions of it so as to lengthen the time or by omitting intermittently small portions of it so as to shorten the time. This is a very different thing from playing a recording at a decreased or increased speed, which would make a young woman talk like an old man or a young man talk like Donald Duck—that is in fact how the Donald Duck voice is created. But by repeating or omitting parts without changing the original speed, all the qualities are preserved. This is possible only within limits, since such transient qualities as the release of a stop

consonant will be unrecognizable if "stretched" beyond a certain degree or may be missed if there are too much omitted parts. On the whole a change of not over 50 % stretching or a 30 % compression will not seriously affect the original qualities. For instance, a half-hour speech which has dragged on to 35 minutes can be compressed in order to finish in time and will sound much more snappy, too—and still leave time for the commercial.

2. *The speech writer.* The converse of a speech synthesizer, which starts from spatial patterns and ends in speech, is the *speech writer*, which starts from speech and ends in writing. In particular a speech writer can take the form of a typewriter operated by voice to form the conventional, or nearly conventional, orthography of a natural language. The speech writer is of course no new idea. As early as in 1984, George Orwell recorded the use of what he called the "speakwrite" (1984, New York, 1949, p. 38). As in the case of artificial speech synthesis, a speech writer will depend upon relative de-emphasis of the sound waves as such and the emphasis of the frequency characteristics as analysed on a spectrograph. Moreover, since writing, so far as its distinctive elements are concerned, has a limited number of discrete elements, a speech writer will have to make use of such devices as will cut speech into discrete elements, if not into phonemes.

Without going into the technical phonetic and acoustical details concerning the design of a speech writer, we shall only consider some of the practical aspects of such a machine. In the first place, our desideratum is not phonemic accuracy as maximum approximation to conventional orthography. It would obviously complicate the design of the machine if it had to distinguish *to*, *two*, *too* or write *to* *pare a pair of pears* in response to dictation (cf. p. 72). In principle it is not impossible to distinguish homophones if enough context is taken into account, but increase of the scope of context for a machine to handle will increase its complexity more than "geometrically" and it will be necessary and enough complication just to take care of immediate transients within the syllable, such as the directions of bending of the formants of vowel next to a voiceless stop consonant, as described above.

The orthographic coalescence of linguistically different units, on the other hand, should be very easy to handle. For example English

has *th* for both the phonemes /θ/ and /ð/ and they may either be combined, in the analyzing stage, by eliminating the distinction of voicing, or, more simply, be kept separate through all stages down to the typebars, except that the same digraph *th* appears at the ends of both typebars. The most troublesome aspect of the orthography problem is of course the lack of consistency in English. It is no problem at all if the simple consonant /ŋ/ appears as *ng* or the French /o/ appears as *eau*, so long as there is consistency. Instead of having to go to long contexts, the early models of a speech writer for English will probably have to write English-like spellings, but follow a more uniform system which will depart from normal orthography for many common words. The work of D. B. Fry and P. B. Denes in England on mechanical speech recognition, which is the first step toward a speech writer, also takes this point into account.

The design of the speech writer can be simplified considerably by having the human speaker meet the machine half-way. If, for instance, *of* pronounced in the usual way makes the machine type *uv*, the desired form *of* may be got by pronouncing it as *off*. If the machine is to type *often* and not *offen*, the speaker will have to pronounce the *t*, whether he approves of it or not. Spacing, such as in the case of *nevertheless* versus *none the less*, may be achieved by actual pauses or by other vocal or mechanical devices.

Table 6. *Distribution of letters for English /s/ and /z/*

Phoneme	/s/			/z/		
	<i>s</i>	<i>c</i>	<i>x/ks/</i>	<i>s</i>	<i>z</i>	<i>x/gz/</i>
Number	849	80	32	473	15	10
Percentage	87	9	4	95	3	2

The machine can be helped by adding auxiliary manual or pedal operations if they do not occur more than say once in a sentence. For example, from a count of several samples of running text of English I found that the approximate distribution of phonemes and orthography is as in Table 6. In other words the phoneme /s/ is spelled *s* in 87 % of its occurrence, while the phoneme /z/ is also spelled *s* in 95 % of its occurrence. To achieve maximum approxi-

mation to normal orthography, one should then decide on the use of the same letter *s* for both the phoneme /s/ and the phoneme /z/, just as in the case of *th* for both /θ/ and /ð/. Nevertheless, for the small 3 % of the occurrence of the letter *z*, it is still open to the user of the machine to depress a special *s*-to-*z* key and get forms like *zero*, *zebra*, which are not likely to occur too often to slow things down.

In discussing the matter of dictating technique with others I have often heard the objection that it would take too much time and patience for the phonetically unsophisticated administrative executive to be always minding his *p*'s and *q*'s. The answer is that one learns by trial and error. From the kinds of mistakes he makes he learns what to do and what to avoid. Thus one might get, as a beginner's attempt, something like the following example, which I quote from my "Linguistic Prerequisites for a Speech Writer", *Journ. of the Acoust. Soc. of Amer.* 28 June, 1956, p. 1109.

Deer Sur:

Wee shoold bee much oblyjd too yoo if yoo
wood ckyndlee^a send us ~~at your~~^b at yoor urliest
~~at~~^c convenient^d ai copee ~~of~~^e of yoor...

a The machine normally types *c* when it hears a [k], but will type *k* if a *k*-key is depressed. Here the operator works the key too late, so that both *c* and *k* get typed.

b Here he forgets to separate the words *at your* and then corrects himself.

c Here the use of the usual unstressed neutral vowel results in the form *cun*—assuming that we have decided, on the basis of frequency, on using the letter *u* for the phoneme /ə/.

d Here the use of the too strongly articulated (third) *n* in the word results in an apenthetic *t*. By using a suitably weak *n* and *s*, it may be possible to separate *dollars and sense* from *dollars and cents*.

e Here the speaker pronounces the word *of* in the usual way, resulting in *uv*, then like *off* and gets the form desired.

At first this sort of stuff will have to be retyped to be presentable. But because it will be quite legible, which shorthand or stenotype is not, it will probably be quickly adopted in inter-office memoranda, informal notes, and conference records. For a time, people will probably apologize for using the outlandish spelling on the plea of haste, just as people used to apologize for writing personal letters on a typewriter. In reply the recipient of such a letter would say, "I would much rather have a letter from

you that is at least legible". It is not likely that people would change their language by adopting spelling pronunciations and say *woe-men* for *women* or make *love* sound like *loathe* (since /v/ and /ð/ have very similar spectrograms). A trend in this direction may show at the beginning, in order to make the result more acceptable to the eye. But as the machine becomes more common, its users will probably fall back on normal pronunciation in dictation and gradually accept a more consistent system of orthography, especially as a machine for such a system will be cheaper to make and easier to use. Thus, by the time we have invented the speech writer, we shall have succeeded in spelling reform without really trying.

§65. *Machine translation*

Machine translation, as the term implies, has the two aspects of translation and of mechanized handling of language. In view of the great number of projects going on currently, with varying degrees of success, we can only review briefly the linguistic problems involved without going into the technical details. The first important development with respect to language is, paradoxically, concerned with the back-to-spelling trend in recent work in automatic processing of language. Since most texts linguists of the Western world work with run from left to right, they speak of scanning a text from left to right, meaning before and after in the time dimension. Moreover, even more so than in the problem of the speech writer, machine translation could very well by-pass or dispense with the phonemics of the language and deal advantageously with the orthographical forms like *pare*, *pair*, *pear*. But in order to take advantage of the rapid operation of the machine, especially in the form of modern computers, the material, even though starting from and aiming at the conventional orthographies of the languages, has to be put in a form, or *coded*, so as to be usable in the machine. For example, the Chinese telegraphic code, which gives a four-place number to each of the nearly 10,000 most common characters, has been used for purposes of research in Chinese-to-English machine translation. But before being fed into a computer, which operates by the makes and breaks in vacuum tubes or transistors, involving only two elements, usually symbol-

ized as 0 and 1, even the original numerical digits, still have to be coded on the base 2: $1 = 1$, $2 = 10$, $3 = 11$, $4 = 100$, $5 = 101$. . . , $8 = 1000$, etc. In this respect the mechanical brain, whether for doing translation or other kinds of work may seem very clumsy and feeble-minded, which it is in a sense, since there are two billion nerves in a brain, as compared with a large computer with 2 million transistors. But though relatively simple in structure compared with the brain, the computer works thousands of times faster. Thus, a bilingual translator will have in his memory more capacity for vocabularies than a computer can store, in coded form, on magnetic drums or discs. But if a translator has occasionally to look up words in dictionaries it will be a matter of seconds or minutes, while a computer will scan a whole vocabulary in practically no time.

For bringing the complexity and size of the source language to within more manageable proportions, certain limitations are usually adopted. In the first place, the fact of multiple translational equivalence between languages has troubled translators from the elementary foreign language student to the machine translation research worker. Since belletristic material is the worst in this respect, it is usually shunned by the latter, though it will make good exercise for the human translator. Most projects for machine translation try for a start to limit themselves to the language of modern science and to some extent journalistic language, both of which, as we noted in connection with translation in general, belong to one international culture and have many fewer cases of multiple translational equivalences. Another limitation of the machine is that it is usually inefficient in handling context, both for the meaning and the structure. Some context will of course have to be taken into account, but as the scope of context increases, the complexity of the searching operation by the machine will increase enormously, even allowing for the extreme rapidity of computer operations. On the whole, it is possible to limit the operation on context to the sizes of compound words, very short idiomatic phrases, and to a listable number of function words and inflectional forms which may affect the word order and inflectional forms in the translation and thus to bring the whole operation to reasonable dimensions.

In the earliest thinking about machine translation, in the 1940s, much emphasis was laid on what was called pre-editing and post-editing. A text to be translated is to be pre-edited so as to make it amenable to treatment by machine—that is, before it is actually coded to feed into the computer. Then the main work of the machine is to scan its stored vocabulary for choice of equivalents and, when the coded translation is decoded into typed words, it will be post-edited to make it read more smoothly and intelligibly. As the programming becomes more and more sophisticated, less and less dependence should be necessary on pre-editing and post-editing and readers may get used to machine translations, just as they may get used to machine orthography from speech writers.

