2/The Rules of Language

MORRIS HALLE

When you talk, what do you say? When you listen to someone else talk, what do you hear? Words, of course—or so all speakers and listeners believe. But they are mistaken, according to Professor Morris Halle of the Massachusetts Institute of Technology. Native speakers do, however, share a great deal of largely unconscious knowledge about their language, and they acquire this knowledge without formal instruction. Drawing examples from a number of different languages, Halle illustrates some of the phonological rules and principles of various languages as well as some similarities among these rules and principles. Every language has its own set of rules, and all human beings have a natural tendency to look for and use rules when processing language. Our ability to learn these rules as very young children and without instruction, and our persistence in using them, are attributable to the uniquely human genetic endowment.

The sounds that we hear when spoken to and that we emit when speaking are produced by complex gymnastics executed by our lips, tongue, velum, larynx, and lungs. The activities of these independent anatomical structures are coordinated with a precision that should be the envy of the most highly trained ballet dancer; yet this truly remarkable exercise is performed at the drop of a hat by even the clumsiest person. In contrast, even the most adroit primates have never been able to master it, despite intensive training. These facts suggest that the ability to speak is linked to our genetic endowment, that it is one of the aspects in which humans differ from all other mammals.

The gymnastic feats involved in speaking are clearly not the whole story. Speech is not just some noise that humans are capable of emitting; it is a noise that is produced to convey meaning. And how speech conveys meaning is surely one of the great puzzles that has intrigued thinkers for centuries.

Once the question of meaning is introduced, it is clear that we have to go beyond an analysis of vocal organ movements and of the acoustic signals these movements elicit. Such an analysis can tell us how the sounds of English differ from those of Finnish or Kwakiutl, but it cannot tell us why a sequence of sounds uttered by a speaker of English means something to us, whereas a sequence of sounds uttered by a speaker of Kwakiutl, or Finnish, usually means nothing. If
we ask ourselves why most of us are able to understand a speaker of English but not a speaker of Finnish or Kwakiutl, the trivially obvious answer is that we know English but we don't know Finnish or Kwakiutl. But that answer leads naturally to a question with a much less obvious answer: What is the character of the specific knowledge that speakers of a particular language possess through which they are able to understand one another? Although not all linguists might choose to formulate it precisely in this fashion, this question has always been central to the science of linguistics.

**Words: To Say and to Hear**

A striking fact about all speech is that all speakers—no matter in what language—are sure that they produce words, and all hearers are certain that they perceive utterances as sequences of words. When we pay attention to our own speech, we observe at once that we do not normally break up our utterances into words; rather, we run words together without intervening pauses. One can readily convince oneself of this fact by reading a text in a way so—as—to—pause—after—every—word and observing that the result is highly unnatural. The acoustical speech signal of an utterance thus differs from its representation in writing: the spaces between the written words are generally missing in speech. Does this mean that, because we do not pronounce utterances word by word, our perception that utterances are made up of words is a kind of illusion—that we perceive words even though they are not actually there?

I would argue that this is indeed the case, for what we hear is only partly determined by the physical signal that strikes our ears. For instance, we generally hear words in utterances of only our own language; we fail to hear words in equally clear utterances in an unfamiliar language. Moreover, many utterances, even when pronounced perfectly clearly, are ambiguous, in the sense that they can be perceived as either of two (or sometimes more) distinctly different sequences of words.

A recent incident illustrates this quite well. Somebody reported to me that he had met a person with the interesting name:

