

## AUTOMATIC ALTERNATION

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**1. Introductory.**<sup>1</sup> When the utterances of a language have been analyzed into their smallest meaningful units, the morphemes, a number of these morphemes in most languages have more than one morpheme alternant.<sup>2</sup> Insofar as these alternants are sequences of phonemes<sup>3</sup> (in which case we call them morphs<sup>4</sup>), the phonemic differences among all the different morphs belonging to one phoneme can be described, classified, and compared with the differences among morphs of other morphemes, considered morpheme by morpheme. The total class of these differences so described, classified, and compared is called

<sup>1</sup> This paper is a radical revision, and adaptation to languages in general, of a paper on Korean morphophonemics written in June 1946 and based on data gathered by myself. I am obliged to C. F. Voegelin, C. F. Hockett, and Bernard Bloch for comments on the earlier paper, and further to Hockett for sending me an abrége of a talk on automatic morphophonemics delivered by him at the Linguistic Institute in Ann Arbor, in August 1947. I desire to express my gratitude to the American Council of Learned Societies, by a grant from whom I was aided in 1946.

The books and papers referred to are the following; they are cited in the text by author's name only unless more than one paper by the same author is here listed: Jan Baudouin de Courtenay, *Versuch einer Theorie der phonetischen Alternationen* (1895); B. Bloch, *English verb inflection*, Lg. 23.399-418 (1947); L. Bloomfield, *Language* (1933); L. Bloomfield, *Menomini morphophonemics*, TCLP 8.105-15 (1939); M. B. Emeneau, *Kota texts*, Part I (1944); H. Grassmann, *Wörterbuch zum Rig-Veda* (1873); Z. S. Harris, *Morpheme alternants in linguistic analysis*, Lg. 18.169-80 (1942); Z. S. Harris, *Yokuts structure and Newman's Grammar*, IJAL 10.196-211 (1944); Z. S. Harris, *Review of Emeneau's Kota texts*, Part I, Lg. 21.283-9 (1945); C. F. Hockett, *Review of Nida's Morphology*, Lg. 23.273-85 (1947); C. F. Hockett, *Problems of morphemic analysis*, Lg. 23.321-43 (1947); H. M. Hoenigswald, *Internal reconstruction*, *Studies in Linguistics* 2.78-87 (1944); H. M. Hoenigswald, *Sound change and linguistic structure*, Lg. 22.138-43 (1946); A. A. Macdonell, *Vedic grammar* (1910); T. H. Maurer, *Unity of the Indo-European ablaut system*, Lg. 23.1-22 (1947); E. A. Nida, *Morphology: The descriptive analysis of words* (1946); E. Sapir, *Southern Paiute: A Shoshonean language*, *Texts of the Kaibab Paiutes and Uintah Utes*, *Southern Paiute dictionary* (*Proc. Am. Ac. of Arts and Sciences*, Vol. 65, Nos. 1-3, 1930-1); E. Sapir and M. Swadesh, *Nootka texts* (1938); H. W. Smyth, *A Greek grammar for colleges* (1920); M. Swadesh and C. F. Voegelin, *A problem in phonological alternation*, Lg. 15.1-10 (1939); G. L. Trager, *A theoretical basis for descriptive phonology* (unpublished lecture delivered at Yale University 11 November 1940); G. L. Trager, *An outline of Taos grammar*, *Linguistic structures of native America* 184-221 (1946); N. Trubetzkoy, *Grundzüge der Phonologie* (1939); J. Wackernagel, *Altindische Grammatik I* (1896); R. S. Wells, *Immediate constituents*, Lg. 23.81-117 (1947); W. D. Whitney, *Sanskrit Grammar* (2nd. ed. 1889).

This list is not and does not aim to be a complete bibliography of all significant contributions either to the theory or to the practice of morphophonemic analysis.

<sup>2</sup> Harris, *Morpheme alternants*; Hockett, *Problems*.

<sup>3</sup> Rather than processes, or some combination of phoneme-sequence and process. An example in Bloch 400-1 and fn. 6; another in Bloomfield, *Language* 214, par. 4, lines 1-2.

<sup>4</sup> Using Hockett's term, but in a sense equivalent to his 'primary morph' (*Problems* 340, par. 3).

the MORPHOPHONEMICS<sup>5</sup> of the language in question, and any two morphs of the same morpheme are said to stand in a relation of (morphophonemic) ALTERNATION with each other.<sup>6</sup> The most common symbol for alternation is  $\sim$ . Alternations may be reduced to their lowest phonemic terms; thus (Bloch 416, Type VIII) the alternation  $duw \sim di$  ( $do \sim di-d$ ) may be reduced to  $uw \sim i$ .<sup>6a</sup> Sometimes, as in this example, the reduction can be effected in more than one way; we could reduce the alternation to two phonemic alternations:  $u \sim i$  and  $w \sim zero$  (cf. Bloch 414, par. 3). In this case, and perhaps always, the difference between alternative ways is trivial.

In any given utterance, a morpheme may be regarded as a focus embedded in a matrix or environment,<sup>7</sup> and the morph which represents it there may be thought of in the same way. Both focus and environment may be thought of as phoneme-sequences, as morpheme-sequences, or in various other ways; thus by the environment of a given occurrence<sup>8</sup> of a given morpheme we may mean the other morphemes adjacent to it (regardless of the phonemic shape of the alternants which occur there), or we may mean some grammatical class of morphemes (e.g. verbs), or we may mean the specific phonemic shapes of the surrounding morphemes. For instance, we may say that the morpheme-sequence *he will not ...* occurs in the environment of any verb—*he will not come*, etc.; we may say that in the sentence *he will not arrive* the environment of *he will not* is the morpheme *arrive*, regardless of the grammar or the phonemic shape of this morpheme; or we may say that in this same sentence this same sequence *he will not*, consider as a phoneme-sequence, occurs immediately before the unstressed vowel  $\text{ə}$ . Another kind of environment is speech-tempo; for example, Korean *cikkim* 'now,' a *lento*-form, occurs in *allegro tempo* in the form *cikim*.

One task of linguistics is to observe and state the distribution of morphs in terms of their environments—phonemic environments, morphemic environments, etc., whichever proves most feasible. '[When] the distribution of the ... alternants is regulated according to a linguistically recognizable characteristic of the accompanying forms, we say that the alternation is REGULAR. [When] ... the deciding characteristic of the accompanying forms is phonemic ... , we say that the alternation is AUTOMATIC.'<sup>9</sup> To paraphrase: given that a morpheme

<sup>5</sup> Which is only a part of a more general class of facts, the facts about the phonemic shapes of morphs in general in the language in question. Hockett's notion of canonical forms (Problems §16; cf. his fn. 28, citing discussions of the notion by B. L. Whorf) is a contribution to the study of such facts.

<sup>6</sup> Sometimes (e.g. Trager, Lecture §2, §2.1) a morph is said to stand in invariant alternation with itself, especially if it is the sole alternant of a morpheme, and more especially if this morpheme is being compared with other morphemes that have more than one alternant. This manner of speaking is a perfectly admissible alternative to ours.

<sup>6a</sup> Phonemic symbols are printed in roman type, without slant lines or other distinguishing marks.