So long as we are speculating on developments which are still at various stages of experimentation, we might as well put two speculations in series and the result will be a *voice-operated machine translation setup*. The input will be the source language as dictated to the speech writer. The intermediate output in the form of some orthography of the source language will be scanned by the translation machine as its input and the output will be the translation. If, further, instead of dealing with written forms, the formants of the languages are used as intermediate stages resulting in re-synthesized speech, then the orthographic stages can be bypassed and the machines in tandem will work with phonemes and allophones and we have *simultaneous translation by machine*. Such machines will still be plagued by problems of context and structure and may have to hesitate at times just as a human simultaneous translator at the UN often has to wait for the end of a long relative clause before he can translate the noun into Chinese, in which the noun must come at the end. Sometimes a translator, for fear of forgetting an item stored too long, will translate it anyway and recast the sentence. In such an emergency, the machine will probably be better than man in its ability to store such items. However, it is too early to be concerned about such details, since most programmes on machine translation still deal largely with written texts. In fact some workers in this field are so modest as to change the name of their project from *machine translation* to *computational linguistics*, which has the double advantage of not assuming too much and covering a wider scope of theoretical research. For instance,

identification of authorship by statistical study of favourite words or expressions done by rapid mechanical scanning of texts would be computational linguistics, though it has nothing to do with translation. Likewise very recent experiments in speaker identification by statistical sampling of spectrograms constitute computational linguistics, though unrelated to translation.

§66. *The influence of speech technology on speech*

The effect of recording equipment and speech writers on the style of speech is not something special, but quite typical of the general phenomenon of a speaker's reaction to what he feels about the way his speech is being received. It is said that the cheapest form of a hearing aid consists of a string with one end in one ear and the other end in the pocket. Anyone seeing such a string will at once talk louder than usual. In long-term phonetic changes in history there is the constant tendency of laziness resulting in under-articulation and loss of sounds, which is only counterbalanced by the constant demand for intelligibility to the hearer, and the actual language in any period represents a temporary equilibrium, which is stable for a generation or so, but a shifting one in the long run. One mumbles as lazily as one can, but articulates as clearly as one must.

When conditions of transmission change, the needs of successful reception change correspondingly. We already noted that the early Germanic lingual [r] was favoured for its greater carrying power in open-air life, as compared with the Gallic uvular [ʀ], which was more suitable for the salons of Paris; we also noted that later the Germans imitated and adopted the uvular [ʀ] as they became more civilized, or decadent, whichever way one looks at it. The opposite has also happened for similar reasons in the artificial Bühnenaussprache, with its substitution of [ɪʃ] for [iç] (*ich*), [tɑ:k] for [tɑ:x] (*Tag*) and the lingual [r] back again, instead of [ʀ], so that the words can go over the footlights without getting lost on the way or misheard by the audience. Vowels are also affected by conditions of transmission as consonants. Since all weak vowels tend to become neutralized as [ə], especially in English, any poor condition for transmission will tend to react on the speaker by

§66. THE INFLUENCE OF SPEECH TECHNOLOGY ON SPEECH making him use the so-called "strong" forms of words, sometimes resulting in otherwise non-existent spelling pronunciations. That was very much the practice at the presidential conventions before the advent of the public address system in the 1920s. That was no Bühnenaussprache, that was platform-aussprache.

In singing, since the time and pitch patterns of natural speech are very much distorted by the melody, especially in lyric and operatic songs, the singer usually tries to recover some of the lost intelligibility by emphasizing what is known as "diction". However, much of traditional diction is more concerned with maximizing musical resonance than with intelligibility, such as lowering the larynx, resulting in [æ]'s sounding like [a]'s, etc., so that it is always harder to understand a song sung than a poem read. That must be the reason for the common practice, when singing the "On Top of Old Smoky" type of song, of first saying each line rapidly in speech intonation before actually singing it.

With the development of modern acoustical aids to the study and use of speech, the first effect was not always in the direction of effortless speech in the so-called intimate style. I already mentioned my early experience with mechano-acoustic recording on wax cylinders and discs in which I had to shout into the horn with consequent distortions, both linguistic and acoustic. It was not only the pitch of the fundamental that was concerned. Because of the relatively low signal-to-noise ratio then obtainable, much of the high frequencies range, important for distinguishing consonants, got masked and could not get through—or too much got through. On one of the commercial records of those days, Hamlet seemed to be advising his players to:

Pick the peach, I pray you,
Trippingly on the tongue.

Here the missing *s* was not really missing; on the contrary the whole recording, like most recordings of that time, had a continuous pedal point, as it were, covering the upper thousands of cycles, so that an *s* was being heard all the time.

What changed the situation was of course the introduction of electronic amplification of acoustic energy and the feedback effect, in the form of relief from strain on the part of the speaker or singer,

was quickly noticeable. It is true that some people today still use a high register of voice and shout at the receiver when making long-distance calls. Speakers at political conventions still use strong forms of words before the microphone, forms which they would not use in private conversation. But on the whole the total effect of the spread of electro-acoustic technology in linguistic life has been that of a return to nature. Under present conditions, where most stage plays still depend upon the power of the voice (with relatively infrequent use of walkie-talkies by actors), they are never able to compete with the electrically transmitted rendition, with its unlimited possibilities of nuances of pitch and voice quality. To be sure, the knowledge that it is Richard Burton or who have you that is on the stage in person still counts heavily in many spectators' appreciation, but that is a value of a totally different order from that of optimum versatility of expression through the use of speech as speech. The two kinds of values are not commensurable.

The effect of modern means of speech transmission is however not always in the direction of the more intimate or casual style. Because it is often important for a message to reach a large or a foreign audience under noisy conditions, it is often necessary to strengthen certain essential distinctive features of speech which are acoustically weak. Part of this need is met by the so-called equalization (actually unequalization, from another point of view) of different parts of the sound spectrum, usually by way of boosting the higher frequencies. But speakers also learn to meet the demand by modifying their speech. For example, one often has to bite harder into the consonants without raising the pitch or even the loudness of the voiced segments of one's speech. Sometimes junctures or pauses have to be put in places where they would not occur in ordinary speech. For example, one often hears over the radio three released *t*'s in the phrase *want to tell you*, which in ordinary speech has only two, or even only one release, after an extra-long held *t*. At the San Francisco Airport I have often heard the point of departure Concourse C announced with a pause between the two *s*-sounds and Concourse E with a plus juncture, if not a glottal stop, whereas in ordinary conversation the only feature in which Concourse C differs from Concourse E is the

§66. THE INFLUENCE OF SPEECH TECHNOLOGY ON SPEECH lengthening of the *s* and a hardly audible difference in the point of syllabic division.

Thus, the same complementary factors of economy of effort and clarity of reception which have operated throughout the history of languages are operating under changed and changing conditions of communication. High fidelity amplification permits a return from forced forms of loud speech to a more natural and intimate style; at the same time, increased demands for reaching larger and varied audiences call for more redundant and more noise-resistant ways of diction—diction in both the literary and the phonetic sense. In other words, the history of language repeats itself. It, too, has a high degree of redundancy.

§67. *Schematic representations of language technology*

By way of summary of the preceding sections we shall set up a scheme of symbolizing the various elements in aural, visual, and/or machine mediated forms of language and related symbolic forms as shown in Figs. 11 and 12:

(a) A triangle stands for the central nervous system; (b) an open semi-circle convex toward the right is the sender, (c) the same toward the left is the receiver; (d) a horizontal line represents the direction of the message from left to right. Frequencies are classified into three ranges: (e) the movements of the speech organs are of the order of ten per second, which I call *talkio frequency* (the technical term is *modulation frequency*), and are marked with a reversed *s*; (f) sound waves which carry the audio frequency signals are of the order of hundreds and thousands of cycles per second, and are marked with a double *s*; (g) when these are transformed into electromagnetic changes for the purpose of recording, etc., the same double *s* is made into the shape of two zigzags; (h) broadcasting waves, which are of the order of hundreds of thousands of cycles per second and upwards, are marked with more than two zigzags. (i) A short line across one end of one of the above shapes stands for a fixed visual form; (j) forms in parentheses represents what happens in the nervous system of the sender or receiver; (k) a *z* indicates electric talkio frequency; (l) closed semi-circles separated by a space represent time uncoupling; (m) rays

represent light; (n) a dot indicates recoded message; (o) a circle indicates a (non-human) physical receiving end.

In the fourteen types of signals for communication in Fig. 12, some have already been described in the preceding sections. The remaining ones have less direct bearing on language and will be described only briefly:

(1) *Speaking and hearing*: This is of course the most simple and direct form of communication by language.

- | | |
|--|--|
| (a)  Central nervous system | (i)  Writing, etc. |
| (b)  Sender | (j)  Words innervated or articulated but not spoken |
| (c)  Receiver | (k)  Electric talkio frequency |
| (d)  Direction of message | (l)  Time uncoupling |
| (e)  Talkio frequency | (m)  Light |
| (f)  Audio frequency | (n)  Recoded message |
| (g)  Electric audio frequency | (o)  Non-human receiving end |
| (h)  Radio frequency | |

Fig. 11. Legend for types of signals.

(2) *Writing and reading*: Reading is a process which takes one of these forms: pure visual reading, reading sotto voce, and reading aloud, as shown in the three branches in the diagram.

(3) *Mechanical recording and playback*.

(4) *Electric recording and playback*: Note the crossing arrows between diagrams (3) and (4), which mean that a mechanical recording could also be played back electrically and vice versa. Electric recording on magnetic tape cannot of course be played back mechanically.

(5) *Public address system*: This is essentially a microphone-amplifier-loudspeaker hookup, resulting in louder speech. The shunting line below the main line shows that the speaker may hear both his speech directly and from the loudspeaker.

(5') *The telephone*: Apart from the difference in distance sometimes requiring intermediate boosting or other special treatment, the telephone is no different in principle from the preceding and the same diagram will serve. Even the shunting line under very special conditions is not without meaning. For example, once my wife telephoned to a neighbour with the window open and the latter also had *her* window open and so both lines of communication were used at the same time.

(6) *Broadcasting and rebroadcasting*: Just as the articulating organs moving at talkio frequencies do not move fast enough to agitate the air audibly and have to depend on the audio frequencies of the vocal cords to carry the message over the air, so the audio frequencies of sounds, even if amplified by a public address system so as to be heard over the whole Yankee Stadium, cannot be heard beyond a relatively short distance. The point of using *radio frequency* electromagnetic waves is that they can carry great distances, of the order of thousands of miles instead of a thousand feet, and by modulating those waves with sound waves (converted electrically to modify the radio waves) they can be carried to almost any desired distance and then reconverted ("rectified") into audio frequency changes at the receiving end. The lower branch in the diagram represents the case of rebroadcasting, where the audio-frequency stage may be stored for use in rebroadcasting.

(7) *The kymograph*: The two branches of the diagram represent the two kinds of graphs obtainable on the kymograph, one following the sound waves and the other the articulatory movements.

(8) *The oscilloscope*: This shows only the sound waves (much more accurately than on a kymograph) either on paper for permanent record or on a fluorescent screen (shown on the lower branch).

(9) *The vocoder*.

(10) *The voder*: Both the vocoder and the voder have been described under speech synthesizers in § 64 (1 and 2).

