MORPHEME ALTERNANTS IN LINGUISTIC ANALYSIS

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[See the first paragraph and the last two.]

The purpose of this paper is to suggest a technique for determining the
morphemes of a language, as rigorous as the method used now for finding its
phonemes. The proposed technique differs only in details of arrangement
from the methods used by linguists today. However, these small differences
suffice to simplify the arrangement of grammars.

THE PRESENT TREATMENT OF MORPHEMES

1.0. In essence, the present treatment uses the following criterion: Every
sequence of phonemes which has meaning, and which is not composed of smaller
sequences having meaning, is a morpheme.1 Different sequences of phonemes
constitute different morphemes; occurrences of the same sequence with suffi-
ciently different meanings constitute homonyms.

In some cases, this criterion dissociates certain morphemes which we wish,
because of the grammatical structure, to unite. Various methods are used at
present to get around this contradiction. In cases 1–3 below, different sequences
of phonemes are considered as different forms of the same morpheme. In
cases 4–5, sequences of phonemes are called not morphemes but processes and
the like. In case 6, a special relation is seen between different morphemes.

1.1. Tubatulabal2 /puw/ ‘to irrigate’, /wbuw/ ‘he irrigated’ would have to be
analyzed as containing different morphemes, since the phoneme sequence
/puw/ does not occur in the second word. Similarly, /pala-la/ ‘to arrive’, /a-bala-la/
‘he arrived’; for every morpheme which begins with a voiced stop after a prefix
there is a similar morpheme beginning with the homorganic voiceless stop in
word-initial. In spite of the phonemic difference between the members of each
of these pairs, we wish to consider each pair a single morpheme, since in other
cases we have a single morpheme in the position of both members of these pairs:
/wa?in/ ‘to pour’, /a-wa?in/ ‘he poured’. We say that there is a regular alternation
in the language: a voiced stop is replaced by the homorganic voiceless stop in
word-initial.

/mo?to/ ‘his death’. Since unstressed /aw/ never occurs before a consonant, we
say that it is regularly replaced by /o/.

1.2. We would also have to say that there are different morphemes in knife
and knives. However, the connection between these is too obvious to be disre-

1 L. Bloomfield, Language 161 (New York, 1933).
2 M. Swadesh and C. F. Voegelin, A Problem in Phonological Alternation, LANG. 15.4
(1939).
3 Z. S. Harris, Linguistic Structure of Hebrew, JAOS 61.155 (1941).
garded in the grammar, and the difference occurs also in several other pairs: 

wives, but stream. We therefore create a morphophonemic symbol, say /F/, which represents /v/ before /-z/ 'plural' and /f/ elsewhere, and say that there is but one English morpheme /najF/. Or we give a morphophonemic formula: /i/ is replaced by /v/ before /-z/ 'plural' in the following morphemes —knife, wife, . . . .

The use of morphophonemic statements or symbols is however of little use in the next case, and of no use in cases 4–6.

1.3. By the criterion of §1.0, Heb. 'i'r 'city' and 'a'r'i'm 'cities' contain different morphemes. Since the difference between 'i'r and 'a'r- is not found between other morphemes with identical meanings, it seems awkward to state it in a morphophonemic formula: /i/ is replaced by /a/ in 'i'r before -i'm. Some linguists have called such pairs morpholexical alternants of one morpheme.

1.4. In Greek μένω 'I remain', μεμένηκα 'I have remained', λήω 'I loose', λέλυκα 'I have loosed', the meaning of the reduplication is the same in all cases, but the phonemic sequences vary so much that they are not commonly considered to constitute a single morpheme. Instead, reduplication is often called a morphological process, a special kind of affix, and the like.

1.5. Much the same is true of vowel changes which correlate with meaning changes. They cannot be expressed by morphophonemic formulas, since these formulas state the alternate forms of a single morpheme, whereas take and took are not the same morpheme, having different meanings. Such vowel changes are usually described as special kinds of morphological modification, though they may alternate with additive suffixes like -ed 'past time'.

1.6. There remain cases of morphemes which complement each other but are entirely dissimilar in their phonemic sequences: am, are, is, be, etc. These are considered different morphemes, but with a special mutual relation of suppletion.

Proposed Treatment of Morphemes

2.0. It is proposed here to arrange the morphemes of a language more clearly by carrying out rigorously three linguistic procedures, the first and third of which are in common use today.