<sup>7</sup> Wells §11.

<sup>8</sup> Wells §33.

<sup>9</sup> Bloomfield, *Language* 211. An example of a non-automatic but regular alternation is the Sanskrit lengthening of root-final *i* and *u* to  $\bar{i}$  and  $\bar{u}$  before various suffixes and endings beginning with  $y$ : Whitney §245a, §770a; Wackernagel §41. Here the conditioning factor is a combination of phonemics and morphology: the lengthening is conditioned mainly by

has, say, two alternants A and B, their alternation is automatic if the environments in which A occurs, and those in which B occurs, can each be characterized in purely phonemic terms.

It does not follow that from the knowledge of morph A we could predict the phonemic shape of morph B AND CONVERSELY. In general, one of two automatically alternating morphs is predictable from the other but not the other from the one, a situation illustrated by Bloomfield's familiar example (*Language* 218-9) from German: the morpheme for 'round' has the alternants *runt* before pause, voiceless consonants, and glottal stop, and *rund* elsewhere; whereas the morpheme for 'motley' has *bunt* in both classes of environments. In view of these facts, *rund* may be labeled as the BASIC ALTERNANT and *runt* as DERIVATIVE (op.cit. 212). (We shall symbolize: *rund* > *runt*; or *d* > *t*.<sup>10</sup>) Our reason is, to speak more picturesquely than accurately, that knowing the existence of *rund* we could predict the morpheme *runt* as the one that would occur before pause etc., whereas knowing only the existence of *runt* we could not, in view of the behavior of *bunt*, predict whether it would be *runt* again or *rund* that would appear before vowels etc.

**2. Aims and theses of this article.** One main purpose of this paper is to replace picturesqueness by accuracy, and to formulate precise and meticulous concepts of automatic alternation. The major points are these:

(a) Two radically distinct conceptions, and a compromise between them, are formulated, both of which satisfy Bloomfield's definition of automatic, and each of which has its recommendations. We label them the static and the dynamic conceptions. Then each of these may be taken either 'widely' or 'narrowly,' yielding in all four conceptions to be reckoned with (or six, counting the compromises). They lead to different results in theory and in practice.

(b) The problem of defining automatic alternations is distinct from the problem of devising a notation to record them, and also from the problem of producing the most efficient body of statements from which all the automatic alternations can be deduced.

(c) There are two particularly complex cases that an adequate definition must provide for: (i) the case of an alternant that exhibits two or more alternations at once; (ii) the case of two (usually adjacent) morphemes that condition each other's alternants.

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morphs beginning in *y*, and of these mainly by those whose morphemes are characterizable in terms of their morpheme classes (Wells §2).

Bloomfield (*Men. morph.* §3), followed by Emeneau 19 fn. 3, speaks of 'morpholexical variations'. The distinction between morpholexical and morphophonemic alternations, as also any fundamental distinction between internal and external sandhi, is given up by Harris, *Morpheme alternants* §1.3 and §6.2, and *Review of Emeneau* 285-6.

Other definitions of automatic: Emeneau §5; Hockett, *Problems* 327 fn. 19.

<sup>10</sup> This symbolism will be used for any alternation, even irregular, in which the first-mentioned morph or phoneme-sequence is taken as basic to the second-mentioned. The basic alternant need not—cf. Bloomfield, *Language* 219 top, Emeneau §6—be one that occurs in zero environment (on this term cf. Wells 100 fn. 34; Hockett, *Problems* §20), or that is more pronounceable in isolation (cf. Bloomfield, *Language* §12.4), or—contra Bloomfield *Language* 164 par. 2—that occurs more frequently or in more environments.

**3. An unsatisfactory definition.** In §9, a rigorous definition of wide static automatic alternation will be presented. By way of leading up to this definition, we shall first state an unsatisfactory definition and then, by pointing out its defects, indicate some requirements that a satisfactory definition must meet.

In the light of §1, the following definition might have some initial plausibility: 'When, by the placing of a morpheme in a certain phonemic environment, a phonemically non-occurrent sequence would arise, an alternation or change in this sequence is called automatic if it yields a phonemically occurring sequence.' Four serious faults in this definition will now be discussed.

**4. First fault.** This definition speaks in terms of changes. But Bloomfield has pointed out (Language 213) that 'the descriptive order of grammatical features is a fiction ...; it goes without saying, for instance, that the speaker who says *knives*, does not "first" replace [f] by [v] and "then" add [-z], but merely utters a form (*knives*) which in certain features resembles and in certain features differs from a certain other form (namely, *knife*).'<sup>11</sup> Now if the reference to time is fictive and metaphorical, it is avoidable; and the account of alternation about to be given avoids it. All that is necessary is to state the morphs of each morpheme and the respective environments in which they occur.

**5. Second fault.** 'No consonant except n, r, or s ... can stand at the end of a Greek word. All other consonants are dropped.'<sup>12</sup> Examples: *gála* (nom. sing.) ~ *gálakt-os* (gen. sing.) 'milk'; *stóma* ~ *stómat-os* 'mouth'. But suppose that whereas the nominative singular of *gálakt* was *gála*, that of *stómat* was *stómato*? This situation would still conform to the definition formulated in §3. This shows that the definition omitted to make any stipulation of UNIFORMITY. We would be willing to regard *gálakt* and *stómat* as basic to automatic alternations if (a) their nominative singulars were *gála* and *stóma*, or (b) if they were *gálakto* and *stómato*, or (c) if they were both different from their basic alternants in any other way, provided that that way was the same or comparable in both cases and all other essentially similar ones; but not otherwise.<sup>12a</sup>

This Greek example brings out another point. Word-final *t*, *kt*, etc. do not occur. But what will occur in their place? Our straw-man definition is further misleading if it suggests that an automatic alternation is predictable, given only the distribution of all the phonemes of the language. The generalization that in word-final position 'all other consonants are dropped' makes detailed predictions possible, but is not itself predictable. For what we saw in a single example is true in general, viz. that there will be possible more than one alternation that

<sup>11</sup> Similarly Harris, Yokuts §4; Hockett, Review 282.

<sup>12</sup> Smyth §133. Instead of speaking in morphological terms ('word-final'), it will be safer to limit our attention to the phonemic (as well as morphological) environment of position immediately before pause.

<sup>12a</sup> Any historical (diachronic) validity for these and all other forms discussed in this article is expressly disclaimed (cf. §14). For instance, a synchronic description of ancient Greek would unquestionably take *stómat* as the basic morph of 'mouth' (cf. Smyth §133b, §244, §258), even though historically we see in *-mat* a 'formative' combined in pre-Greek times from the formatives *men* ~ *mḡ* and *t* (cf. Brugmann, Gdr.<sup>2</sup> 2.1.237 §166).

To avoid a cumbersome notation, I do not attach an asterisk to unattested forms. The context will sufficiently indicate for each form whether it is alleged to be attested or only conjectured or imagined.

will satisfy the requirement of uniformity. *Gálakt* and *stómat* might both lose their final consonants; they might both add *o*; they might both replace their final consonants by *r*: *gálar*, *stómar*; etc.