(11) *The spectrograph and the translator*: These have been fully described in § 62. There is no difference in principle between the two except that the latter is less detailed and lasts only as long as the fluorescent screen light lasts.

(12) *Spectrographic playback*: Actual spectrograms are usually too fuzzy to operate electric circuits. In speech synthesis from

spectrograms, one usually has to choose a few essential features and draw them by hand in bold, broad bands. That is the meaning of the dot at the beginning.

(13) *The talking book*: The talking book is a visible speech playback in a sense, but the result is of course nothing like ordinary language. That is why there are so many recordings in the diagram. It was described by V. K. Zworykin and L. E. Flory, in their "An Electric Reading Aid for the Blind", *Proc. of the Amer. Philos. Soc.* **91**, 2, (1946), 139-42. The "reader" has in his hand a scanning stylus like an electric razor. It has at the operating end a photo-electric eye. When it moves across a shape \, it produces a falling pitch, while a shape / will produce a rising pitch, so that a fall and rise circumflex tone will be the pattern for the letter V. When the stylus moves slowly across and gives a middle pitch, followed by a chord of two notes gradually widening and narrowing again into one, then it is the letter o. The opposite of such a pattern will be an x. A rich chord of all tones ("white noise") quickly followed by a chord of three notes will be the letter E. The principle seems simple enough but in practice there are many bugs to take out. In fact at the demonstration I attended most of the sounds were like the chirping of crickets. It was reported that after 150 hours of training, two blind persons acquired a reading speed of 15 words per minute, or a rate of 20 minutes per page of 300 words. This is about one-fourth as fast as the speed of conversation attainable with the visible speech translator.

A very interesting sidelight about the talking book is that there is a close analogy between the design of the talking book and the brain. As reported by Norbert Wiener, in his *Cybernetics* (New York and Paris, 1948), p. 32, when the diagram of a similar apparatus came to the attention of the neurophysiologist Gerhardt von Bonin, he immediately asked, "Is this a diagram of the fourth layer of the visual cortex of the brain?" Thus, although the blind person cannot profit by wearing glasses, they can substitute a sound plus a mechanical substitute for the scanning device of the brain. This is a highly significant point from a symbolic point of view, since it puts the scanning of a visual intuitive form within the possibility of an artificial analogue outside the body of a living organism.

§67. SCHEMATIC REPRESENTATIONS

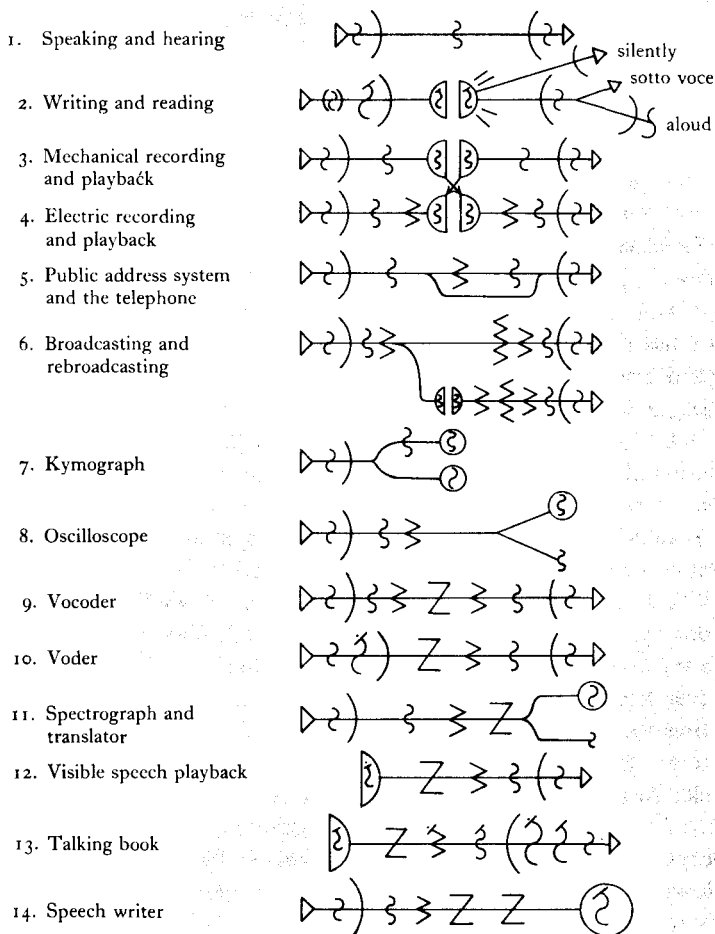


Fig. 12. Schemata for types of signals.

(14) *The speech writer*: This has already been discussed in § 64 (2).

Within the symbolism used in these diagrams we have not included machine translation, since the most important part there has to do with transformations and coding within talkio frequencies and all the stages will be mostly a succession of dotted *s*'s or *z*'s.

SYMBOLIC SYSTEMS

§68. *Symbols as generalized language*

In discussing wider senses of language (§ 56) we mentioned the two important categories of isomorphs of language and extensions of language. Writing is an example of a language isomorph in that it has a close part-to-part correspondence with natural language and scientific formulae are extensions of language in that they begin with language and then go on to constructions which are language-like, but not actually used in natural languages. Symbols are still wider generalizations of language than either isomorphs or extensions. In the widest sense a symbol is anything, linguistic or non-linguistic, which stands for or "symbolizes", something else. The symbol "a" stands for the sound [a], the visual symbol "1", whatever you call it, stands for the number 'one' in more than one system of writing. A repeated low-pitch horn may stand for a warning that there is a heavy fog in the harbour. A symbol however has to be something which can be conveniently produced, presented, and perceived without necessarily perceiving the object it stands for. Thus, the magnetizations in a tape-recording or the electro-magnetic waves in radio or television broadcasting are not symbols of the sounds recorded or transmitted, since they cannot be conveniently drawn by hand or perceived by eye and are thus isomorphs which are not symbols of language.

In the preceding chapters we have been following popular usage in using the words *symbol*, *sign*, and *signal* almost interchangeably, which they are in many contexts. Smoke from a chimney is a sign of life in the house, smoke is a signal for getting help, and smoke is a symbol for certain religious observances. As usual, whenever systematic inquiries are set up in which everyday words are used in technical senses, then both restrictions of and departures from ordinary usage will become unavoidable. For instance when we treat symbols here as having primarily an arbitrary relation to what is symbolized, it is precisely the opposite of what in one

usage is described as being "symbolic". Thus most of the Chinese characters used in historical times are symbolic in the general sense, but only a very few pictographs and ideographs are symbolic in the popular sense.

It is true that logicians, mathematicians, and linguists do not all agree in their use of the terms symbol, sign, etc. They even follow common usage in speaking of the "sign of equality" when in their own system it should be called a symbol. In our present discussion we shall follow the terminology of Charles W. Morris in his short but very basic treatise *Foundation of the Theory of Signs* (vol. 1, no. 2 of *International Encyclopedia of Unified Science*, Chicago, 1938), of which there is a more elaborate development in his *Signs, Language and Behavior* (New York, 1946), which we need not go into for our purposes. The most general thing Morris deals with is not symbols, but, as the title of his work implies, signs, of which symbols form a special case. For example, lowering clouds are a sign of rain, a shiny wet road is a sign that the road is slippery, but the road sign which says "Slippery When Wet" is not only a sign, but also a symbol. In general, as we have noted above, a symbol is something which can be conveniently produced and has a conventionalized, usually arbitrary, relation to what is symbolized.

§69. *What is one symbol?*

In analysing a complexity of things, such as symbolic systems, there is always the twofold problem of (1) identification or differentiation on the one hand, and (2) individuation or segmentation on the other. We have already met with similar problems in the case of phonemes and words. More generally, we can ask: What similar or different things can be classed together as instances of the same symbol? This is a question of kind. Or we can ask: How much of a chunk of a thing extending in space or time or both in space and time (such as gestures) shall be considered one piece of a symbol? This is a problem of size. To revert to our linguistic interest in things grammatic, the former is a paradigmatic problem, while the latter is a syntagmatic problem. This is in fact not too far from Morris's terminology, since he calls the study of the structure of signs (including symbols) themselves syntactics, which of course

has a much wider application than syntax in the grammatical sense.

(1) To take the problem of identity of symbols first, it will be more convenient to regard a symbol, not as one event or one thing, but as a collection of events or things considered as members of a class, in other words, a symbol is usually taken as a type rather than a token. On the other hand one instance of a symbol, or token, such as an utterance made on one occasion, is often termed a *signal*. In common usage, one speaks of signals usually in connection with special forms of visual and other forms of communication other than linguistic forms, but there is no reason why a signal in the sense of one instance of the use of a symbol should not include language.

Symbols extended in space are classes of physical things (including light), such as two-dimensional marks on a surface. Symbols extended in time are classes of events, such as spoken words, or in space-time, such as the motions of the hands of the director of a symphony orchestra. Between things and events we generally prefer the former, because they are easier to handle. If someone tells me a telephone number, I will write it down, so that I can have it before me when I reach the telephone. Then I shall not have to say it to myself all the time as I walk to the telephone, although on modern computers, the "memory" used for certain short-run purposes takes the form of repetition of symbols, and is so-called "circulating memory".

Instances of the "same symbol" may form a class of gradually shading members or one which consist of completely different kinds of members. A word, say *dog*, is usually treated as one and the same word and the actual phonetic value within the phonemic limits (not to speak of the varying conditions of auditory reception of the hearer) will have various shadings according to sex, age, individual, occasion, and mood, not to speak of locality if we want to consider the word *dog* as the same in an American English language with dialects under one overall pattern (/dɒg, dɔhg, dæg, dæhg, dɔwg/, etc.). As to the written word, we noted that in high antiquity the beginnings of writing were direct symbols of things, later became symbols of spoken words, and then, as writing and reading becomes more general, the language part is at least

partially short-circuited and writing has become direct symbols of things again. Thus for the word *dog*, there are two kinds of members which constitute the class within each of which there are shadings in sound or shape, but between the two of which there is a discontinuous difference. The popular confusion between writing and language, which we linguists take so much trouble to correct, has therefore some logical and psychological basis. Moreover, as between the spoken and the written word, common sense prefers physical objects and often fails to recognize the nature of the spoken word as a symbol and constantly falls back on the written form even when the discussion is about the spoken word, as we have seen.