2.1. We divide each expression in the given language into the smallest sequences of phonemes which have what we consider the same meaning when they occur in other expressions, or which are left over when all other parts of the expression have been divided off. This is identical with the criterion of §1.0. The resultant minimum parts we call not morphemes, but morpheme alternants.

It is useful to generalize this definition of morpheme alternant by taking sequence to mean not only additive sequence (the addition of phonemes), but also zero (the addition of no phonemes), negative sequence (the dropping of a phoneme), and phonemic component sequence (the addition of a physiological feature of phonemes). In He cut it there is a zero morpheme meaning 'past

4 Ibid. 159.

5 L. Bloomfield, Menomini Morphophonemics, TCLP 8.105 (1939).
time' after cat. In Hidatsa, we have a minus morpheme, consisting of dropping the final vowel mora, with the meaning of command: 6 cixic 'he jumped', cix 'jump!', ika-c 'he looked', ika 'look!'. In took we have two morphemes: take, and /ej/ ~ /u/ 'past time'. The latter occurs also in shook as compared with shake. It is a combination of negative and additive sequences: dropping /ej/ and adding /u/. Another negative-additive morpheme is /a/ ~ /e/ 'plural', which occurs in men as compared with man. Lastly, we have a phonemic component morpheme in to believe, to house, etc., if we wish to divide these words into belief, house, etc. plus a morpheme consisting of voicing the final consonant and having the grammatical meaning 'verb'.

As in the case of ordinary additive morphemes, zero and the others can be recognized only by comparison with other morphemes. Thus in deciding whether to recognize a minus morpheme in Hidatsa we are faced with the following choice: Consider cixic, ika-c, also kikuac 'he set a trap', kiku 'set a trap!'. If we call cix, ika, kiku single morphemes (functioning both as stems and as command), then the morphemes meaning '(he) did' would be ic, 'c, ac, etc. We would have no way of indicating which of these forms occurs after each stem except by listing all the stems. Linguistic procedure chooses the simpler arrangement: it considers the stems to be cizi, ika, kikua, and the suffix always -c. Then the command forms must be analyzed as having two morphemes, the stem plus the dropping of the last mora. 7

Note that at this stage of the analysis every element, here called morpheme alternant, has only one sequence of phonemes: knife and knive- are two separate morpheme alternants.

2.2. From the list of morpheme alternants which results from the preceding step, we take any two or more alternants which have what we consider the same meaning (but different phonemes) and no one of which ever occurs in the same environment as the others. 8 The two or more alternants which meet these conditions are grouped together into a single morpheme unit: am, which occurs only in phrases with I, and are, which never occurs with I, are put into one morpheme unit. In many cases when we take one alternant and try to find another to group with it, we fail: e.g. in the case of walk, rain. In such cases we say that the single alternant constitutes a morpheme unit by itself. A morpheme unit is thus a group of one or more alternants which have the same meaning and complementary distribution. To make these units more similar to our present morphemes, and more serviceable for grammatical structure, we now add a further condition: In units consisting of more than one alternant, the total distribution of all the alternants (i.e. the combined range of environments in which each of them occurs) must equal the range of environments in which some unit with but a single alternant occurs. Thus the combined environments

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7 Cf. Bloomfield, Language 217, where it is shown that the relation between masculine and feminine adjectives in French can be most simply described by regarding the feminine forms as basic.
8 This excludes synonyms, i.e. morphemes of approximately similar meaning, which usually occur in the same positions: a fine youngster, a fine lad.
of am, are, be are included in the environments in which walk occurs: I am, they are, to be, as compared with I walk, they walk, to walk. The case is different with twenty and score, even though they have the same meaning and never occur in the same environment. For there is no morpheme unit in English which consists of only one alternant and which occurs in the combined distribution of twenty and score. Therefore, we consider the alternants am, are, be as being members of a single morpheme unit; but of the alternants twenty and score, each constitutes a morpheme unit by itself.