**6. Third fault.** In not requiring uniformity, the definition of §3 is too lax; in another respect it is needlessly stringent. If uniformity is duly insured it does not matter whether the 'avoided' phoneme sequence is non-occurrent in the language or not. It could occur, but not at a morpheme boundary. A perfect actual example has not come to the writer's notice, but some close enough approximations have been encountered<sup>13</sup> to make the possibility worth discussing. In Sanskrit, *as* + *n* yields *on* (generally transcribed *o n* with a space to indicate word division), and *ās* + *n* yields *ān* (Whitney §175, §177); yet the phoneme sequences written *asn*, *āsn* occur. Only, when they occur there is no morpheme boundary between the *s* and the *n*.<sup>14</sup> For instance, the following words contain the suffixes *snu*, *sna* (Whitney §§1194–5): *vadhasnu* 'wielding a deadly weapon', *sthāsnu* 'fixed', *karasna* 'forearm'. The sequence *sn* is then what Trubetzkoy (256) calls a negative Grenzsignal: a sign that there is no morpheme boundary within it.

Would we, in this case, say that the alternations *as* > *o*, *ās* > *ā* before *n* are automatic in Sanskrit? The affirmative answer will be an instance of what we shall call the WIDE static conception, the negative an instance of the NARROW static conception. It is not incumbent upon us here to choose between these conceptions, but only to mark their difference. They will be exactly defined in §10.

**7. Fourth fault.** The following and a number of other English pairs exhibit an alternation which one would like to regard as automatic:<sup>15</sup> *disastr-ous* > *disaster*, *ancestr-y* > *ancestor*, *angr-y* > *anger*, *nobl-er* > *noble*. The alternation, reduced to its lowest terms, is between phonemic zero and ə before the final phoneme of the basic and the derivative morphs. But a difficulty is presented by some other pairs, for instance *theatr-ical* > *theater* (θijætr > θijətər),<sup>16</sup> whose

<sup>13</sup> E.g. the Latin example of §13.

<sup>14</sup> Search in grammars has turned up at least one exception: *trasnu* 'fearful' (root *tras* plus suffix *nu*, Whitney §1162b). In any event, although in general the juxtaposition of *as*, *ās* and *n* is one that occurs only in external sandhi (not stated in Whitney, but implied §§110, 117c, 166, 175a–c), the general pattern of the language indicates that this is an accident, which is due mainly to the rarity of inflectional and suffixal morphemes beginning with *n*; the pattern also warrants the prediction that if *as* + *n* had occurred in internal sandhi, the result would have been simply *asn*. (The actual form *trasnu* bears out this prediction.) Quite apart from the actual known exception, then, the imperfection of the example is that it exploits a non-occurrence which may fairly be regarded as quite accidental.

<sup>15</sup> Namely, before pause and before consonant, only the derivative alternants appear.

<sup>16</sup> If, as in Wells §§66–78, the stress be regarded as a separate morpheme, its different placement in θijætr and θijətər is not another difference in the morphs of *theater*. (Similarly in *cylindr-ical* ~ *cylinder*.) The placement of the stress—that is, the fact that it coincides with one syllabic rather than another, in morphs that contain more than one syllabic—is a fact on the morph 'level', i.e. a fact about the order-relations of morphs as such. These relations cannot all be reduced to the relations of preceding and following, nor even to these two and simultaneity, because in both θijætr and θijətər the stress morph is simultaneous with the morph that is made up of vowels and consonants. Whether on the morpheme 'level' ('tactics': Hockett, Review 274 bottom) a similar complexity is required, is a problem which we have no occasion to go into here; cf. Wells 109 fn. 47 and §§71, 84, 88.

alternation is not completely parallel and which therefore spoils that perfect uniformity that was required in §5. However, the solution to the difficulty is simple: we need only recognize that *theatr* > *theater* exhibits, simultaneously, two independent alternations—both of them capable, as it happens, of being considered automatic: (a) æ > ə in unstressed position, and (b) *zero* > ə before prepausal or preconsonantal r, l.

There is a morpheme common to *analysis* and *analyst* and *analyze*, no morph of which is basic as a whole. Suppose that we see in *anal-ize* and *anal-yst* the same suffixes as in *theor-ize*, *theor-ist*, and accordingly interpret *analysis* as *anal-ysis*. The result will be two morphs ænəl and ənəl. They exhibit the same alternation twice; it is alternation (a) above. But in its first instance the basic æ is contained in the one morph, ænəl, and in its other instance it is contained in the other, ənəl. So we cannot say that either one as a whole is basic. Similarly, neither læθərj (as in *lethargy*) nor læθərj (as in *lethargic*) is basic as a whole.

**8. Communis and propria.** A technique enabling us to deal with such simultaneous alternations consists (a) in reducing them to their lowest terms, as we have been doing all along, and (b) stating the positions of the phonemic alternants. In the Sanskrit alternation *vāc* ~ *vāk* ~ *vāg* 'voice' there is a stable, unchanging part which we shall call the (pars) COMMUNIS and three different parts, *c*, *k*, and *g*, each of which we shall call the (pars) PROPRIA of its respective morph. Part (a) of the technique, then, is to separate the communis from the propriae. Part (b) is to state where, relatively to the communis, each propria occurs; for instance, that *g* immediately follows *vā* to produce *vāg*, rather than being prefixed to produce *gvā* or interpolated to produce *vgā*. Task (b) is simplest when both communis and propria are continuous phoneme sequences (including, of course, as a special case, single phonemes) of which the one either immediately precedes or immediately follows the other. One propria may be zero, as in *gāla* (compared with *gālakṭ*). When the communis is zero, we speak of complete suppletion; for example (Bloch 416, Type VII), between the alternants *goh go-ne* and *went went* of the verb *go* there is no phoneme in common. Between *goh* and the third alternant *gow go* there is the communis *go*, and between *gow* and *went* there is the communis *w* (to which the propriae are differently disposed: *go* precedes, but *ent* follows); but in these latter instances it seems that no purpose of theory or practice will be served by the isolation of communis and propria. It is not necessary, though, to alter the definition of communis and propria so as to exclude such analyses, because it is easy to simply ignore them and make no use of them.<sup>17</sup>

When communis or propria or both are discontinuous, task (b) is more complicated. In *θijætr* and *θijætər* the communis is *θij...t...r* and the respective propriae are *æ...zero* and *ə...ə*. The dot notation is tantamount to a statement as to the manner (in this instance, interlocking rather than simple preceding or following or interpolation) in which the propriae are disposed to the communis. In Sanskrit *yunaj* ~ *yun̄j* ~ *yuj* 'join', the communis is discontinuous in the

<sup>17</sup> A similar treatment could be developed for 'components' of phonemes; cf. Hockett, *Problems* 335, par. 3.

first two alternants, continuous in the third; one might use the notation *yu(...)**j* to symbolize the alternation between continuity and discontinuity.

A still more difficult case is metathesis, where the phonemes are the same but their order is different. Example: Sanskrit *barh* ~ *brah* 'be large'.<sup>18</sup> One way of treating metathesis would be to say that *b...h* is the communis and that *ar* and *ra* are different propriae.<sup>19</sup> As long as we have one satisfactory means of treating metathesis at our disposal, that is enough, because the whole concept of communis and propria is useful only as a means to defining automatic and certain other types of alternation.