(2) As to the problem of segmentation, there are two sides to consider: (a) What is one symbol and what is a complex of symbols? (b) Where does a particular symbol begin and end? These are obviously generalizations of corresponding linguistic problems of subunits of language, with which we are already familiar. As for the complexity of symbols, no upper limit can be set. As Rudolph Carnap has noted, to any sentence which is reputed to be the longest sentence possible, one can always add the co-ordinate clause *and the moon is round*, which makes it a longer sentence. For that matter, he could have added *and the moon is square* or *and the moon is made of green cheese*, since the discussion is by no means limited to true sentences. The lower limit to the size of a symbol is not the smallest physical element which is perceivable, but a symbol which, even if perceivable when subdivided, would no longer be a symbol (or a set of symbols) in the system of which it is a part. We have noticed, for example, that the letters *p* and *q* and *b* and *d* have certain symmetrical geometrical properties, but that these are symbolically irrelevant. As letters in an alphabet they are therefore simple unit symbols. Contrasted with the roman letters, the letter-like symbols in the Korean *ŏnmun* are sometimes complex, since even the parts of some letters correspond to certain phonetic features, such as semivowels, tense consonants, etc. (For examples, see § 52, pp. 107-8.)

The marking off of a symbol from its neighbour or from no symbols is usually no problem. The characters of a system of writing are normally easy to mark off from each other and from

blank space, though the marking off of words in connected speech is not only difficult for foreign learners, but for native children and even adults. Witness the back formation of *an orange* from *a norange*, a *nickname* from *an ekename* and similar formations. Traffic signs—we are reverting to conventional terms, since symbols form a species of signs anyway—are usually easy to distinguish from other signs, though sometimes there is confusion between traffic lights and the neon lights of stores in such metropolitan streets as those of New York and Tokyo. Some symbolic systems make profitable use of no symbol as a symbol. When a passage of music is marked *cresc.* or *dim.* or *rit.*, the effect is not only to apply to the part immediately under the notation, but to go on until countermanded by another notation, such as the constant-value symbols *f*, or *p*, or *a tempo*, which in turn has a continuing force. In one form of true-or-false examinations, the student is to mark something for 'true' but do nothing for 'false' and so cannot be non-committal in his answers. The Morse code, considered at the acoustic level of analysis, consists essentially of two elements in time series: sound and silence. (At the next level of organization it is of course made of dots, dashes, and spaces.) The use of zero as a symbol sometimes leads to ambiguities, but on the whole it is a powerful symbol.

§70. *Symbol and object*

1. *Symbols and icons.* The normal relation between a symbol and its object, or denotatum in Morris's terminology, is conventional, arbitrary, and fortuitous. There is usually no similarity or causal relation between the two. There is for example nothing intrinsically long about the English word *long* or intrinsically short about the word *short*. In fact the word *short* is longer not only graphically but also phonetically and foreigners often tend to pronounce it *shot* in order to make it sound more symbolic—symbolic in the popular sense we noted above: 'fitting, expressive, consonant, appropriate', which is precisely the opposite of 'conventional, arbitrary', etc. In this popular sense red is symbolic of danger, stop, etc., because it is physiologically more impressive. As we have noted in connection with the Chinese system of writing, the

few cases like $\perp$ for 'up', $\top$ for 'down' and ∇ for 'middle' are symbolic in this special sense, while the majority of Chinese characters are symbolic in the general and more important sense. Likewise, such words as *dingdong*, *slurp slurp*, with a slight or sometimes fancied resemblance to what they mean, form a small minority of English words, while most of them are symbolic in the general sense.

To distinguish such special symbols which share with the object some common property from symbols in general, Morris, among others, follows C. S. Peirce (1839-1914) in calling them *icons*. In a set of symbols for systematic use, it is not important that the individual unit symbols be iconic, but isomorphism between symbol complexes and object complexes which constitutes a larger form of iconicism, is definitely advantageous. For example, it is purely a matter of convention that x, y, z are used to represent variables and a, b, c the constants, but in using the 'greater than' symbol in $a > b > c$ the order of the letters is iconic with respect to the order of the quantities symbolized, while the same relations stated in the form " b is between a and c " is not iconic of the serial order. Again, a map is iconic to a high degree, but many items under the "legend" are only slightly or not at all iconic.

2. *Symbols of symbols*. Symbol and object being relative terms, it is of course possible to have symbols of symbols, as we have met with in the case of language being symbol of things and writing being symbol of language. Moreover, as in the case of writing, when more than one level of systems of symbols is involved, they tend to be short-circuited and become parallel members of direct symbols of the original objects. The telegraphic code is a symbol of writing, but experienced operators use the Morse code as direct symbols, at least for their operating business, with little or no trace of intermediate forms of symbols. (It may be noted in passing that the symbol $\cdots - - - \cdots$, with no spaces, was originally made up as an arbitrary symbol for distress and only subsequently read as symbols for the letters $S O S$, which strictly would have spaces between the dots and dashes.)

Symbols of different levels need not be made of different departments of sense (e.g. sound and sight) or different kinds of

composition of elements (e.g. dots and dashes vs. letters). Thus, when one says: New York is larger than Washington, one is talking about two cities, and actually using their names. But when one says: *New York* has fewer syllables than *Washington*, one is talking about the symbols for the cities by using symbols of symbols, obtained by devices of juncture, pause, or pitch or in writing by italicizing or adding quotes to the first-order symbols. The reason that it sounds funny to say *when* when asked to say when is that a first-order symbol is being used as a second-order symbol.

In formal logic and mathematics, it is often necessary to symbolize symbols at several levels, which are usually called L_1 , L_2 , L_3 , etc., meaning the first-order language, the metalanguage, or second-order language with which to talk about the first-order language, etc. This book, for instance, is largely in a metalanguage L_2 , since it talks mainly about ordinary language L_1 . The present paragraph however is a metalanguage of a higher order since it is about metalanguages. Of what order is the last sentence or this sentence? To answer that would get us into paradoxes and various proposed solutions from Bertrand Russell on, but to go into these, interesting as they are, would lead us too far afield.

3. *Substitution.* A distinction should be made between symbolizing and substitution at the same level. A large part of the development of discursive systems consists in defining certain simple symbols as synonymous with and substitutable for certain complex forms. When we define electrical resistance as the ratio of voltage to current by the formula

$$R = \frac{V}{I}$$

we are setting up additional symbols at the same level as that of the symbols for which it is a substitute. R is not the symbol for the symbol V/I , but another symbol for that which is symbolized by V/I .

4. *Ambiguity, vagueness, and generality.* Symbol and object may correspond in the relation of one to one, one to many, many to one, or many to many, understanding of course that one symbol may consist of a class of various members whose differences do not matter. Even in the so-called exact sciences, cases of exclusive one-

to-one correspondence are rare. For one of the most important developments in any symbolic system is to set up definitions for substitutions, as has just been indicated, so that there is usually more than one symbol for the same object.

Of cases of one-to-many relations, it is important to distinguish *ambiguous*, *vague*, and *general* symbols, as have been well analysed by Max Black in his *Language and Philosophy* (Ithaca, N.Y. 1949, chap. II). For example the symbol “ $>$ ” in “ $d > t$ ” is ambiguous, as it may mean either ‘ d is greater than t ’ or ‘ d has changed into t ’. An ambiguity can usually be resolved by specifying the context or other limiting qualifications. A symbol is vague in so far as its borderline cases loom large in comparison with its clear cases. The term *partly cloudy* or the weather map equivalent for ‘partly cloudy’ is vague, but not ambiguous. It has a certain range of applications, but between ‘clear’ and ‘partly cloudy’ or ‘overcast’ there is a fringe of cloud conditions where the application of the symbol is very uncertain. So is the word *table* or the colour name *brown*. In fact vagueness itself is rather vague, since those borderline cases in which borderline cases loom large loom large themselves.

A symbol is general when it applies to any one of the members of a class. For example in the inequality

$$x + a > x$$

x is a general symbol for any real number and a is a general symbol for any positive number.

In natural language, a many-to-many relation between symbol and object is the rule, involving ambiguities, vaguenesses, as well as generalities. It should be remembered of course that in all this discussion one symbol or one thing is taken at the level of identification and segmentation *qua* symbol or *qua* thing. Otherwise one would have to go into no end of philosophical analyses, such as reduction of all things to sense-data, sense-data into stimulus and behaviour, stimulus and behaviour into matter and energy, and matter and energy back into sense-data, so that everything would be composite and nothing would ever be one symbol or one object and the question of one or many would be pre-empted of meaning.

5. *Symbols and models*. So far we have been considering the

fitting of symbols to the objects. Now is it possible or desirable to fit the objects to the symbols? This would at first sight seem to be a kind of intellectual perversity. But that is exactly the procedure of much of modern mathematics. A symbolic system is built up in which the terms and relations do not refer to anything concrete and are defined implicitly by the set of their behaviour in the system. We don't know what they are except by being shown what they do. Then one looks around for possible actual cases of things which do behave like the objects in the system. If at least one application is found, that proves that the system must be self-consistent, since nothing in nature can be self-contradictory. Such an application is often known as a *model* of the system. I have not made much use of this notion here because there are many divergent ways in which it has been used by linguists and logicians. In a paper on "Models in Linguistics and Models in General", *Proc. of the 1960 International Congress on Logic, Methodology, and Philosophy of Science* (Stanford, 1962, pp. 558-66), I have examined and counted thirty-nine different ways in which the term *model* has been used, some of which have exactly opposite meanings. The only thing which seems to be common among all the various usages is that there should be some structural similarity shared by two things, however abstract or concrete, of which one is a model of the other.

In a larger sense, I think even the abstract approach without immediate concern for actual concrete interpretations is still of the nature of fitting a system of symbols to a system of objects. Intuitively everyone is thinking of possible applications (models) while working on the abstract system. The difference is only a matter of procedure and division of labour. No one, with the possible exception of a candidate for the Ph.D. looking for a topic for his thesis, would devote himself to the building of trivial or freak systems. But who knows what's trivial and what's important? It may be years before a Marconi could find electromagnetic waves after a Maxwell wrote their equations which had been lying around like so many empty symbols on paper. But in the long run one can say that the general trend of abstract thinking, be it in mathematics, theoretical physics, and what not, is mainly concerned with symbolizing things.

§71. *Symbols in communication and control systems*

In the preceding sections we have been treating symbols as more or less static things. In actual symbol instances there is of course nothing static about them. Not that spoken words make air particles dance and pictures and letters reflect light waves, which is not our concern with symbols as symbols, but when a symbol is "uttered" and received and interpreted, in other words, when a symbol functions as a signal, it forms an element of communication of *information* and recent rapid developments in this direction all have to do with the transmission of symbols, of which we already considered some example in connection with language technology.