A few examples of alternants which can be grouped together into units: knife and knive--: knive- occurs only before /-z/ 'plural', knife never does; the sum of the positions in which both occur equals the range of positions in which the single alternant fork occurs.

go and wen--: wen- only before -t 'past', go never; walk occurs in both positions. /-az/ (only after alternants ending in /s, ŋ, ŋ, z, t, j/ but not after all of these), /-s/ (only after alternants ending in the other voiceless phonemes), /-z/ (only after alternants ending in the other voiced phonemes), /-ən/ (after ox), zero (after sheep), /a/ ~ /e/ (with man), etc., meaning 'plural'; the total range of environments equals that of zero 'singular', the suffix -ful, and other single-alternant morpheme units.

/-az, -s, -z/ (all these in the same environments as above), zero (only after the /-az, -s, -z/ alternants of 'plural'), and no more, all meaning 'possessed by' or the like.

/-əd, -t, -d/, zero (after cut), /ej/ ~ /u/ (with take, etc.), and several other alternants, 'past'; no two of these occur after the same alternant, and the combined environments in which they all occur equals the distribution of -s '3d sg. pres.'.

One might ask why it is necessary to perform this step formally, instead of merely recognizing that various suffixes (e.g. -ed) have occasional variant (suppletive) forms like vowel change (e.g. /ej/ ~ /u/), or that reduplication is an affix having special phonemic similarity to its stem. The drawback in the latter method is that it tells both the special form and the morphological status of the affixes at the same time. This makes it difficult to treat these two features separately, to discuss the special forms together with the special forms of other suffixes and stems (i.e. with the other groupings of alternants), and to discuss the morphological status on the same plane as the morphological status of affixes which do not have special forms. In the proposed method, reduplication is described as a group of morpheme alternants, grouped into a unit, between whose members a particular kind of difference exists; the status of these alternants in the morphology is irrelevant here and would be discussed in the section dealing with the relations between morpheme units.

2.3. We now have a list of morpheme units. We take each unit which consists of more than one alternant, and note the difference between its alternants. If we find another morpheme unit having an identical difference between

9 As in a score of voices, but twenty voices. However, we may consider that twenty occurs in the same position as score in a twenty 'a $20 bill'.
its alternants, we can describe both units together. Thus the difference between *knife* and *knife-* , which make up one unit, is identical with the difference between *wife* and *wive-* , which make up another, and with the difference between *leaf* and *leave-* , and so on. Instead of listing both members of each unit, we now list only one representative of each unit with a general statement of the difference which applies to all of them: Each of the units *knife*, *wife*, . . . , has an alternant with /v/ instead of /f/ before /-z/ 'plural'.

In cases like this we can readily see that the units in question have identical relations between their alternants. In other cases it is far more difficult to see that the differences between alternants is identical in various units. For example, in Tubatulabal there are many units whose alternants differ in length of vowel: *ya-yay* ‘to be timid’, after the reduplication morpheme (which means ‘past time’) *-yayay*; *ta-wak* ‘to see’, after reduplication *-dawg*; but *pola-la* ‘to arrive’, after reduplication *pola-la*; the reduplication vowel, too, is short before some morphemes, long before others. Swadesh and Voegelin\(^\text{10}\) showed that a general statement can be made for all these differences in vowel length. They first investigated each morpheme unit to see whether any of its vowels had basic length or basic shortness. A vowel is here said to have basic length if it is long in all the alternants of the unit:\(^\text{11}\) e.g. the second /ə/ in *pola-la*. A vowel has basic shortness if it is short in all the alternants of the unit:\(^\text{12}\) e.g. the second /a/ in *ya-yay*. Vowels which do not have basic length or shortness may be called neutral. Then the general statement is: In every morpheme alternant, counting from the beginning of the word, every odd-numbered vowel which is neutral is long, and every even-numbered vowel which is neutral is short.\(^\text{13}\)

The length of the neutral vowels in each alternant of any particular unit is therefore determined by the number of vowels which precede the alternant within the same word: in *ta-wak* the first neutral vowel of the morpheme is the first vowel of the word, and therefore long; in *a-dawg* the same first neutral vowel of the morpheme is the second vowel of the word, hence short. As a result of this general statement, it is no longer necessary to list the alternants which differ in vowel length.\(^\text{14}\) We merely indicate which vowels of each unit have basic length or shortness.

In the case of some morpheme units, the difference between the alternants is expressed in two or more general statements: e.g. the difference in consonants between *ta-wak* and *-dawg* is expressed in the statement that all morphemes with voiced stops have alternants with voiceless stop when the stop is at word boundary, while the difference in vowel length was expressed above.