We may speak of the communis not only of all the morphs of a given morpheme, but also of any subset of two or more. If we select different subsets we may get different results. For instance, if we take into account, besides the morphs *yuna**j*, *yuh**j*, and *yuj*, one more alternant of the Sanskrit root 'join', namely *yug*, the communis is not *yu(...)**j* but simply *yu*. The reason for sometimes leaving one or more morphs out of consideration when extracting the communis is that the omitted morphs stand in no automatic or otherwise regular alternation to the remaining morphs, whereas the remaining morphs are so related to each other. For instance the morphs *særkl circl-ing* and *særkæl circle* exhibit an automatic alternation discussed above; but the third alternant, *særkjæl circul-ar* (assuming that it belongs to the same morpheme), cannot be considered in any way regular. It does not spoil the automaticity, because it occurs in the prevocalic environment where both the other alternants already occur anyway, not in the prepausal and preconsonantal environment where only *særkæl* occurs.

**9. Wide static alternation.** We are now in a position to define wide static automatic alternation. In this definition we will use the following symbols:

M: any morpheme having two or more morphs

A: one morph of M

B: another morph of M

$E_a$ : the totality of environments in which A occurs

$E_b$ : some particular specified environment in which B occurs

M': any morpheme other than M

A': any morph of M' that occurs in  $E_a$  (There could be two or more such morphs, since  $E_a$  is not necessarily a single environment.)

B': the morph of M', if any, that occurs in  $E_b$

C: the communis of A and B

A-C: the propria of A (i.e. A minus C)

B-C: the propria of B (i.e. B minus C)

X: phonemic zero, or any sequence of one or more phonemes

Y: phonemic zero, or any sequence of one or more phonemes, other than X  
(It follows that X and Y cannot both be phonemic zero.)

The alternation  $X > Y$  (as exemplified by the morpheme M) is WIDELY

<sup>18</sup> Macdonell §51c.

<sup>19</sup> An alternative treatment of this particular example would be to take *b...r...h* as the communis and *a...zero*, *zero...a* as the propriae of *barh* and *brah* respectively.

STATICALLY AUTOMATIC in the environment  $E_b$  if all of the following conditions are met, and not otherwise:

- (a)  $E_b$  can be characterized in purely phonemic terms;
- (b) Excepting B, no morph of M occurs in  $E_b$ ;
- (c) X is part of A-C, and Y is part of B-C;
- (d) For every morpheme M' which has a morph A' in  $E_a$  and a morph B' in  $E_b$ , if A' contains X in a position corresponding to the position where A contains X, then B' contains Y in a position corresponding to the position where B contains Y; or else there is no B' that occurs at all.

It will be observed that condition (d) does not require that the X-Y difference be the only difference between A and B, or between any A' and the corresponding B'.

The reference in condition (d) to 'corresponding position' serves the following purpose. The phonemic environment in which a given alternation takes place may be specified in two separate statements: (i) the position of the alternating phonemes relative to their respective morphs; (ii) the position of these morphs, taken as wholes, relative to their environments. Thus the statement that in German, d is replaced by t immediately before pause, can be replaced by the conjunction of two statements: (i) t occurs in a morph which occurs immediately before pause; (ii) t is the last phoneme of this morph. It will be noted that the symbol  $E_b$  only refers, in this instance, to the environment mentioned in (i), not to the environment mentioned in (ii); in other words, it refers only to the environment of the morph as a whole. Accordingly, it is necessary to specify in addition the environment within the morph. The fact that the morph *hajde Heide* 'heath' occurs immediately before pause does not constitute an exception, because the position in which the X—namely, d—occurs there does not correspond to the position in which it occurs in prevocalic *rund* 'round.'

We can now further define the wide static automatic alternation of morphs taken as wholes:

Morph B is (widely and statically) automatically derived from morph A of the same morpheme M if and only if (a) all the phonemic alternations  $X_1 > Y_1$ ,  $X_2 > Y_2$ , ...,  $X_n > Y_n$  into which the alternation of the propriae A-C and B-C can be broken up are automatic as defined above, and (b) it is the X of each alternating pair, i.e. that phoneme sequence contained in A-C, which is basic.

An example:  $\theta ijætr > \theta ijətər$  is automatic before pause or consonant when there is a stress on the first syllabic. Two phonemic alternations are involved; in each the base is contained in the alternant  $\theta ijætr$ . The alternation  $\æ > \ə$  is conditioned by the stress placement,<sup>20</sup> the alternation  $zero > \ə$  by the following consonant or pause; hence, viewing the combination of stress placement and following consonant or pause as a single relevant phonemic environment  $E_b$ , we

<sup>20</sup> If, contrary to fn. 16, stress be regarded as part of the morph, the following revised account will be required: the morphs are  $\theta ijætr$ ,  $\theta ijætr$ ,  $\theta ijətər$ ,  $\theta ijətər$ . Then: (a)  $zero > \ə$  is automatic as before; (b) the stress shifts are non-automatic; (c) the change  $\æ > \ə$  is automatic when ' or ^ is lacking on the  $\æ$ . What is new in this account is that the environment (sc. the stress) conditioning a certain alternation in a morph is a part of the morph itself, rather than belonging to a morph of some other morpheme.

can say that in this environment  $\theta ij\text{æ}tr > \theta ij\text{ə}t\text{ər}$  is automatic. But there are other environments where, though the alternant  $\theta ij\text{ə}t\text{ər}$  occurs, it is not an automatic alternant; e.g. an environment consisting of a vowel immediately following the morph and stress on *ij* rather than on the following syllabic. For in this environment there COULD occur an alternant  $\theta ij\text{æ}tr$ , say in the rare adjective  $\theta ij\text{æ}tr\text{əl}$  *theatral*. Hence in this environment  $\theta ij\text{ə}t\text{ər}$ , though the only morph actually occurring in such forms as *theater of war* and *theatering*, is not automatic. Its  $\text{ə}$  before *t* is an automatic result, but its  $\text{ə}$  after *t* is not.

**10. Narrow static alternation.** Narrow static alternation imposes all four of the above requirements and in addition a fifth, stipulating that the 'avoided' phoneme sequence does not occur in the language at all. What is an avoided sequence? Given a morpheme *M* with morphs *A* and *B* (and perhaps others); and given an environment  $E_b$  in which, of these morphs, only *B* occurs; then, whether or not the alternation  $A \sim B$  be automatic in some sense, and whether or not *A* be taken as basic to *B*, we shall say that in the particular instance of morpheme *M*, the phoneme sequence  $AE_b$  is AVOIDED. The notation  $AE_b$  is not meant to imply that the environment necessarily follows the morph which is being considered as the focus. It may precede the focus. Thus in Sanskrit the sequence *uṣta* is avoided, in favor of *uṣṭa*; here the preceding morph *uṣ* 'shine' may be regarded as the environment, and the following morph *ta*, signifying past participle, as the focus, of the non-occurrent, avoided morph-sequence *uṣta*. Or, conceivably, the environment could surround—partly precede and partly follow—the focus; or it could be simultaneous with it. Thus in English the phoneme sequence  $\theta ij\text{æ}tr$  is avoided; here the  $E_b$ , the stress phoneme, is simultaneous with the focus, the morph  $\theta ij\text{æ}tr$ .