1. *The bit as a unit of information.* The first and most important element of analysis in symbols in communication is that of discrimination of alternatives. Obviously no information would be conveyed if only one monotonous quality were communicated. Even a long straight-tone siren sounding the "all clear" becomes a signal only in contrast to the period of no siren preceding it. In communication theory, one of the earliest accounts of which was given by Claude E. Shannon and Warren Weaver in their book *The Mathematical Theory of Communication* (Urbana, Illinois, 1949), the basic unit is known as *bit*, short for *binary unit*, since it is the alternative between something and nothing. A bit of information, then, is not just any little bit of information, but a very specific amount of information. If more alternatives are included, the choice of one out of a rich variety is of course more significant than one out of two. Now before a common sense idea is narrowly defined in a technical sense, especially when a quantitative idea is involved, there is usually a choice of procedures and the theorist would like to choose such a definition as will lead to simpler systematic results. In the case of the amount of information, since the more alternatives there are, the less likely each alternative is likely to occur and the more its occurrence will mean, one might say that the amount of information is inversely proportional to the probability. It is therefore quite possible to define the amount of information as the reverse of its probability, so that if the chance of an item occurring is one in n , then the amount of information

could be measured as $-\frac{1}{n}$. But there is another way to define it which will work even better from the point of view of what we usually understand about the nature of information. It stands to reason that when we have had one little amount—since we can't say "bit" now—of information and then another little (not necessarily the same) amount of information, we would like to be able to say that the total amount of information we now have is the sum of the two amounts. But if, as suggested above, the amount of information is measured by the probability, or rather improbability, then since the probability of two things happening with separate probabilities $\frac{1}{n_1}$ and $\frac{1}{n_2}$ is the product $\frac{1}{n_1} \times \frac{1}{n_2}$, the total information so defined will not be an additive quantity. There is nothing wrong or contradictory in this way of defining things, but it goes counter to the useful conception of information as something which can be added "bit" by "bit". The natural and simple thing to do in this case then is just to take the logarithms of the probabilities and adding logarithms will do the same trick as multiplying the quantities themselves. Hence the definition of information, not as simple inverse probability, but the negative logarithm of the probability. For instance, if there are n possible symbols which might be given, the information given by one of them is $-\log \frac{1}{n}$. In particular, the information given by one of two alternatives 0 and 1 is $-\log \frac{1}{2}$, which is the value of the bit.

In an alphabet of 26 letters plus comma, period, space and a few other punctuation marks, the information given by any one of them is that of one in about 32, or 2^5 , and therefore about 5 bits. In the case of Chinese characters, since a newspaper uses between 4096 (i.e. 2^{12}) and 8192 (i.e. 2^{13}) characters, a single character gives between 12 and 13 bits of information and is therefore worth two to three times the information value of a letter of the Latin alphabet.

2. *Frequency, redundancy, and noise.* In § 34, pp. 72 ff, we considered various factors affecting the degrees of meaningfulness. At the risk of "redundancy", we shall show, by considering the

same factors, illustrated by a parallel set of examples, that the information value is but another side of the same coin of meaningfulness. All items in a list of symbols do not have the same information value, since they do not occur with the same *frequency*. Since there are fewer vowels (i.e. the letters) than consonants and vowels occur much more frequently than consonants, each of the latter gives much more information than the former; hence it is much easier to g**ss *t th* w*rd* wr*tt*n w*th**t v*w*ls than to *ue** a* **e *o*** **i***e* *i***ou* *o***o*a*** (cf. p. 106). In the case of words, a very frequent word such as *a*, *of*, or *goes* gives less information, since it is much more likely to occur than, say, *sad*, *ounce*, or *escape*, which have a much lower probability of occurrence. In connection with meaning (chapter 5) we noted that the more a phrase is hackneyed, the less it means. When an American meets an American friend on the street and says *Where are you going?* he means what he says, but when a Chinese says the Chinese equivalent to a Chinese, the hearer knows he will very likely say it anyway and may say the same thing himself simultaneously, as it means no more than *Hi!* (See p. 73 for further examples.) If the probability of a form occurring approaches that of certainty, then little or no information is given. For example, after a *q* in written English, it is practically certain that there will be a *u* and no information will be gained by writing it. Nothing will be lost, for example, if by some acquired quirk a squire should require all questions and inquiries to be quoted in such quite quaint and queer forms.

But the *u*'s after the *q*'s are not entirely a waste for communicational purposes. Besides the less justifiable, though quite practical, consideration of the form *qu* being more familiar, there is less chance of confusing *q* with *p* or *g*, such as misreading the last two examples as *paint* and *peer*. The use of superfluous symbols to make sure that the other symbols will be received correctly is known in communication theory as *redundancy*, since it includes actual repetition as a special case, as when one says under noisy conditions "has been stolen, repeat, stolen", or when the receiver in naval and aeronautical practice confirms a message by repeating it back to the sender.

Noise in the communication sense need not be actually noisy, but anything which tends to affect the correct reception of signals,

i.e. the symbols being sent. The neon lights which may be mistaken for traffic signals referred to above are noises in this sense and they can be countered by redundancy, for example by placing traffic lights on both sides of the street.

Since conditions of communication by language are never perfect, there is always a large degree of redundancy in every language, though languages vary in the degree of redundancy. Written English for example has by one method of reckoning a redundancy of more than 50 %, so that approxly fifty pct of the *Encyc Brit* cd be concentr in a few vols., the omission of vowels mentioned above being another illustration of the situation.

3. *Coding*. For purposes of communicating symbols effectively and efficiently they often have to be coded into various forms, some of which are symbols but others, such as modulated electromagnetic changes in space or magnetizations on tape, are not symbols, since they are not perceivable and can only serve as physical isomorphs to produce perceivable symbols. In the case of coding, recoding, and recording for use at later stages in a computer system, the overall procedure is known as *programming*. In particular a very important type of coding consists of transforming a system of symbols into sets of combinations of nothing but a succession of only two alternatives, labelled as 0 and 1 (the make and break in electronic tubes or transistors). Suppose we take the nearly one hundred phonetic values as given in Table 1, p. 23. A sound represented by [m] can be coded in this system as follows: A sound is either voiceless (0) or voiced (1), and since [m] is voiced, its first digit is 1; a sound is either a stop or a continuant, and [m] being a continuant, its second digit is 1; a sound is either nasal or non-nasal, and [m] being nasal, the next digit is 0; a sound is either front or back, and [m] being front, the next digit is 0; a sound is either labial or non-labial, and [m] being labial, the next digit is 0. Thus, the sound [m] can be coded as 11000, and, as each alternative of two has an information value of one bit, the sound [m] has an information value of 5 bits, which happens to be the same as the information value of the written symbol *m*, as we have seen. But this value is given for illustrative purposes and other formulations are also possible, as well developed in the system of distinctive features referred to above (p. 43).

4. *Small-energy control and cybernetics.* All communication systems are *control systems*, systems in which some physical configurations control some other related physical configurations. Controls may be applied to matter, electricity, energy, patterns of energy, and patterns of patterns. Bodily transfer of pieces of matter is of course the most primitive form of control. Transfer of force was the concern of Archimedes when he was in search of a lever and a fulcrum to move the earth by hand. So was the seventeenth and early eighteenth-century interest in clockworks and man-powered machinery. With the advent of the steam-engine, the control of extra-human energy, in much greater quantities than human energy, was the main feature of the control systems of the age down to the late nineteenth century. Though there was a good deal of trigger-action in internal-combustion engines and electric motors, the main concern there was still the efficient use of large energies. It was not until the development in this century of electronic control of small energy transfers that energy patterns for purposes of communication have moved to a place of primary importance in communication technology in general and in language technology in particular, of which we have seen the main applications in the last chapter.

The theory of small energy control has been formulated most explicitly by Norbert Wiener (1895-1963) in his pioneer work *Cybernetics, or Control and Communication in the Animal and the Machine* (New York and Paris, 1948) and since then *cybernetics* (usually pronounced to rhyme with *phonetics*, though Wiener himself rhymed it with *orthopedics*) has acquired the status of a new discipline. The word is cognate with *governor* and the idea is that of the governor as on a steam-engine, where the principal action is that of a reactive control arising from and regulating the original action. Typical examples of such self-regulating systems are, to use Wiener's own examples, thermostats, gyro-compass ship-steering systems, self-propelled missiles, anti-aircraft fire-control systems, automatically controlled oil-cracking stills, ultra-rapid computing machines, and the like. For that matter the simplest physiological action such as reaching for a cup is a case of self-regulating action: the eye directs the hand to move in a certain direction, the result is reported to the eye and any little

deviation is corrected and the result of the correction is again reported until the cup is reached—all of which is of course more easily done than said and its importance is not realized until we witness a pathological case or the case of a drunken person, who is unable to pursue such an apparently simple and direct goal as reaching for the cup. Another example is that of driving an automobile, in which the result of steering is reported to the eye and corresponding adjustments are made in the position of the steering wheel to keep the car on the road. The critical action in all such control systems is known as *feedback*, which is essentially a small-energy result acting back on the large-energy system in such a way as to restore any deviation from a steady state or a prescribed and relatively slow course of change. All feedbacks do not of course necessarily have a stabilizing effect. If the change increases the original effect, then a vicious circle increases and reaches a divergent outcome. This is in fact what happens in nuclear explosions, in contrast to the controlled use of nuclear energy.

An important feature of communication control is that the efficiency of the energies involved is of only minor consideration. Of the thousands of kilowatts expended by a broadcasting station, be it for radio or television, only a tiny fraction is used by receivers and most of it goes to waste. The important thing is to communicate the information contained in the patterns of the signals. So long as they are strong enough to be amplified and discriminated at the receiving end, it will be efficient enough. The limit is that when the signal is too faint in the ever present ambient noise, noise in the generalized sense, then the information will be lost, and that is why, for example, there have to be midway amplifications in long-distance telephone lines. In any case the small energy transfer of information and control is not concerned with transfer of energy as such and if at any stage there is a large amount of energy involved it is only controlled by the symbolic stages and not an actual transfer of energy, as in the case of large energy engineering, where efficiency of output to input is important. To put it in popular terms, efficiency in large-energy engineering is quantitative engineering, while communication control is qualitative engineering.

5. *Records*. While control systems serve to extend the spatial

reach of communication, *records* of all kinds, including writing and phonographic recordings as special cases, serve to extend its time reach. Records are symbols or icons temporarily frozen as "memory". To be sure, one might claim that there is really nothing completely frozen or static. Even a letter in a deadletter museum consists of seventeen—now the number is around 100—kinds of "fundamental" particles dancing incessantly in fields of certain configurations, ever ready to dance differently if perchance a visitor to the museum turns out to be the addressee. In the case of the memory of organisms, and the circulating memories of computers referred to before, the dynamic nature of memory is still more obvious. These aspects of records and memories are however on a more philosophical level and do not directly concern the transmission of symbols. So long as relatively static and permanent configurations of message symbols or their isomorphs are not being sent through the usual media of communication, we have a case of recording or memory.