\(^{10}\) Lang. 15.5 ff. (1939). The formulation presented here is a restatement, in terms of morpheme alternants, of their morphophonemic analysis.

\(^{11}\) Or if it is always short while each of its neighboring vowels is either always long or always short.

\(^{12}\) Unless it is next to a basically long vowel, in which position even a neutral vowel is always short.

\(^{13}\) But a neutral vowel next to one with basic length is always short.

\(^{14}\) Certain additional general statements involving /?/, etc., must be applied before the statement about vowel length.
THE RESULTANT ANALYSIS

3.0. We can now describe the six cases of §1.1–6 as being all particular instances of one general operation.

3.1. The Tüb. alternants puw and -buw, both 'irrigate', are grouped together into one morpheme unit. For the first alternant occurs only at word initial, the second never; and the total range of positions in which both occur equals that of the single-alternant unit hvd̂a 'to be up (sun)'. Similarly, Heb. máxυt and mos-t', both 'death', are grouped into one unit (compare ró-ς and ro-ς' 'head').

3.2. knife and knive- satisfy the condition for composing one unit.

3.3. Heb. 'i-t and 'a-r- 'city' are grouped into one unit: 'a-r- occurs only before -i-m 'plural', 'i-t never; the combined positions of both equal the positions in which su's 'horse' occurs.

3.4. Greek με, λε, and other reduplication prefixes, meaning 'perfect aspect', are alternants of one morpheme unit: με occurs only before morphemes beginning with /m/, λε only before those beginning with /l/, and so on (with other alternants before special types of morphemes); the combined range of environments of all these alternates equals the range of the ε- verb prefix (augment). A similar case is that of the echo words in languages of India. Thus, in Kota,15 puğ is 'tiger', puğ-qi is 'any tiger'; kaln is 'thief', kaln-qi is 'some thief'. qi, qiln, and the other echo words have the same meaning; qi occurs only after morphemes of the form CVJ, qiln only after morphemes of the form CVhJ, and so on. The combined range of positions of all these echo words occurring with qi is equal to the range of any single alternant which occurs as second member in compounds and which (unlike the echo words) is not restricted to particular first members. We therefore group all these echo words into one morpheme unit with the meaning 'any, some, and the like', and say that the general form of the unit is qiX, where X is whatever follows the initial CV of the first member of the compound.

3.5. The form took is divided into take plus /ej/ ~ /u/; /ej/ ~ /u/ is an alternant which is grouped with /d/ and other alternants into a morpheme unit meaning 'past time', since they all satisfy the conditions for such grouping.

3.6. The forms am, are, be, i- (before /a/ '3d sg. pres.'), -as, -ere (both after w-, which is an alternant grouped with /d/ 'past time') are all grouped into one morpheme unit.

4.0. It is not enough to show that all such relations between alternants are special cases of one relation, namely that between the alternants of one morpheme unit. For there are differences between these cases, and we must see if it is possible to arrange these differences systematically as subdivisions of the operation of grouping alternants into units. It appears that we can record these differences in a simple manner if each time we group alternants into one unit we answer four questions: 1. What is the difference between the alternants of this unit? 2. In what environments does each alternant occur? 3. What

15 M. B. Emeneau, An Echo-Word Motif in Dravidian Folk Tales, JAOS 58.553–70 (1938); Echo Words in Toda, New Indian Antiquary 1.109–17 (1938).
similarity is there, if any, between the alternant and the environment? What morpheme units have this difference between their alternants?

4.1. The difference between the alternants. In some morpheme units the alternants are the same except for one or two phonemes: e.g. the cases in §3.1–3. In other units there are many alternants, all (or most) having some phonemic structure in common: e.g. the reduplication alternants in §3.4 have the form Ce. In both cases we say that the alternants differ in only part of their phonemic sequence. In other units, however, such as in §3.5–6, the alternants differ entirely.

4.2. The environment in which each alternant occurs. When a morpheme unit occurs in a given context, the alternant which appears there is determined by the environment of neighboring alternants. Each alternant of that unit occurs only in the neighborhood of particular other alternants; and often, if we investigate each of the morphemes in whose neighborhood the given alternant occurs, we will find that there is a common feature to all of them.