Suppose that all of the following are regarded as morphs of the English plural morpheme: *s*, *z*,  $\text{əz}$ ,  $\text{ən}$  (as in *oxen*),  $\text{rən}$  (as in *children*). Then the actual plural form *leaves* avoids the phoneme sequences *lijvs*, *lijvəz*, *lijvən*, and *lijvrən*, as well as others if the plural morpheme has other morphs.

In order to state the difference between wide and narrow static automatic alternation, we will introduce an auxiliary notion of partitioned phoneme sequence. A PARTITIONED PHONEME SEQUENCE (abbreviated PPS) is a phoneme sequence considered as being broken up into morphs, or fragments of morphs, in a certain way. (By definition, a purely phonemic transcription does not indicate partitioning.) In the sentence *prices are going higher*, the PPS  $\text{haj-ər}$  occurs; therefore the lesser PPS's  $\text{haj-ə}$ ,  $\text{aj-ər}$ , *haj*, etc., also occur there, because they are parts of the longer PPS  $\text{haj-ər}$ . Here *haj* and *ər* are morphs, *aj* and  $\text{ə}$  are morph-fragments. In *taxi for hire*, the PPS  $\text{hajər}$  occurs. It is the same phoneme sequence as the PPS  $\text{haj-ər}$ , but a different PPS, since it is differently partitioned. On the other hand, *haj* as in *hire* is a morph-fragment, and *haj* as in *higher* is a morph; but the two *haj*'s are both the same phoneme sequence and the same PPS, since they do not differ in partitioning; neither of them contains an internal morph-boundary. The reason for extending the notion of PPS to include morph-fragments as well as whole morphs is that in stating the conditions of alternations, sometimes part of a morph is irrelevant. Thus, in discussing below the question whether the avoidance of English *lijvəz* in favor of *lijvz* could

be considered an automatic alternation, it is not the PPS's *lijv-əz* and *lijv-z* that are relevant, but only the shorter PPS's *v-əz* and *v-z*.

The concept of PPS is extended not only to actually occurring phoneme sequences, considered as containing such-and-such morph-boundaries, but also to non-occurrent ones that are being considered, e.g. to avoided sequences.

Both the resemblance and the difference between wide and narrow static automatic alternation can now be concisely stated. Both kinds of alternation rule out certain PPS's; in addition, narrow alternation rules out those phoneme sequences on which these PPS's are based. For an example, consider the hypothesis that the alternation  $\text{əz} > \text{z}$  after *v* is statically automatic. (This hypothesis turns out to be false; but of course that does not preclude the possibility that  $\text{əz}$  might automatically change to *z* under other or more narrowly restricted conditions.) This hypothesis, whether taken widely or narrowly, would rule out a PPS *v-əz*; it implies, that is, that no actually occurring utterance will include such a PPS. So in any dialect in which, say, *Give as much as you can* is pronounced *givəz ...*, the hypothesis is refuted. But whereas the wide alternation would not rule out PPS's *vəz* and *və-z*, the narrow alternation would. Hence the form *Geneva's* *ʃəniɪvəz*, containing PPS *və-z*, refutes the narrow conception but not the wide one. All of these PPS's are based on the same phoneme sequence: *vəz*, and the hypothesis in question, on the narrow conception, would rule out this sequence no matter how partitioned.

A disadvantage of the wide conception (and the same disadvantage will turn out to apply to wide dynamic alternation) is that whether an alternation is automatic may come to depend on how we analyze certain utterances into morphs. Even if we use Hockett's notion of empty morphs (cf. fn. 29), a similar problem can arise.

Within both the narrow and the wide conceptions, there is a sub-possibility. On the narrow conception, every hypothesis to the effect that the alternation  $X > Y$  is statically automatic in environment  $E_b$ , rules out certain phoneme sequences; e.g. (in our example above) the phoneme sequence *vəz*. If those sequences do not actually occur, the hypothesis is tenable. But we might require, still more strictly, that not only must those phoneme sequences not occur, but also their non-occurrence must not be an accident. In the example of §6, even if the sequence *asn* did not occur at all in Sanskrit, it might be that its non-occurrence was a mere accident. Also a similar stricter requirement could be imposed on the wide conception. In §6 we said, in effect: granting that the PPS *a-sn* occurs, as in *vadhasnu*, and pretending that the form *trasnu* does not occur, then the alternation  $\text{as} > \text{o}$  before *n* is widely automatic in Sanskrit. If we impose the stricter requirement we will say: No, it is not even widely automatic; because even if the PPS *as-n* does not occur (in reality, a contrary-to-fact assumption), its non-occurrence is only an accident, as pointed out in fn. 14.

A very curious example from Greek may be worth mentioning here, although the alternation it exhibits is not automatic in any sense. Granting that in 5th-century Attic Greek the letter gamma before mu represents the sound [ŋ], the question arises, to what phoneme this sound [ŋ] should be assigned. Various considerations, chiefly morphological, make the case for assigning [ŋ] to the

phoneme *n* moderately strong. But such assignment has a remarkable morpho-phonemic consequence: whereas *n* > *m* before *m* (e.g. *pammélās* 'all black': *pan* 'all', *mélās* 'black'), *g* > *n* before *m* (e.g. *phlénma* φλέγμα 'flame': *phleg* 'burn', *ma* 'result of action'). In short, the phoneme sequence *nm*, and the PPS *n-m*, are avoided in one alternation, but are the very outcome of another.

Of course this fact might be used as a ground for rejecting the assignment of [ŋ] to the phoneme *n*.

**11. Reciprocal conditioning.** What if two morphemes automatically condition each other? For instance: one alternant of the Sanskrit past participle morpheme is *ta*; one alternant of a verb meaning 'take hold' is *rabh*. The past participle of *rabh* is not, as one might expect, *rabhta*, but *rabdha*. The most natural analysis of *rabdha* into morphs is into *rab* and *dha*.<sup>21</sup> (There is no possibility of a discontinuous morph *rab...h*, since *bh* and *dh* are unit phonemes.) It follows that the immediate environment of *rab* is *dha*, and that of *dha* is *rab*, and it so happens that the *dh* of *dha* and the *b* of *rab* are all of these environments that is relevant.

Now we can view *rabh* and *ta* as basic, *rab* and *dha* as derivative; their alternation will then be statically automatic, both widely and narrowly. But let us now turn to the dynamic conception, for it is in instances of reciprocal conditioning that the difference between the static and the dynamic conceptions appears most patently.

**12. The dynamic conception of automaticity.** The manner of describing alternation that is implicit in most grammars is quite different from the static one as presented above. The customary description of an alternation (not necessarily automatic) presents, in its most formalized dress, a quasi-chemical equation,<sup>22</sup> e.g. *rabh* + *ta* = *rabdha*. In words: *rabh* before *ta* becomes *rab*; *ta* after *rabh* becomes *dha*. This manner of conception and description we call DYNAMIC, because it employs the metaphor of change—change in the environment as well as in the focus—described in §4. The difference between the dynamic and the static conceptions is obvious: the former takes as the relevant conditioning environment the basic alternant of the conditioning morpheme, the latter takes the derivative alternant. It follows that there is no difference in result between the static and the dynamic conceptions when the conditioning morpheme remains invariant; for example, the past participle of the Sanskrit root *man* 'think' is *mata*; if we describe in phonemic terms the environment conditioning this alternation *man* > *ma*, it would be *ta* according to either conception. But when a form, e.g. *rabdha*, contains a derivative alternant of the environment as well as of the focus—when, in other words, there is what may be described as reciprocal conditioning of two morphemes, the static and the dynamic descriptions diverge.