A record has the double function of time-uncoupling and repetition. In fact a little reflection will show that the device of time-uncoupling (cf. item (I), Fig. 11) by records is as old as history, or older. When one prehistoric man cut notches in trees for another to follow his trail because he could not be there with him at the same time, that act was as great an invention as twentieth-century split-second broadcasting. It was in fact a greater invention, since a time spread was new in principle, while space spread is only an amplification of something already known, such as shouting louder in order to be heard farther. Thus, with the addition of the element of recording and records, the scope of communication and control is enormously extended. A person can write himself notes, so that he will be at both the sending and the receiving end of the line of communication. What is philology but the work of clearing the channels of communication across the ages? By burying the "time capsules" of the world fairs, man of today is also at the sending end of messages to the far future. But why bother? He has been doing that in all manner of ways already.

§72. *Ten requirements for good symbols*

Linguists tend to avoid making value judgments about language and regard the description of the facts of language as the proper concern of linguistics. They do not ask what is good English, but what kind of people talk in what ways under what circumstances, and let the reader draw his own conclusions about categorical imperatives on the basis of the hypothetical imperatives given by descriptive linguistics. That is why the general public is disappointed because Webster's *Third International* is not another Fowler. In the case of scientific terminology and other symbolic systems, since they have been more consciously designed for definite purposes, the value aspects of the symbols are usually granted to be legitimate and so one can speak of good and bad systems of symbols. One reason that one does not usually speak of an entire language as being good or bad is that it has grown slowly as an intimate, perhaps the most intimate, part of a culture, and therefore the best system of symbols for representing that culture. On the other hand, with the change of culture and borrowing of cultural elements the original language is often found to be inadequate and so changes and additions have become necessary, resulting in word borrowings and structural borrowings to answer the new needs. The Japanese had to borrow Chinese words (the *on-readings*) as well as characters (the *kanji*) along with the cultural contents they represented; and as the borrowing language had fewer phonemic distinctions than the borrowed language, and still fewer after centuries of phonetic attrition, the phonological load has become too heavy for the modern phonemics to carry, so that if one opens even a small dictionary there will be two columns of homophones all pronounced *kōtō*. Modern Chinese has similar problems. The classical idiom, as we have seen, is still being written and read in many quarters in newspapers, magazines and books; but its pronunciation is in a similar state of phonetic attrition and when the burden of scientific terminology, especially as handled by the linguistically unsophisticated scientists, is placed on the 1,277 monosyllables of Standard Mandarin, the result is that both sulphur and lutecium used to be called *lū*; both nitrogen and tantalum called *tān*; silicon, selenium, and tin

(stanum) had similar sounding names; and so had yttrium, ytterbium, and iridium, as shown in Table 7.

Table 7. *Similar sounding chemical elements in Chinese*

Lfu	Lfu	(Lü)	Tàn	Tàn (T'ăn)	Hsì	Hsì	Hsì	Yì	Yì	Yì
硫	錫	(鐳)	氮	鉭	鈹	矽	硒	錫	釔	鐳
S	Lu		N	Ta	Si	Se	Sn	Y	Yb	Ir

In a recent revision of chemical terms, however, lutecium has been renamed *lǔ* and the pronunciation for tantalum changed from *tàn* to *t'ăn* (as shown in parentheses in Table 7), so that no longer two elements will be completely homophonous (since syllables in different tones are not homophones). In the case of organic compounds, characters have been made up with no idea of how they are going to be said as spoken words and some chemists, when lecturing in Chinese, even fall back on saying them in whatever Western language the textbook happens to be written in. Thus the pragmatics of symbolic systems, including their audio-lingual aspects, are definitely concerned with questions of their being good, effective, efficient, etc., or the opposite.

It is obvious that the answers to such questions will depend upon the purposes for which the symbols are used. Unambiguity is usually a virtue, but in a system of symbols to be used in oracles or fortune-telling, it will do well to have plenty of ambiguities in order to be applicable to a variety of cases. Ease of reproduction should in general be a desirable feature, but coin and currency as symbols should not of course be too easy to reproduce. Again, widespread intelligibility among people should in general be a desideratum for good symbols. But in the case of cryptology and cryptography, the object is to limit the use of the symbols to a small group for which it is intended—perhaps cryptology and cryptography have no *raison d'être* in a rational society.

But even apart from such unusual desiderata as secrecy and limitation of reproduction, features which seem to be good for most purposes are often mutually conflicting and, according to the actual problems in which the symbols are to be used, the relative weights to be assigned to the various factors will have to be diffe-

rent. Moreover, before the factors are defined in quantitative terms, there is no point in speaking of their relative weights, nor whether they are mutually independent. In the following enumeration of requirements for good symbols I shall state each as if it were absolute, understanding that each is only one of a number of variables which form the arguments of a mathematical function, to be defined according to the nature of the problem. The ten requirements for good symbols are: (1) simplicity, (2) elegance, (3) ease of production, reproduction, etc., (4) suitability of size, (5) balance between number of symbols and size of symbol complexes, (6) clearness of relation between symbol and object, (7) relevance of the structure of symbol complexes to the structure of objects, (8) discrimination between symbols, (9) suitability of operational synonyms, (10) universality.

1. *Simplicity*. The criterion of simplicity for good symbols is usually taken for granted, but it is often not clearly defined and its importance is often exaggerated. If a certain symbol is used for a certain object, then it is a simple symbol *qua* simple, as we have already noted. As to the internal structure of the symbol itself as a thing, it may be as simple as a small black dot on paper or as complicated as the Chinese character 點 for 'dot'. Apart from evaluation by the other criteria enumerated below, the requirement of simplicity is limited by the necessity for discrimination from other symbols of the system. For this purpose there must be a sufficient degree of complexity or individuality in each symbol. A system of symbols with the least amount of complexity to represent a given amount of information will require that every little detail count and the slightest difference of detail will make a significant difference in the message, in other words, it will have the least degree of redundancy. Since in the actual use of symbols there is always "noise" present, of which failure to keep up one's attention to detail on the part of the receiver is a special case, it is always desirable, as is usually done, to have more elaborate distinctive features in the symbols than would be necessary under ideal conditions. That is why in every actual system of symbols there is always a certain amount of redundancy, as we have noted. In order to be sure to be understood one has to repeat oneself or paraphrase oneself. It would be sufficient to say "Turn up the

mike!" and yet one also says "Please turn up the volume of that microphone!" where the addition of more words adds little to the information.

Simplicity in a system of symbols sometimes refers to such factors as the total number of different symbols, the total number of defining sentences, symmetry of features, etc. These will be dealt with separately under later subsections.

2. *Elegance.* The element of elegance becomes important when symbols are used for arousing attitudes and influencing action. To be sure, according to a behaviouristic theory of signs, such as that developed by Charles Morris, all symbolizing ultimately leads to response or disposition to respond. However, the older dichotomy between emotive and denotative uses of signs, even if it can be reduced to a difference of degree, is still the most convenient distinction to use in our discussions. Since the relation between simple symbols and objects is in most cases an arbitrary one, any aesthetic quality in the symbol is "good" only on its own account and not as a symbol. The reason that a girl named *Rose* would be offended if you called her *Onion* is purely because of her symbolic association with the respective objects. In itself *onion* is in fact more elegant than *rose*, as one can tell by pronouncing the words backwards: *Naina* would make a much prettier girl's name than *Zwor*. Therefore a rose does sound sweeter if called by some other name, such as *onion* (approximately *Naina* backwards).

It is in the structure of a system of symbols—parallelism, symmetry, articulateness—that the elegance of symbols counts more. Those who build symbolic systems, such as mathematical logicians, put great emphasis on simplicity, economy in the number of elements, the relative sizes of simple symbols and symbol complexes, etc., all of which we shall discuss later.

3. *Ease of production, reproduction, repetition, and transmission.* On the whole, auditory symbols are the easiest to produce, visual symbols the easiest to reproduce, and some electric or magnetic patterns of auditory or visual symbols are the most convenient to transmit and record, though these are not normally readable as symbols.

The requirement of ease of production and reproduction is of such great importance that more than ninety-nine per cent of all

symbolism in science is reduced to two-dimensional figures, either as written words or in the form of two-variable graphs. Iconic figures play a relatively small part in scientific symbolism and resort to models and colour schemes is made mostly for the purposes of teaching or popularization, practically never for serious research. Obviously most problems involve more than two factors. But one always manages to squash three or four dimensions into two. If the inverse proportion in the pressure-volume relation of a gas has to be represented in both dimensions of the page, variations in temperature can always be shown on the same page by having a

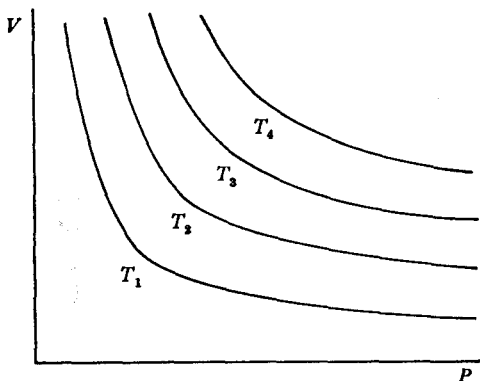


Fig. 13. Pressure-volume-temperature graphs.

family of curves labelled T_1 , T_2 , etc., as in Fig. 13, just as the map of a hilly country can show elevation by a series of contour lines. Or, to come closer home to matters linguistic, more than one phonetic dimension may be represented on one sheet, as in Table 1 (p. 23), where the horizontal dimension represents places of articulation, but within each place, left and right represents voiced and voiceless, or in Table 2 (p. 32), where the horizontal dimension represents front and back, but within each position, left and right represents unrounded and rounded. To build three-dimensional models for such relationship, as is sometimes done (though usually in perspective only) to represent vowel harmony in Turkish, is neither practical nor necessary. Three-dimensional *chess* or *go* is so hard to play that such games have never become popular. It would be interesting to speculate, if cuttlefish—the squid-like

animals that emit ink—could write freely in water and then have their writing fixed in three dimensions, whether they wouldn't have a more powerful system of symbolism and a better grasp of complicated things than we paper-and-pencil animals.

Ease of production, transmission, etc., is of course relative to the circumstance of use. Primarily it is a matter of handiness in the literal sense. But whenever gadgetry is involved in which symbols are often transformed into unreadable physical forms, for purposes of rapid or distant transmission or to gain time delay, then technological efficiency takes precedence over physiological convenience, as we have seen in the case of the Morse code, which is hard to send but easy for the physical channel to carry. That is in fact the justification for all the trouble in coding and programming of symbols in the machine handling of language or of any other system of symbols.

Language and writing are quasi one-dimensional in that their unit symbols themselves—phonemes and letters—have more than one dimension but that all constructions are in serial order. Hence the perennial problem of immediate constituents, as typified in that story about the narrow gentleman's comb or the comb for a stout gentleman, with rubber teeth. While in principle a complex of any number of dimensions could be serialized, as the taping of a TV programme, or for that matter the scanning process line by line of each picture of TV itself, it is after all a tedious, though clever and quick process and certainly not something that can be handled manually. For direct use of symbols by sender and receiver, nothing has yet been invented to compete favourably with the pages of a book. With all the back tracking devices on tape-recorders and even the ultra-rapid electronic scanning of a coded vocabulary, one never can examine or repeat parts of a spoken passage out of the corner of one's ear as conveniently as one can glance over a page out of the corner of one's eye.