Me [iba] tory,
in which 9 represents the sound of $a$ in *about*. "Oh, yes," said I, "this person has the same last name as a sixteenth-century Polish king, Stefan Batory, who fought against the Turks." As I began a minilecture on Turkey's role as a major military power for many centuries, I was interrupted with the information that the person in question was female and that her first name was *Melba* and her last name *Torrey*. Although this name also provided the basis for an erudite disquisition,
the opportunity somehow had passed. Be that as it may, the point of
the anecdote is that the utterance was ambiguous, and that its ambi-
guity was not located in the acoustical signal nor in the intention of
the speaker. The hearer's misapprehension thus was due to the as-
sumption (or illusion) that a particular sequence of sounds was divided
into words in a way that did not coincide with the division intended
by the speaker. Since knowing words is an essential component of
every fluent speaker's command of language, an obvious topic to in-
vestigate is the form in which this knowledge is internalized by speak-
ers: What do they know about the words of their language? At first
blush it may appear that the answer is trivially simple. Speakers know
that certain sound sequences have particular meanings; for example,
the sound sequence [dog] refers to the animal otherwise known as
man's best friend, whereas the sound sequence [tok] refers to the ac-
tivity of speaking.

There is more to it, however. Speakers know not only the words
of their language; they also know whether a given sound sequence
could or could not be a word, in their language. Consider the strings
of letters in Table 1. Most readers have never encountered any of these
"words" before. Yet there will be widespread agreement that some of
these might be English words whereas others could not possibly be
English. Furthermore, most readers will agree as to which "words"
belong where; i.e., thrim, snork, dramp, platch, and shripe are likely to
be judged English words, while gnet, lgal, vrag, pfin, bdit, and nsip are
not English. Since none of the "words" was previously encountered,
the judgment cannot be the result of checking through a list of mem-
orized words. The explanation must be that we all share some basic
information about the structural properties of English words—for ex-
ample, that English words never begin with the consonant clusters sn
and Ig, whereas sn and pi are allowed. In other words, we all share
some abstract principles of word structure such as those in the illus-
tration.

It is unlikely that any readers will recall working out such prin-
ciples in the course of learning English; in fact, few speakers will claim
that they are even aware of knowing such principles. Yet their ability

<table>
<thead>
<tr>
<th>thrim</th>
<th>lgal</th>
<th>dramp</th>
<th>pfin</th>
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<tbody>
<tr>
<td>platch</td>
<td>gnet</td>
<td>shripe</td>
<td>bdit</td>
</tr>
<tr>
<td>snork</td>
<td>vrag</td>
<td>chrude</td>
<td>nsip</td>
</tr>
</tbody>
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Table 1. Readers whose mother tongue is English will rec-
ognize that some of these letter strings might be English
words but some could not be. Abstract principles of word
structure guide us subconsciously in our evaluation and
use of these "nonwords."
Some Principles of English Word Structure

1  m n  do not figure in any clusters except sn and sm; snail and small are words, gnet is not a possible word.
2  m n l r w y  do not occupy the first position in a cluster; platch and frith are possible words, lpatch is not. do not occupy the last position in a cluster; bidit is not a possible word.
3  b d g  may occupy either the first or the last position in a cluster, but not both; thrim, sphere, and scare are possible, but pfin is not.
4  p t k f o

Table 2. This list illustrates but a few of the abstract principles of English word structure. Although access to these (or similar) principles is necessary to account for English speakers' judgments about the "nonwords" above, few if any speakers will remember developing such principles in the course of learning the language.

to judge "words" such as those cited above as English or not can only be explained by the assumption that speakers of English possess this type of knowledge. In other words, this suggests that we have knowledge about our native tongue of which we are not conscious. Like Moliere's M. Jourdain, we all speak prose; but we are totally unaware of doing so.

Knowledge: Taught, Learned, and Innate

The existence of knowledge not directly accessible to our consciousness is not a particularly new discovery. One of the main purposes of Socrates' questions in Plato's writings was to demonstrate that even the most untutored among us possess knowledge of which we are totally unaware.

Many readers will accept this idea and yet be surprised that in passing on our language to our children we should be transmitting knowledge of which we ourselves are not consciously aware. Implicit in this surprise is the assumption that learning is always the result of overt teaching. But that assumption is false. Indeed, the acquisition of our mother tongue, I would argue, is a prime example of this kind of learning.