There is in use a modification of the dynamic conception: the compromise mentioned in §2(a). This modification gives a stepwise description of a reciprocal conditioning, assigning an order of succession to the steps. Using the metaphor of change, we might describe the change of *rabh* + *ta* to *rabdha* in any of

<sup>21</sup> Grassmann 1707 and Macdonell §33.2 so analyze comparable words,

<sup>22</sup> E.g. Macdonell §33.2.

three ways: (i) in one step: *rabh* and *ta* change simultaneously. This is the pure dynamic conception. (ii) In two steps: first *rabh* + *ta* becomes *rabh* + *dha*; then *rabh* + *dha* becomes *rab* + *dha*. (iii) Again in two steps: first *rabh* + *ta* becomes *rab* + *ta*; then *rab* + *ta* becomes *rab* + *dha*. In (ii) *ta* changes before *rabh*; in (iii) after it; and in (i) simultaneously with it. The reason for calling descriptions (ii) and (iii) compromises between the pure static and the pure dynamic conceptions is that in each of them, the conditioning alternant of one morpheme is its basic alternant and the conditioning alternant of the other morpheme is its derivative alternant. The chief advantage of these compromises is an expository one of the type mentioned in §16(b): we may be saved the need of stating an extra rule, if the two steps into which a reciprocally conditioned alternation can be broken up are each of them covered by a rule which is needed anyway. In some cases, in order to achieve this economy, it is necessary to specify the order in which the steps take place; in other cases it is not. Whitney himself, in describing forms like *rabdha* (§§159-60), uses the pure dynamic description, for the following reason. His consistent practice<sup>23</sup> is, in all cases where a preceding and a following morpheme condition each other, automatically or otherwise, never to describe the following morpheme as changing first. In nearly all these cases he describes the preceding morpheme as changing first (compromise of type (iii) above); in those few exceptions, like the case of *rabdha* itself, where, for special reasons, he does not do this, what he does is to revert to pure dynamic description, i.e. describe the two changes as simultaneous. We shall not pause to examine the rationale of this procedure; it is arbitrary in part, but only in part.

**13. Non-equivalence of the two conceptions.** An example that will bring into sharp relief the practical differences between the static and the dynamic conceptions is found in Latin. Let us consider the hypothesis that formulae such as *pat* 'suffer' + *tus* (past participle, nom. sing. masc.) = *passus*, *met* 'harvest' + *tus* = *messus*, etc., display two automatic and reciprocally conditioning alternations. Stated in dynamic terms, and reduced to the phonemes involved, these alternations are: (a) *t* becomes *s* between a short vowel and a following *t* which in turn is followed by a vowel; (b) a *t* followed by a vowel becomes *s* after a *t* that follows a short vowel. (We state the environmental conditions so narrowly so that changes such as *ūt* 'use' + *tus* = *ūsus* will not constitute exceptions. Furthermore, the statements are only meant to apply within single words, simply because our knowledge of word sandhi in Latin is so scant. Consequently, a phrase such as *et tū*, *Brūte* would not here be considered an exception.)

First of all, a discrepancy between the wide and the narrow dynamic conceptions is to be noted. According to the former, the verb *mittō* 'I send' does not constitute an exception either to (a) or to (b), because there is no morpheme boundary between the two *t*'s. *Attendō* 'I offer to' is not so easy for the wide dynamic conception to dispose of. It makes a difference whether *ad* or *at* be considered the basic alternant of the morpheme meaning 'to'. If *at* is basic,

<sup>23</sup> E.g. §175a; §203.

both rules (a) and (b) must be given up; neither of them need be if *ad* is basic. The rules tell us that *at* + *tendō* would become *assendō*, but do not tell us what will become of *ad* + *tendō*. It is noteworthy that whether an alternation is dynamically automatic can depend, according to the wide conception, on which of two alternants of a certain morpheme be regarded as basic. It can also depend, as also for the wide static conception (cf. *honestus*, below), on whether and how a certain form is analyzed into morphs. *Mittō* is not an exception only because *mit* is not a morph.

If the forms and facts presented above are a fair sampling of all the relevant Latin forms and facts, then neither rule (a) nor rule (b) states a NARROW dynamic automatic alternation, because the 'avoided' sequence *tt* occurs in *mittō*; but both rules state a WIDE dynamic automatic alternation if *ad* rather than *at* be taken as the basic alternant.

In applying the static conception, some quite different forms and facts are relevant, and, as it turns out, fatal. Rules analogous to (a) and (b) above may be formulated: (A) between a preceding short vowel and a following *s* which is in turn followed by a vowel,<sup>24</sup> derivative *s* occurs instead of basic *t*; (B) between a preceding sequence of short vowel and *s* and a following vowel, derivative *s* occurs instead of basic *t*.

The question as to which morph of a morpheme is basic is now irrelevant, because if a morpheme has two or more morphs that might be considered as exhibiting a certain automatic alternation, the requirement of uniformity—see §5, and §9 condition (d)—will dictate which of these be regarded as basic relative to the alternation in question. Such a form as *sistō* 'I remain stationary' disqualifies rule (B) from being statically automatic, according to the narrow conception, but not according to the wide conception, since the indubitable analysis into morphs is *si-st-ō* (hence no morpheme boundary between the *s* and the *t*). *Fūnestus* 'deadly', *honestus* 'honorable' are exceptions according to the wide conception if they are analyzed so into morphs: *fūn-es-t-u-s*, *hon-es-t-u-s*; but not if they are analyzed so: *fūn-est-u-s*, *hon-est-u-s*. But since the analysis of *estō* 'be thou!' and *este* 'be ye!' into *es-t-ō* and *es-t-e* is beyond serious question, Rule (B) cannot be automatic even according to the wide conception. Rule (B) would require *essō*, *esse*.

Rule (A) is disqualified, according to the wide as well as to the narrow static conception, by at least one form: the conjunction *etsī* 'and yet, although', which is apparently a single word but whose morph analysis into *et* 'and' and *sī* 'if' is transparent.

The upshot of our discussion is this. Rules (A) and (B) are the closest possible static analogues to the dynamic rules (a) and (b). According to the narrow conceptions, none of these four rules is automatic, but for different reasons: (a) and (b) are both non-automatic on account of intervocalic *tt*, but (A) is non-automatic because of *ts* and (B) because of *st*. As between the wide conceptions, there is a difference not only of reason but of result: (A) and (B) are definitely non-automatic; (a) and (b) are automatic if *ad* is basic to *at*, but non-

<sup>24</sup> If we did not specify 'which is in turn followed by a vowel,' then *mīlēs*, alternant of *mīlit* 'soldier' in nom. sing. *mīlēs*, would constitute an exception.

automatic if *at* is basic to *ad*. Thus it is proven that there are cases where the static and the dynamic, the wide and the narrow conceptions lead either to different results or to different reasons for the same result.