However, we will find that it is not enough to say that there is a common feature to all the environments in which a particular alternant occurs. It is not enough to say that all the environments in which /-az/ ‘plural’ occurs have a common feature, namely that they all end in a sibilant or affricate. For while it is true that every time we have /-az/ we find before it a morpheme ending in /s, ŋ, č, z, ž, j/, e.g. fox, foxes, the statement seems to be false when we consider ox, ozen. Since ox ends in /s/ we might have expected the /-az/ alternant to occur after it. The catch lies in this: that every time /-az/ occurs it has a morpheme ending in a sibilant or affricate before it, but not every morpheme ending in a sibilant or affricate has the /-az/ alternant after it. After we have counted all the morphemes before /-az/—and all of them end in /s, ŋ, č, z, ž, j/—we have left over one or two morphemes which end in sibilants without having /-az/ after them. We therefore say that /-az/ occurs only after morphemes ending in /s, ŋ, č, z, ž, j/ but not after all of them. The case is different with the Hebrew alternant mawt. This alternant occurs only with main stress; that is, whenever we find mawt, we find the stress on it. The other alternant, mot, occurs only before the stress. Here we can turn the statement around, as we could not in the case of /-az/. We can say that whenever the stress is on the unit mawt, the alternant which appears is mawt, and whenever the environment is stressed after the unit, the alternant which appears is mot. After we have counted all the unstressed occurrences, where the alternant is mot, we have no unstressed occurrences left over where the alternant is something else. We therefore say that mot occurs only in unstressed environments and in all unstressed environments. The difference between these two cases is seen again in the Menomini e,18 which is an alternant of the morpheme juncture /-. In most cases, when a Menomini morpheme follows another within one word, there is no extra sound between them, and we may mark the junction between them with a hyphen. However, every time the first morpheme ends in C and the second begins in C, we find an e between the two morphemes, appearing, we might say, in place of the hyphen. This e also occurs between certain morphemes ending in V and certain ones beginning in /w/. As in the cases of

18 Bloomfield, TCLP 8.105-15 no. 10-2.
/-œz/ and mor, we must distinguish the two environments: the first is any morphemes ending and beginning in C; the second is certain particular morphemes ending in V and beginning in /w/. Hence we say that the alternant e for /-/ (morpheme juncture) occurs in all environments of the form ...C-C..., and in certain environments of the form ...V-w.... 

A special case of environments which consist of a phonemic feature is that of junctures (boundaries of words, etc.). Some alternants occur only at word boundary and at any word boundary: e.g. Tüb. ta\textsc{\textasciitilde}\textsc{\textasciitilde}\textsc{\textasciitilde}\textsc{\textasciitilde} as compared with -\textsc{dawg}-.\textsuperscript{17}

In some morpheme units, what is common to all the environments in which a particular alternant occurs is the presence of a morpheme from a particular grammatical class. Thus, the contraction which occurs in Menomini\textsuperscript{18} between certain morphemes ending in Vw and others beginning in /e/, occurs between all such morphemes if the first is a verb stem and the second an inflectional suffix.

In other units, a given alternant appears only next to particular morpheme units (knife—only before /-z/ ‘plural’, am only with I), or only next to particular morpheme alternants (zero alternant of ‘possessed by’ only after the /-s, -z, -ez/ alternants of ‘plural’).

A special problem of morpheme division may be mentioned here. In some cases, not only does a morpheme unit have a unique alternant which occurs only when it is next to a particular second unit, but the second unit also has a unique alternant when it adjoins the first; e.g. children, if it is divided into /čild/, alternant of /tajld/ only before -ren, and -ren, alternant of /-z/ ‘plural’ only after child. Such situations often result from vowel contraction; e.g. Menomini morpheme units ending in /\textsc{\textasciitilde}e/\textsuperscript{19} have alternants with /y/ (instead of /\textsc{\textasciitilde}e/) before morpheme units beginning with /o/; and units beginning with /o/ have alternants with /ā/ (instead of /o/) after units ending in /\textsc{\textasciitilde}e/: instead of having the sequence /...\textsc{\textasciitilde}e-o.../ we have /...y-ā.../. Each morpheme functions as the environment which determines the alternant of the other. In such cases it is sometimes hard to decide where to put the division between the two alternants. Thus children could alternatively be divided into /čildr/ and -en; from the point of view of grammatical arrangement each of the two points of division has advantages and disadvantages. In another Menomini contraction,\textsuperscript{20} the sequence of certain morpheme units ending in /aw/ followed by certain other units beginning in /e/ has not /...aw-e.../ but /...ē.../. We could

\textsuperscript{17} What is called external sandhi, therefore, differs from internal sandhi merely in that the former contains statements which have word juncture as a necessary part of their determining environments, while the latter does not. In some languages, alternants next to word juncture may differ so much from those which are not, and differences determined by word juncture may have so many features in common, that it becomes convenient to arrange all statements involving word juncture environments together. In other languages, however, where many statements apply to environments both within words and across word juncture, it is simpler not to distinguish external from internal sandhi.