The fact that most of what we know about our native tongue is acquired without overt teaching raises a further question. All children are naturally interested in words and constantly inquire about them. But neither they nor their parents are the least bit curious about principles such as those illustrated in Table 2 that govern the distribution of initial consonant clusters. Yet somehow in the process of learning English we must have learned them. How can one explain this? How
can one explain, in other words, that in the process of learning the words of English we incidentally learn principles of English word structure in which we have no conscious interest and to which nothing in our daily existence might plausibly draw our attention?

The only reasonable account of how speakers come to know these principles is to attribute them not to external factors but to innate mechanisms involved in memorizing words—that is, to assume that our minds are so constructed that when we memorize words, we automatically also abstract their structural principles. We might suppose that human memory for words is at a premium so that every word must be stored in a maximally economical form—i.e., in a form where every redundancy is eliminated. Since the principles noted in Table 2 capture an essential aspect of the redundancy inherent in English words, access to these principles is required to store English words in their most economical form. Different principles will, of course, be developed for different languages, but there is no language that lacks them altogether that does not place severe constraints on sequences of consonants and vowels in words. Thus the postulated mechanism that causes speakers to seek the abstract structural principles in their words will always produce a useful result.

It almost goes without saying that the propensity to search for structural regularities in the words we commit to memory is not something that we acquire from experience. Try to imagine, for instance, what sort of experiences might lead a child of average intelligence to grasp the fact that words contain redundancies that might be utilized for more economical coding. Moreover, these experiences must be common to children of all cultures, to Greenland Eskimos as well as to those whose parents are, for example, college professors. The only plausible explanation for the special way in which humans memorize words is innate: we do it in our particular way because for members of our species there is no other way.

There is of course nothing implausible in the suggestion that an organism is genetically constructed to perform particular tasks in particular ways. In fact, that is surely a major reason why a particular organism executes certain tasks very well and others poorly or not at all. Think, for example, of a kitten that shares a young child's every waking moment. At the end of a year or two the child will have acquired substantial mastery over its mother tongue, but the pet will fail to show any progress of this kind; instead, it will show great skill at catching mice and climbing trees. The reason for this is that humans are genetically different from cats, and part of that difference consists of the intellectual capacities that enable humans to acquire command of a language, presumably through special built-in features that determine, among other things, the way we memorize words.
The Special Roles of b, d, and g in Spanish

<table>
<thead>
<tr>
<th></th>
<th>&quot;low&quot;</th>
<th>alpaj</th>
<th>&quot;below&quot;</th>
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<tbody>
<tr>
<td>donde</td>
<td>&quot;where&quot;</td>
<td>al[5]onde</td>
<td>&quot;where to&quot;</td>
</tr>
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</table>
| guardar| "to watch"| afrguardar| "to wait for"

Table 3. The consonants b, d and g are the subject of special rules in English (see Table 2) and Spanish (above). Though the rules are very different in the two languages, the fact that the same group of sounds figures in the rules of two distantly related languages points toward a single set of principles governing sound groupings in all languages.

Universals of Language?

If the basis of our command of a language is genetically pre-determined, then we should expect to find similarities among the principles and rules of all the different languages that are or have been spoken by humans. And we do.

In every language there are rules that affect groups of sounds rather than individual sounds, and the same groups of sounds figure in the rules of widely differing languages. For example, consider [b d g]. One of the most basic rules of Spanish phonetics states that these consonants are pronounced much as in English when they are the initial sound of a word and in certain other environments. However, they are pronounced very differently elsewhere, as shown in Table 3. We recall that clusters of consonants in this same class [b d g] are excluded from last position in English words (see Table 2). Thus, this class figures in rules of two such distantly related languages as English and Spanish.

Similarly, the class of consonants [m n l r w y] receives special treatment in the Papago language spoken by Indians native to Arizona, as shown in Table 4.; here those consonants figure in compound nouns, the second element of which is [ʔ o o ʔ o o], meaning "bone." In compounding, as the illustration shows, nouns are simply adjoined. However, adjoining consonants permute position, as in Table 4, when the first noun ends with a consonant from the set [m n l r w y] and the initial consonant of the second noun is a glottal stop [ʔ], a sound that in English we pronounce when we attempt to distinguish an aim from a name. Thus, when wawuk (raccoon) is adjoined to ʔooʔoo, the result is wawukʔooʔoo, but when ban (coyote) is adjoined to ʔooʔoo, the result is not banʔooʔoo but baʔnooʔoo.