A second example to show the discrepancy between the static and the dynamic conceptions is drawn from Sanskrit.<sup>25</sup> The past participle morpheme has alternants *ta* and *na*, among others; their distribution is complementary, but their alternation is not automatic in any sense. In the absence of weightier reasons, the vastly greater frequency of *ta* justifies us in taking it to be non-automatically basic to *na*. The root *ac* 'bend' has (in the Brāhmaṇa-Sūtra period of Sanskrit) the past participle *akna*, and no other. The dynamic formula would be: *ac + ta = akna*. It has already been remarked that the alternation  $t > n$  is not automatic; but it is consistent with the facts to regard  $c > k$  before basic *t* as a dynamic automatic alternation (both widely and narrowly). Viewed statically, however, *akna*, so far from being automatic, is highly irregular; in internal sandhi, *n* after *c* should become  $\tilde{n}$  (Whitney §202); in other words, the statically regular (though perhaps not automatic) participle would be *acñā*.

**14. Reason why the dynamic conception has been customary.** The preference for the dynamic conception is due to the predominantly historical interest of most linguists, especially during the 19th and early 20th centuries. When morpheme alternants were described, linguists were motivated by their historical interest to choose as basic that one which they believed to be primitive; or if they believed neither to be primitive, they moved on to the fictive conception of §15 and constructed a non-existent form. Greek *thrik* and *trikh* 'hair', for instance, would both be referred to a fictive *thrikk*—descriptively fictive because it does not actually occur in Greek. The basic-derivative alternation was rightly regarded<sup>26</sup> as a clue to the temporal sequence of past events. The metaphor of change in synchronic linguistics in general is favored by the same ultimately historical, diachronic interest. Such an interest is usually served much better by the dynamic conception of alternation than by the static conception; the formula *pat + tus = passus* can be interpreted historically as well as descriptively, which the formulae *pat + sus = passus* and *pas + tus = passus* cannot, and the very fact that the dynamic alternation stated in the first formula is not narrowly automatic has historical meaning. It enables us to infer that the exceptions came into being at a time subsequent to the epoch when the alternation described by the formula was an actual sound-law, i.e. after *patt-* before vowel had actually changed to *pass-*.

<sup>25</sup> We have simplified the actual facts, as recorded in Whitney §§955g-957, by ignoring (a) the form *ita*, and all participles formed from it such as Epic *acita*, and (b) the few cases of non-complementation of the forms *ta* and *na*. We pass over the question whether *ta* and *na* should be analyzed into two morphs each, *t-a* and *n-a*.

<sup>26</sup> By a method which has been made explicit, and studied, by Hoenigswald in the two papers cited in fn. 1. The principle that the existence of alternants is evidence of historical development out of original unity is elaborately studied, though very diffusely expounded, by Baudouin de Courtenay. But that the dynamically basic alternant does not always represent a historically older form is proved, for example, by an illustration in §5: although, descriptively, Gk. *stómat* 'mouth' is dynamically basic to *stóma*, there was never, historically, a nominative singular *stómat* which was later replaced by *stóma*. Cf. fn. 12a.

For purely descriptive purposes, on the other hand, the dynamic conception has the disadvantage of requiring that for every morpheme that has two or more morphs, one of these be treated as basic to all the others.

**15. The fictive conception.** Thesis (b) of §2 was that the problem of defining automatic alternations is distinct from the problem of devising a notation to record them, and also from the problem of producing the most efficient body of statements from which all the automatic alternations can be deduced. These last two purposes are often well served by a system of MORPHOPHONEMIC WRITING. Such a system is a class of letters or other symbols, each of which is said to designate a morphophoneme, and to which meanings are assigned in such a way that from the morphophonemically written formula for a given morpheme, by application of the rules which assign meanings to each of its component symbols, one can deduce some or all of its actually occurring morphs. The simplest meaning that such a symbol can have is simply one single phoneme, under all circumstances; it is customary to use for such a symbol the same mark as for that phoneme itself, by a systematic ambiguity which is generally dispelled by the context or by some explicit convention. The next simplest meaning is, that the morphophonemic symbol designates one phoneme in the neighborhood of such-and-such symbols and another phoneme in the neighborhood of such-and-such other symbols. The convention in this case is to use the capital letter corresponding to the small letter that designates the phoneme which is regarded as basic. Example (Swadesh and Voegelin 2): that the morpheme *leaf* lijf has the alternant *leave* lijv before the plural morpheme, whereas the morpheme *belief* bəlijf remains invariant, could be symbolized by the morphophonemic formulae bəlijf vs. lijF.

Discussion of morphophonemic writing is not part of our present task; the technique has been applied with success by Swadesh and Voegelin (to non-automatic alternations only), Bloomfield (Menomini Morphophonemics), Emeneau, Hockett (Problems §5 and §6), and others.<sup>27</sup> Our only concern here is to point out that whatever a morphophonemic formula does mean, it does not mean any actual morph, and in this way differs essentially from a phonemic formula.<sup>28</sup>

<sup>27</sup> The possibility of dispensing with fictive base forms is pointed out by Harris, Review of Emeneau 285-6. Occasional fictive forms are to be found in older grammars; e.g. Whitney §765a refers root *dīw* 'play', exhibiting actual morphs *dīw* and *dyū*, among others, to a 'proper' form *dīū*, from which the actual morphs could be regularly, though non-automatically, derived by his §129. He mentions (§104d, §242a) but does not use the morphophoneme symbolized *ṛ* (long syllabic *r*), which was invented by the Hindu grammarians. That the use of fictive base-forms in comparative Indo-European linguistics has led to misconceptions, namely the mistaking of morphophonemic for phonemic formulae, is clearly shown by Maurer; see his last paragraph

<sup>28</sup> Swadesh and Voegelin (10) say: 'If it has been possible, by the recognition of a non-patent phonology which involves the construction of fictive formulae ..., to reduce the apparent irregularity of Tübatulabal phonology to system, this very fact guarantees the truth of our theory.' However, it is not clear what the 'theory' is, as distinct from their construction of formulae. On p. 2 they remark that 'the process of constructing morphophonemic formulae has some resemblance to that of historico-phonological reconstruction.' Is their theory the theory that their formulae represent not only historical realities but synchronic realities of some sort as well?

For instance the morphophonemic formula *bəlijf*, although it looks just like the phonemic formula *bəlijf*, does not have the same meaning, because it means the fact that the morpheme *belief* has the same alternant in the singular and in the plural. So that when Emeneau, for instance, says (§5) that morphemes 'are set up in theoretical basic forms, the minimum distinctive segmental units of which are the morphophonemes ... replacements of morphophonemes may take place in the descriptive passage from the morphophonemic to the phonemic level. Statements of such replacements are ... (1) automatic ... and (2) nonautomatic', this sense of the term 'automatic' must not be confounded with the senses under discussion in the present paper, according to which it is applied only to alternations between actually occurring morphs.

**16. Miscellaneous observations.** In conclusion, we assemble here a number of remarks which do not readily fit in any of the previous sections.