\textsuperscript{18} Bloomfield, TCLP 8.105-15 no. 18.

\textsuperscript{19} Ibid. no. 15.

\textsuperscript{20} Ibid. no. 18.
say that the unit ending in /aw/ had an alternant ending in /ə/, and the one beginning in /e/ had an alternant without the /e/; or we could divide differently. The choice is immaterial here, and can be decided only by seeing which division would be more similar to the division of other morpheme sequences.

4.3. Similarity between the alternant and its environment. In many morpheme units there is no recognizable similarity between the alternants and the environments in which they occur; e.g. between am and I, between i- (alternant of am) and /-ə/ '3d sg. pres.', between /ej/ ~ /u/ and take. In some cases, however, there is identity in phonemic feature (partial assimilation) or in phonemes (repetition or total assimilation); e.g. /-s/ 'plural' occurs only after alternants ending in voiceless phonemes and is identically voiceless with the phoneme preceding it, while the voiced alternant /-ə/ occurs only after voiced phonemes. Identity in whole phonemes is rarer: the consonant of the Greek reduplication, and the X of the Kota qiX.

4.4. Morpheme units in which the difference occurs. Some differences between the alternants of a morpheme unit occur in all the units of that language which have the particular phoneme involved in the difference; e.g. the difference between alternants with voiced and with voiceless stops occurs in all Tübatalabal units, if they but have a voiced stop at either end. Other differences occur in many units, but not in all; e.g. the difference between alternants ending in /t/ and in /v/ occurs in wife, life, etc., but not in fife. Still other differences appear only in one unit; e.g. the differences between the alternants in §3.3, 6.

5.0. To sum up: The difference between alternants of a unit may be partial or complete. It may occur in all units which have a stated feature (e.g. a given phoneme in a certain position), or in some units having a stated feature in common, or in a unique unit (or in several units which have no stated feature in common). The range of environments which determine the appearance of the alternant in question may consist of all morphemes which have a stated feature, or of only some of the morphemes having that feature, or of a unique morpheme (or of several morphemes having no common feature).

It now becomes a simple matter to recognize wherein one grouping of alternants into a unit differs from another (see §4.0).

5.1. If the difference between alternants of a unit is complete, it necessarily applies only to one unit.21 If the difference is partial, it may occur in one, some, or all units which have a stated feature.

5.2. If there is a phonemic or morphologic feature which is present only in the units in which the difference under discussion occurs (and in no other units), then we may name the feature in a general statement and there is no need to list the units in which the difference occurs: all Hebrew morphemes with /aw/ had alternants with /ə/. On the other hand, if there is a feature which is common to all the units in which the difference under discussion occurs, but which is also present in other units (in which this difference does not occur),

21 E.g. the complete difference between go and wen- exists only between these two sequences of phonemes, hence (barring homonyms) only in this particular unit. However, the partial difference between knife and kni- can occur between any two sequences of phonemes that contain /f/ and /v/.
then we may either list all the units, or else make a mark upon their common
feature to distinguish these units from the other units in which the difference
does not occur: see *knife* in §5.4.

But if the unit in which the difference occurs is unique, or if there are several
units which have no common feature, then we must list all of them.

5.3. The method of describing the environment in which an alternant occurs
is similar to the method of describing the units in which the difference occurs.

If whenever a certain feature is present in the environment only a given
alternant (and no other one of its own unit) occurs, i.e. if the given alternant is
the only one of its unit to occur when that feature is present in the environment,
then we name the feature in a general statement and there is no need to list all
the environments in which the given alternant occurs: Hebrew units with */aw/
always had alternants with */or/ when the unit was unstressed. Similarly, if a
certain feature is always present in the environment when a given alternant
appears, but if some other alternants of the same unit also have that feature in
their environment, then we may either list all the specific environments in
which the given alternant appears, or else mark these environments to distin-
guish them from other environments which have the same feature: */ej/ ~/u/
alternant of *-ed* ‘past time’ appears only with morphemes having the struc-
ture *CejC*, but not all morphemes *CejC* are followed by the */ej/ ~/u/ alternant,
since *rake* and other morphemes of this structure are followed by the *-ed*
alternant.