The same group [m n l r w y] that figures in the Papago rule of noun compounding plays a role in English; the group is excluded from initial-consonant clusters in English words (see row 2 in Table 2).
Some Special Roles of Consonants in Papago

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>wawuk[&quot;oo&quot;]oo</td>
<td>&quot;racoon bone&quot;</td>
</tr>
<tr>
<td></td>
<td>PjuP]uhig[&quot;oo&quot;]oo</td>
<td>&quot;bird bone&quot;</td>
</tr>
<tr>
<td></td>
<td>mawipjooPloo</td>
<td>&quot;mountain lion bone&quot;</td>
</tr>
<tr>
<td>2</td>
<td>ba[&quot;oo&quot;]oo</td>
<td>&quot;coyote bone&quot;</td>
</tr>
<tr>
<td></td>
<td>kaa[?]woop]oo</td>
<td>&quot;badger bone&quot;</td>
</tr>
<tr>
<td></td>
<td>ceekoP]looP]oo</td>
<td>&quot;squirrel bone&quot;</td>
</tr>
</tbody>
</table>

Table 4. In forming compounds, the Papago language of Indians native to Arizona treats nouns ending with m, n, l, r, w, and y differently (see Table 2) from other nouns (see Table 1). These consonants also figure in the principles of English (Table 2). That the same consonant groups—and few others—are involved in such rules in other languages suggests that to all humans no matter what their linguistic heritage, certain sounds are naturally related and others unrelated.

These examples—and experienced linguists should have little difficulty in extending the list indefinitely—show that identical groups of consonants function in totally unrelated languages. Indeed, the same groupings of sounds reemerge in the rules of language after language whereas other groupings of sounds—e.g., [n b k] or [k r g m]—are never encountered. This observation suggests that to the human speaker there is something natural about certain groupings, of sounds—that they somehow belong together—whereas other groupings are unnatural and therefore never encountered. The judgment as to what sounds naturally belong together probably derives from the design of our nervous system; and that, in turn, is determined by our genetic endowment.

Forming Words From Words

Rules and principles of language are not at all something esoteric that only linguists and other pedants enjoy splitting hairs over. On the contrary, rules are the very stuff of which language is made, and speakers use them with the greatest ease, even abandon. Indeed, the rules and principles that determine the shape of the words in a language make up only a fraction of those regularly mastered by fluent speakers of the language.

To convey some impression of the exuberance with which languages use rules, let me briefly discuss part of the system of plural rules in Kasem, a language spoken by about 80,000 people in West Africa, primarily in Ghana. For the class of nouns shown in Table 5, the singular forms end with the suffix a and the plural forms end with the suffix i. The suffixes appear in this form in row 1 (bakada-bakadi and fala-fali). The same suffixes are involved in the other examples, but their appearance there is masked by the effects of special rules.
The Plural Rules of Kasem

<table>
<thead>
<tr>
<th>Singular</th>
<th>Plural</th>
<th>Singular</th>
<th>Plural</th>
</tr>
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<tbody>
<tr>
<td>1 bakada</td>
<td>bakadi</td>
<td>&quot;boy&quot;</td>
<td>fala</td>
</tr>
<tr>
<td>2 kambia</td>
<td>kambi</td>
<td>&quot;cooking pot&quot;</td>
<td>pia</td>
</tr>
<tr>
<td>3 buga</td>
<td>bui</td>
<td>&quot;river&quot;</td>
<td>diga</td>
</tr>
<tr>
<td>4 mala</td>
<td>male</td>
<td>&quot;chameleon&quot;</td>
<td>kaba</td>
</tr>
<tr>
<td>5 naga</td>
<td>ne</td>
<td>&quot;leg&quot;</td>
<td>la[n]a</td>
</tr>
</tbody>
</table>

Table 5. For one class of nouns in Kasem, a language spoken by about 80,000 people in West Africa, the singular suffix is a and the plural suffix is / (see rows 1 and 2). But an elaborate set of rules obscures this simple state of affairs in many instances (see rows 3, 4, and 5).