4. *Suitability of size.* Symbols and symbol complexes should be of suitable sizes in all their constituting dimensions. Redundancy is in fact one form of gaining size, as in the case of large or repeated traffic lights against a background of other lights referred to above (p. 206). The single words *quote* and *unquote* are felt by some speakers as inadequate and have to be blown up to *he says, and I*

quote followed by *end of quotation*. In general, a good size for a symbol or a symbol complex is one that fills a substantial part of the field of attention.

On the other hand, since we have to do with symbol complexes much more often than with symbols, it is advantageous for each symbol to be small, in order to put as many related things as possible together. In this way, with the same effort of memory, or of power of concentration, one can have a greater grasp or span of complexity of relationships. One can of course always define new simple symbols and equate them to complexes. This is in fact how big systems are built up which no mind can grasp in all details at once. However, by having the simple symbols kept down to suitably small but discriminable sizes, one has a better chance of intuitive insight into relations which otherwise might escape notice because of too many steps of substitution and possible danger of hypostasis, i.e. the mistaking of symbol for object.

The size of a symbol is a quite different matter from the amount of information it represents. To distinguish between the two, George A. Miller, in his article "The Magical Number Seven, Plus or Minus Two" (*Psych. Rev.* vol. 63, 1956, pp. 81-97), proposed the suggestive and useful distinction between *bits* of information and *chunks* of information. For example, on an automobile licence plate with three letters and three digits, there are six chunks of information, but the first three chunks contain 1 in 26^3 , or 17,576 possibilities or a little over 14 bits ($2^{14} = 16,384$), while the last three chunks contain only about 10 bits ($2^{10} = 1024$). But so far as the span of memory goes, as Miller has shown, it is about as easy to carry in one's head BGAHBHA as 2718281 and the capacity for immediate recall, according to Miller, is about seven plus or minus two, depending upon the nature of the symbols. The sizes of the chunks in perceptual terms will of course make a difference. For example, although I think I know the numerals in English almost as well as in Chinese, since I do sums just as readily in English, I can hold more figures in my head in Chinese because the Chinese numerals are mostly of the CV (consonant-vowel) or CVC types, whereas some of the English numerals are in such large chunks as CVCC (*six*) and CVC(V)C (*seven*). It takes about 30 seconds to say the multiplication table in Chinese from $1 \times 1 =$

1 to $9 \times 9 = 81$, whereas the same thing in English as recited by a native speaker, will take about 45 seconds. Samuel E. Martin reports that his daughter Norah, who at 2⁺ years has learned to count to ten, consistently leaves out the one disyllable in the set, "seven", and has to be prompted to put it in.

5. *Balance between number of symbols and size of symbol complexes.* The total number of simple symbols in a system should be well balanced against the size of symbol complexes. In general the larger the inventory of elementary symbols, the smaller the symbol complexes need to be. This is true for most established systems and for reasonably constructed systems, otherwise, it is possible to have too few symbols in too few combinations, resulting in ambiguities, or too many of each, resulting in redundancies. One reason that clichés are bad from the point of view of the theory of symbols is that they are redundant in the communicational sense. If no fresh information comes of it, why use a stale phrase?

To take some examples of the inverse relation between variety and length, there is at one extreme the binary system of 0 and 1, which as we have seen, takes inordinately lengthy forms to write the simplest number, such as "10000" for what in the usual system of ten digits would be written "16". Another example is the number of primitive notions and the number and length of postulates necessary to set up the same system of logic. In traditional practice one makes use of some (but not all) of the notions of 'and', 'or', 'not', 'all', 'if . . . then', etc., and can define the whole system in a few simple postulates. But, as H. M. Sheffer has demonstrated ("A set of Five Independent Postulates for Boolean Algebra," *Transactions of American Mathematical Society*, vol. 14, 1913, pp. 481-8), it was possible to make use of only one basic notion 'neither nor' (symbolized by " $|$ " as in $p|g =$ 'neither p nor g ') and build up a whole system of logic in terms of this one symbol, at the expense, however, of longer and more complicated forms for stating the postulates, not to speak of the relatively unnatural idea, from the common sense point of view, of using 'neither nor' as a starting-point.

To take another set of examples, it is possible, at the cost of having to know thousands of characters, to give the same amount of information in written Chinese with a shorter string of symbols

than in most other systems of writing. Spoken Chinese, on the other hand, is concise or verbose according to the variety of syllables a dialect has. On this point a beautiful demonstration was made by S. W. Williams in his *A Syllabic Dictionary of the Chinese Language* (rev. ed., T'ung Chou, 1909, pp. xlii-xlvii), in which he took a passage from a seventeenth-century imperial edict enjoining filial piety and compared the varying lengths of the passage as translated into several dialects. Without exception the richer the inventory of syllables a dialect has, the more concise the translation; and the poorer the inventory, the lengthier the translation. Cantonese, as expected, comes out on top as to distinctiveness and conciseness, but even very similar dialects reflect the same effect of the size of the syllabary on textual length. The dialect of Hankow is a Mandarin type of speech, quite intelligible to speakers of Northern Mandarin, but it does not distinguish initial *l* and *n*, final *ing*, *eng* from *in*, *en* or retroflex from dental sibilants. All this comes out in the translations—the passage in the Hankow dialect is the longest of all.

A distinction should of course be made between the sender's and receiver's sensory uses and those for the artificial "sense" of machines of communication. For the latter purpose, as we have seen, most modern devices have made extensive use of the binary system, such as the make and break in electric circuits. These instruments of transmission work so rapidly that the lengthiness of symbol complexes resulting from the paucity of the variety of elements is no drawback at all. Any symbolic system can be coded suitably for the medium of transmission. But for the human sender and user, the balance between the variety of unit symbols and size of complexes should be considered from the point of view of learning and long-term use and the optimum in most cases is not likely to be at either extreme. Although on the neurological level, every nerve impulse works on the all-or-nothing principle, like that of a binary system, the resulting more highly organized physiological processes, whether they have to do with afferent or efferent nerves, are practically continuous processes, involving units of various sizes and numbers. In this regard J. C. R. Licklider, in *Cybernetics, Transactions of the Seventh Conference* (New York, 1951, p. 156) has made a very significant estimate of the

situation. He says: "I think that the human receiver of information gets more out of a message that is encoded into a broad vocabulary (an extensive set of symbols) and presented at a slow pace, than from a message, equal in information content, that is encoded into a restricted set of symbols and presented at a faster pace." This sounds almost like advocating the use of the Chinese characters, though of course not quite to that extreme. On the other hand, the twenty-six or so letters of the Latin alphabet seem to represent the preferred average of a large section of writing mankind which is a little nearer the extreme of paucity in the variety of symbols. In consciously designed systems of symbols one could of course try to adapt means more closely to the ends for various purposes. A perfect balance between variety of unit and size of complexes in an ideal system of symbols for general purposes will probably be visionary, but there must be vision in order to have progress.

6. *Clearness of relation between symbol and object.* Although symbols in science are primarily used for directly representing things, sometimes the relation between symbol and object is by no means clear and sometimes even intentionally obscure. Symbolism in primitive culture has to be unearthed by deep research. Symbolism in dreams has to be dug up by psychoanalytic probing. In symbols used in commercial advertising and political propaganda the real objects are often made obscure or misleading by design and it is up to the reader to find them out and take them for what they are.

In contrast with symbols of the primitive kind, symbols used in science are usually non-iconic (non-pictorial) but arbitrary and should contain as few irrelevant iconic features as possible. For example, in the usual diagrams for logical inclusion, overlapping, and exclusion, classes are represented by the so-called Euler's circles. Now circles are figures with properties of their own, quite irrelevant to the general relation of inclusion, etc. Thus, the more arbitrary outline in Fig. 14 B would seem to contain less irrelevant features than those in Fig. 14 A. On the other hand one is still never sure not to read irrelevant meanings into the irregular outlines in Fig. 14 B either, since iconic symbols are very easily taken as symbol complexes in which the parts might have separate meanings.

7. *Relevance of the structure of symbol complexes to the structure of objects.* Structural relevance is much more important than any fortuitous relevance between a simple symbol and its object, as we have just seen. Take for example the use of serial order. We noted (p. 199) that the symbol complex in the order $a < b < c$ is better than some other form of representation. Take the naming of streets as another example. In the central parts of New York and Washington, streets are easier to find than those in cities where the relation between streets and names are arbitrary. Additiveness of

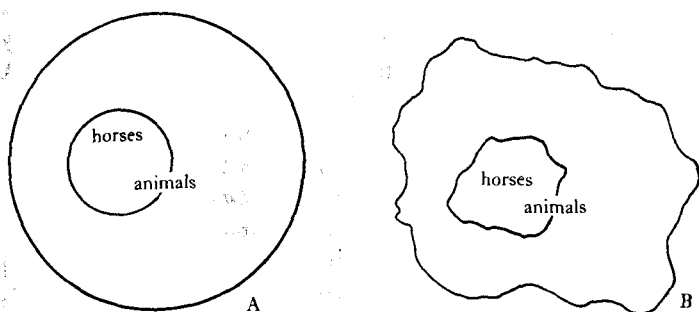


Fig. 14. Generalized Euler's circles.

relations between symbols is another desirable feature if the objects represented have additive relations. For example, it was a mistake to have left out the year zero between years B.C. and years A.D., since it disturbs the normal procedure by which an interval is reckoned by subtracting the number for one date from that for another. The interval from 4 B.C. to 29 A.D. would seem to be 33 years, since $29 - (-4) = 33$, but there being no zero, it was actually 32 years. Again, to call one week *huit jours* and two weeks *quinze jours* would make twice eight fifteen. The innocent-looking time indication: year 1968, month 2, day 16, hour 7, minute 7, second 0 is bad symbolization because the figures for year, month and day, are for ordinal numbers, whereas the other figures are for numbers of units completed, and consequently one could not apply ordinary arithmetical reasoning here. It was also for gaining additiveness that information is measured, as we have seen, not by the inverse probability, but by the logarithm of inverse probability, so that the amount of information contained in two messages will

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come out as the sum of the two amounts of information contained in the two separate messages.