If the environment in which the alternant occurs is unique, or if there are sev-
eral environment morphemes which have not common feature, then we must
list all of them.

5.4. A few examples:

Early Hebrew: All units having */aw/ have alternants with */or/ instead, when
any stressed morpheme follows within the word. (Both the units and the en-
vvironments to which this applies include all which have the features
stated here.)

Menomini: 22 Some units ending in */n/ have alternants ending in */s/ instead,
before all morphemes beginning with */e/. (The units involved here are only
some of those having the stated feature */n/ . Therefore they must be listed or
marked. Bloomfield writes the units which do not have the */s/ alternant with
N, and those which have the */s/ alternant with n, thus distinguishing the two
groups.)

Kota: The unit for ‘any, some, and the like’ has alternants of the form *giX*
after any morpheme CVX. (The unit is unique; the environment is any unit
having the stated feature.)

English: Some units ending in */f/ have alternants ending in */v/ instead,
before */-z/ ‘plural’. (We may write all these units with F: */najF/, but */fajf/.
The environment, being unique, need not be specially marked.)

The unit */cjl/ has the alternant */cld/ before *-ren ‘plural’.

The unit *-ed* ‘past time’ has the alternant */ej/ ~/u/ with some units of the

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22 Bloomfield, TCLP 8.105-15 no. 13.
form CejC. (Note that here it is the environmental morphemes that have to be listed or marked.)

The unit /-z/ 'plural' has the alternant /-s/ after most morphemes which end in a voiceless phoneme, and in no other environments. (The unit is unique. The environments have to be listed or marked. However, since the cases where an alternant other than /-s/ occurs after the stated feature are relatively rare, it is simpler to list the cases where /-s/ does not occur. They may be listed in connection with the alternants with which they occur; i.e. we list the alternants of 'plural': /-az/ after /s, ñ,.../, -en after ox, ... /-s/ after the other morphemes ending in a voiceless phoneme.)

5.5. Statements made for unique alternants are best included in the dictionary rather than the grammar. Units referred to in general statements are written with one base form representing all the alternants and containing any special marks which the general statement may require. By applying to the base form all the general statements which refer to it we obtain the alternants which occur in the environments named in the general statements.

CONCLUSION

Possible advantages of the method described here are:

6.1. It prescribes three explicit procedures which, if rigorously followed, will lead to a unique arrangement of the phenomena described here for a particular language.

6.2. It presents regular phonology, morphophonemies, sandhi, morphological processes like vowel change, morpholexical variation, suppletion, and the like as cases of a single linguistic relation, described in §2.2. The differences between these cases are systematized in §§4 and 5.

6.3. It leaves not merely less, but a simpler morphology. This is necessarily so, because the procedure of §2.2 (especially the condition concerning the total range of environment) removes from consideration as a separate morpheme unit any alternant which has a more specialized distribution than the rest of its class and which is complementary to other over-specialized alternants. The morphology describes the relations between morpheme units, all those in a given class now having roughly the same distribution.

6.4. It simplifies our general picture of linguistic structure, i.e. of what relations can be discovered between the elements of linguistic expressions. For it shows that we can arrange alternants into units in exactly the same manner as we arrange sound types (positional variants) into phonemes.

7.1. SUMMARY: The method of arranging the morphemes of a language consists of three steps: 1. dividing each phonemically written linguistic expression into the smallest parts which recur with the same meaning in different expressions, each such part to be called a morpheme alternant; 2. grouping into a distinct morpheme unit all alternants which satisfy the following conditions: (a) have the same meaning (b) never occur in identical environments, and (c)
have combined environments no greater than the environments of some single alternant in the language; 3. making general statements for all units which have identical difference between their alternants.

7.2. Every statement, general or particular, about the alternants must contain three pieces of information: (a) what is the difference between the alternants; (b) in what environments does each alternant occur; (c) in what units does the difference occur. It is seen that various groupings of alternants into units differ on these three counts.