For example, Kasem is subject to a rule that deletes the first in a sequence of identical vowels. Because of this Vowel Deletion Rule, the plural forms in row 2 are not kambii and pii, but kambi and pi.

A different rule—the Consonant Deletion Rule—accounts for the forms in row 3. This rule deletes stem-final [g] and [rj] in the plural. Consequently, in place of the expected bugi we get bui, and the plural of diga is not digi but di. The form di is somewhat more complicated than is first apparent. We know that the Consonant Deletion Rule would delete the g in digi, turning it into dii, but that is not the correct form; the correct form is di. There is, of course, no difficulty explaining how di arose: dii was subject to the Vowel Deletion Rule.

In the derivation of di, the two rules were applied in a specific order. If the rules had been applied in the reverse order, the result would have been dii. Since the basic form digi does not contain a sequence of identical vowels it could not be subject to Vowel Deletion. The subsequent application of Consonant Deletion would then produce dii, but to this form Vowel Deletion can no longer apply since this rule has been ordered before (not after) Consonant Deletion.

A further complication arises in the case of mala, chameleon (row 4). The plural form should be malai; instead we find male. To a linguist this is not strange, because linguists know numerous languages where, as a result of the Monophthongization Rule, the diphthong [ai] is replaced by the monophthong [e]. In fact, English spelling still shows traces of this development; the letter sequence ai is pronounced e as in pain, maim, and gain. This process is even more general in Kasem, with not only [ai] becoming [e] but also [au] becoming [o]. Now we are in a position to explain the forms in row 5 of Table 5: they are the result of the interaction of the Consonant Deletion Rule with the Monophthongization Rule. Specifically, the basic plural forms nagi and la[i])fj are transformed by the Consonant Deletion Rule into nai and lai, respectively. They are then turned into ne and le by the Monophthongization Rule.
The fact that Kasem speakers use special rules to generate the plural forms of their nouns should not seem strange in light of what we have said. What may strike the layperson as implausible is the relative complexity of the procedure—outlined only incompletely in Table 6—that appears to be involved in the inflection of Kasem words. We might well wonder whether we really go to all this trouble just to say a few words.

Implicit in this objection is the assumption that humans find it difficult to perform this sort of computation—that it would be easier to memorize such facts as the plural of naga is ne and that of diga is di. than to postulate a single plural suffix i for all nouns in this class and to compute the different outputs according to the rules. The linguistic evidence suggests that the converse is much closer to the truth, for the Kasem example is the norm rather than the exception. Indeed, recourse to computation is so strongly favored over rote memory that speakers apparently do not have the option of foresaking rules for memorization.

Owhay Ancay Ouyay Eadray Isthay?

This natural bent for rules is expressed in a great many special uses of language. Children frequently use secret languages such as Ab-language or pig Latin, both of which are nothing but normal English to which one or two extra rules have been added. The rules for pig Latin, for instance, consist of a permutation that moves the initial consonant cluster from the beginning to the end of the word, to which the diphthong ay is then adjoined. Thus, pig becomes igpay and Latin becomes atinlay. These simple rules produce words so greatly at variance with standard English that children effectively possess a secret language quite impenetrable to their teachers and parents, which is, of course, the main purpose. Though to my knowledge the history of pig Latin has not been documented in detail, we know that it goes back many generations; today's speakers are not its inventors but have learned it from older children.

There are, however, numerous instances of secret languages invented by children. One such "language" was discovered about 20 years ago in Cambridge by Professor Joseph Applegate, then a member of the Department of Modern Languages at M.I.T. A couple living in his building consulted Professor Applegate about their two younger boys who, they feared, were suffering from some neurological disorder. Although they appeared to understand English, the boys were