Although symbols need not be iconic, symbol complexes in iconic relations with object complexes will have certain advantages. The typical examples are of course the representation of quantities by the length of straight lines in one or more dimensions, or simple transformations of quantities, such as their logarithms. An interesting case of the mixture of principles is that of musical notation. The horizontal dimension represents the time, but the shapes of each note also makes a difference in time value, and teachers often warn the students not to write a half note followed by four eighth notes at equal spaces, but give more room, if not quite proportionately, to the longer note. The vertical dimension is supposed to



Fig. 15. Huntington's "normal notation" for music.

represent pitch, but since the usual notation is based on the diatonic scale, with unequal steps, it represents pitch only roughly. Thus, equal vertical spaces do not always correspond to equal intervals and unequal pitches are often in the same position on the staff, as in the case of sharps and flats. To normalize the relation between pitch and vertical space, the mathematician E. V. Huntington proposed (in *Scientific Monthly*, September 1920) what he called "normal notation", in which each staff represents an octave with one semitone for every step. Since this takes more space than in the usual diatonic notation, it takes four staves, marked 1, 2, 3, 4, each staff to one octave, to cover the usual range of two staves from cello C to the soprano high C. In the normal notation the middle C is in the middle, in fact the C's always on the ledger lines between staves, G's always on the middle lines, etc. For the so-called signature for the key, instead of giving the set of sharps and flats, simply giving the tonic triad before the time signature will do. As an example, the opening chords of a piano version of the

slow movement of Dvořák's *New World Symphony* will look as in Fig. 15, where 15 A is in the usual notation and 15 B is in Huntington's normal notation. While such a notation may be very good for a solo piece or even a string quartet, it would certainly be unsuitable for an orchestral score, which already has more than a dozen simultaneous staves on one page and a notation with almost twice that many staves would surely be looked at askance by a conductor having to take all that in at a glance. This is simply a case of the frequent conflict of desiderata, namely relevance (no. 7) versus suitability of size (no. 4).

8. *Discrimination between symbols.* The fineness of discrimination between different symbols should be suited to the conditions of use. In order that no information be lost in the transmission, the degree of discrimination should exceed, but not very much exceed, the degree of discrimination expected of the objects. To get the circumference of a kitchen utensil from the diameter, there is not only no need to multiply it by π to five places, but the resulting symbolism would be misleading, since it would represent nothing in the object. For the same reason the scale of discrimination on the cathode ray translator for visible speech (§ 62, p. 171) was designed not only to discriminate visually all acoustical qualities that the ear can discriminate, but it was designed so as not to introduce any optical detail that the ear could not discriminate in the sounds portrayed. If, however, there is too much disturbance around, too much noise, in the transmission of a message to allow the necessary fineness of discrimination in the symbols, then the symbols will have to be recoded on a coarser scale to suit the transmitting medium, to be decoded later at the receiving end. But even under normal "quiet" conditions, the reception of symbols never occupies the whole field of attention, except perhaps during hypnosis. In other words, there is always noise (from other departments of sense, if not from auditory noise) accompanying the desired signals. To provide for sufficient discrimination for average conditions, a good system of symbols should therefore use much coarser discrimination than the ideally possible, although, as we have noted, it should be slightly more than fine enough (when decoded) to account for all differences in the objects. According to George A. Miller, in his *Language and Communica-*

tion (New York, 1951), the ear's capacity of discrimination is of the order of 340,000. But, as is well known, most languages of the world make use of only a few dozen phonemes. Much of the duplication, as we have seen, is due to the non-distinction of perceptibly easily distinguishable allophones of the same phoneme, such as the same vowel at various levels of absolute pitch.

9. *Suitability of operational synonyms.* Operational synonyms of symbols are the social counterpart of technological coding for purposes of physical transmission or recording. Under conditions of interpersonal use of symbols, it is well to have every symbol appearing synonymously in various departments of sense, whether for adaptation to varying conditions of direct use, or for purposes of reflective theorizing. Thus, the symbol



is an operational visual symbol, the syllable *sol* (or *la* according to another usage) is an operational verbal form, "A" (or "*dominant*") is a written name, and /ei/ (or /'daminənt/) is a spoken name.

In this connection the requirement of noise-resisting redundancy has to be balanced against the desirability of the richness of information in each chunk of a symbol. The names of the letters of the English alphabet, with so many ending in the same vowel, are extremely poor as operational names. Hence such redundant forms as in Table 8.

Table 8. "*Redundant*" operational names of the letters

Alfa	Foxtrot	Kilo	Papa	Uniform	Zulu
Bravo	Golf	Lima	Quebec	Victor	
Charlie	Hotel	Mike	Romeo	Whisky	
Delta	India	Nectar	Sierra	X-ray	
Echo	Juliet	Oscar	Tango	Yankee	

For example, when I once checked in at the counter in an airport, the man announced my seat number as "Charlie Three", although my ticket actually read "C-3". The above list, though somewhat internationally oriented, was based on tests made with English-

speaking users, so that internationally "Mike for M" may not be so good as, say, "Metro for M", for, apart from perceptual suitability, the consideration of the linguistic background of the user is also an important factor.

Operational synonyms in the form of abbreviations can be of varying degrees of efficiency according to the way it is constructed:

(a) When an acronym is called by the names of the letters, as when *YMCA* is called *Wye Em See Ay*, *MIT* called *Em Eye Tee*, *UCLA* called *You See El Ay*, etc., there is plenty of redundancy for fairly small amounts of information, as each letter is worth a little less than five bits and its name as a chunk is from two (e.g. *M*) to six or seven phonemes (e.g. *W*) long, averaging about $2\frac{1}{2}$ phonemes.

(b) We have much handier chunks when acronyms are pronounceable as words and are so pronounced, as *FIDO* for 'fog, intense dispersal of' (for burning a clear stretch of the runway for takeoff), *Laser* for 'Light Amplifying by Stimulated Emission of Radiation', *TIROS* for 'Television Infrared Observation Satellite'. Some of these happen, perhaps not entirely without design, to be actual words, for example, *Ghost* for 'Global Height Horizontal Observation Sending Technique'. All such words do not of course have to do with science and engineering. There are *NATO* for 'North Atlantic Treaty Organization' and *UNESCO* for 'United Nations Educational, Scientific, and Cultural Organization', although *UN* itself is called 'You En'.

(c) The most efficient forms of acronyms as operational symbols are those using monosyllabic morphemes or partial morphemes of the full forms. For example, *Cal Tech* (with six phonemes) takes about the same time as *MIT* (spoken as 'Em Eye Tea'), but it conveys much more information, since each near-morpheme is one out of several thousand, while each letter (however it is called) is only one out of twenty-six. Allowing five bits to a letter and twelve bits to a morpheme (estimated conservatively as one in 4,096), *Cal Tech* gives twenty-four bits while *MIT* only fifteen. Another advantage of morphemic acronyms is that the morphemes being part of the user's language, they are much easier to learn and remember than a pronounceable but meaningless string of letters of the *FIDO* type. Further examples are *Conelrad* for

'Control of Electromagnetic Radiation', *Syncom* for 'Synchronous Orbit Communications Satellite', and *Chinsyn* for 'Synthesis Oriented Chinese-English Machine Translation System' (paper by A. Kaltman at the 1964 meeting of the Assoc. for MT and Computational Linguistics). Sometimes one does not even need to learn the partial morphemes to know what it means, as when I saw in an article the statement that a parsec was 3.26 light years and though I had never seen the word *parsec* before I could read it at once as short for 'the parallax of one second of arc' as easily as if it had been in Chinese. I say Chinese because all Chinese acronyms are by morphemes and therefore contain more information per chunk of symbol of the same size.

One feature of operational forms of symbols which sometimes troubles logicians and not so much linguists is that sometimes a symbol seems to correspond to nothing for an object. For example, when the symbol D in Dy were first introduced, in the 1920s, to represent the $\frac{d}{dx}$ part of $\frac{dy}{dx}$, objections were raised that $\frac{d}{dx}$ was nonsense, since $\frac{dy}{dx}$ is the limit of a ratio of $\frac{\Delta y}{\Delta x}$ as Δx approaches zero. But the symbolism has since become common and every user seems to feel that he understands what it means. From a linguistic point of view this is quite similar to the situation where any frequent combinations of forms may acquire the status of an IC. In *by means of will*, the highly frequent *by means of* is an IC operating as a preposition, while in *by strength of will*, *by* is the preposition and *strength of will* is the object. Linguists are usually quite comfortable to deal with forms only and let meanings take care of themselves.

10. *Universality*. While universality of symbolism among possible users is obviously a great social desideratum for good symbols, the cost of learning of symbols or relearning of new symbols is often a major factor to consider. When we remember that the greater part of our lives has been spent in the constant use of the two great symbolic systems of one's native language and writing, we can easily realize that to apply any of the preceding nine requirements for good symbols, with the intention of changing natural languages and systems of writing will run into such high

costs that the other requirements will all pale into insignificance by comparison. That's why most people never learn a foreign language, most books are printed in straight text, and most readers are shy of special symbols and technical terms. With all its obvious defects, the set of arabic figures and the latin alphabet, or its variations, far outweigh their defects according to the other requirements for good symbols. On a comparable scale of invested interest, the very difficult system of Chinese writing, which will rate very low on most of the requirements—except that of elegance (in a sense) and except that of operational efficiency in terms of information per chunk—has not only served well the Chinese speaking people; but also several of the countries of Eastern Asia speaking various non-Chinese languages. It not only extends widely over space, but also over more than two millennia in time without substantial structural change. It was therefore not without some intellectual and emotional hesitancy that for a number of years I have advocated the use of the latin alphabet for writing the Chinese language, which will probably be the future form in which the language will be written. However, I felt safe to advocate an alphabetic form of writing Chinese and have actually contributed toward designing and promoting a version of it, for I think that there is little danger of the characters being abolished too soon and that the characters will remain in use for decades, if not indefinitely, as a parallel form of writing.

Ideally, in the quest for a universal system of symbols, be it for the natural languages or for an artificial international language, we are bound to be pulled in various directions by the partially conflicting requirements, as we have been considering. If vested interest could be discounted in favour of end efficiency, my guess for an ideal system of visual and auditory symbols for general purposes of speech and thought will involve neither the extreme paucity in elementary units nor the extreme luxury of thousands of them, but probably about 200 monosyllabic symbols, such that a string of "seven plus or minus two" of them can be easily grasped in one span of attention. A previous guess (p. 112), made on a slightly different basis, came out as 170.

While such visionary proposals will have to be left to future dreams and schemes, universality of a sort can be approached by

§72. TEN REQUIREMENTS FOR GOOD SYMBOLS

human or mechanical "translations" of one system of symbols into another, as have been made in various inter-disciplinary inquiries. In such "translations" one may find certain "universals", valid for all mankind, to which all symbols can be related. The world must be small enough and history has been short enough—if not suddenly made too short—for this to be a possible and reasonable idea to entertain. These invariants may not look alike or sound alike, but the important thing is that they should feel alike for all members of the human species.

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