(a) Sometimes dynamic alternations are stated in formulae of the following type:  $A + B = C$ ; that is, two phonemes yield one. For instance, Korean  $w + i = u$ , e.g. *caŋkw* 'lock up' + *imnita* (a finite verb ending) = *caŋkumnita*. Again, in Kota (Emeneau §10, rule 1.a) 'a cluster of identical consonants is replaced by the corresponding single consonant'; e.g. *av(n) no·čt* 'that man having looked'. If we take analysis into morphs seriously, we must go beyond such statements and say to which morph the single phoneme belongs. Shall we analyze *caŋku-mnita* or *caŋk-umnita*? Shall we analyze *avn-o·čt* or *av-no·čt*?<sup>29</sup>

(b) We spoke in §2 and §15 of efficiency of statement. Efficiency is some function of brevity and of intelligibility or perspicuity. One way of attaining brevity is morphophonemic writing. Another, independent way is to state not all the automatic and other regular rules but only some selection of them which implies all the others. For example, it is unnecessary, as Whitney virtually points out (§152), to state the regular non-automatic derivation of *vāg* 'voice' from *vāc*, because it is implied by the two rules (i) *vāc* > *vāk* before pause (§141) and (ii) *vāk* > *vāg* before vowels and voiced consonants, under certain further grammatical conditions (§159). But the fact that it is unnecessary to state the alternation does not mean that such an alternation does not exist.

(c) It is sometimes convenient to treat a hypothetical morph as basic. A hypothetical morph is not the same as a fictive morph. If in a certain environ-

<sup>29</sup> Two other conceivable solutions are sufficiently recherché for a footnote. (a) Both the *n* of *avn* and the *n* of *no·čt* are regarded as empty morphs in Hockett's sense (Problems §15). (b) Hockett's concept (ibid.) of portmanteau morphs could be generalized to provide for the possibility of saying that *n*, while not a morph at all, is PART of two morphs: part of *avn* and part of *no·čt*. Of course, as with empty and portmanteau morphs, the principle of total accountability (op.cit. 332 top) would have to be respected. We might call *n* in this example, and other phoneme sequences so treated, 'partial portmanteaus'; or, more simply, 'links'. We could say that *l* is a link in the English adverbs *fully*, *amply*, etc.: it belongs both to *full* and to *ly*, at once. Some zero-morphs would then be rendered superfluous, e.g. the zero alternant of the past tense morpheme assigned by Bloomfield, Language 215 bottom, to *cut*, *hit*, etc., when they have past tense meaning. The advantage is that we are spared arbitrary divisions, as of *fully* *fulij* into morphs *fu* and *lij* or into *ful* and *ij*. I have learned orally from F. G. Lounsbury that he has been using the notion of links in his work on Iroquoian languages.

ment no morph at all of a given morpheme occurs, but if on the strength of some phonemic or grammatical pattern of the language we venture a prediction as to what morph would have occurred there, our predicted morph is hypothetical. A fictive morph, on the other hand, like Hockett's Latin *nigw* 'snow' (Problems 326) has no environment; in every environment it is crowded out by some actual or hypothetical morph: before *s* by actual *nic*, before vowels by actual *nīw*, *nīw*, *ning*, *ningw* in various grammatical environments (assuming that all these morphs are to be referred to the same morpheme), before consonants other than *s* by hypothetical *nig* or *nic*.

In Southern Paiute as analyzed by Sapir, intervocalic  $\eta w^{30}$  is regularly (and automatically?) derivable both from basic *m* and from basic *w*; there are some morphemes that actually occur only after a vowel, and whose morphs there begin with  $\eta w$ ; for such morphemes (see the dictionary part of his grammar, 540 and 591) Sapir has no ground for deciding between two possible hypothetical basic morphs, one beginning with *m* and one with *w*.

(d) A phonemic alternation is completely identified by specifying four items: (i) the phonemes involved; (ii) their phonemic environment, both within the morphs to which they belong and within all other morphs that are the relevant environment of these first morphs; (iii) the direction of the alternation, i.e. which phoneme-sequence is basic and which derivative; and (iv) in the case of non-automatic alternations, the environments in which each member of the alternation occurs. If the alternation is automatic, (iv) will already be included in (ii). If an alternation is statically automatic, there could not be another alternation like it in respects (i) and (ii) but different in (iii).

To specify merely (i) is deceptive, because it has been known to lead to confusions like the following. There is in Japanese a non-automatic alternation  $t > d$  (and hence of course  $t \sim d$ ), as in *ta*  $\sim$  *da* 'field', *tomo*  $\sim$  *domo* 'companion'; and an alternation  $t > z$  (and hence  $t \sim z$ ), as in the *ti* of *ti-ti* 'father'  $>$  the *zi* of *o-zi-san* 'uncle', *ture*  $\sim$  *zure* 'accompaniment', etc. Both alternations occur at morpheme-initial; but the former takes place only before the vowels *a*, *o*, *e*, the latter only before *i* and *u*. And no morpheme exhibits alternations between any of the vowels *a*, *o*, *e* on the one hand and either *i* or *u* on the other, excepting a very few in which the vowel is not preceded by *t*, *d*, or *z*. So although there is an alternation  $d \sim t$  and an alternation  $t \sim z$ , these do not combine to make one triple alternation  $d \sim t \sim z$ . There is no one morpheme exhibiting all of these alternations at once.

(e) It is sometimes convenient to make use of evanescent forms in stating alternations. For instance, the Latin alternations which were proven in §13 to be non-automatic except, provisionally, in the wide dynamic sense, could be less stringently stated so as to cover the formula:  $\bar{u}t$  'use' + *tus* =  $\bar{u}sus$ . We would postulate an evanescent form  $\bar{u}ssus$ , and would then add another rule according to which this  $\bar{u}ssus$  immediately changes to  $\bar{u}sus$ . The formula ' $\bar{u}t + tus = \bar{u}ssus = \bar{u}sus$ ' reflects historical fact (apart from the fact that the change of *os* to *us* is here ignored); but the point we wish to make is that there was a

<sup>30</sup> It is not perfectly clear that Sapir's letters ' $\eta w$ ' represent  $\eta w$ . See Sapir §§12.2.b, 13.2, 16.1.

period (sometime after the beginning of the Imperial period) when  $\bar{u}sus$  occurred and  $\bar{u}ssus$  did not, and that in describing the language of this period the symbol ' $\bar{u}ssus$ ' has neither actual nor hypothetical, but only fictive meaning. If it had actual or hypothetical meaning, it would imply that there is a morph  $\bar{u}s$  and a morph  $s$  (as well as an ending  $us$ , however this be analyzed into morphs), which are not linked to each other in the manner described in fn. 29. And that is not the case, no matter how we may analyze the actual  $\bar{u}s$  (of  $\bar{u}sus$ ) into morphs. We could say that  $\bar{u}t$  here has the alternant  $\bar{u}s$ , and  $t$  (the past participle morpheme) has the alternant zero; or that  $\bar{u}t$  has the alternant  $\bar{u}$ , and  $t$  the alternant  $s$ ; or that the  $s$  both belongs to the morph  $\bar{u}s$  (alternant of  $\bar{u}t$ ) and, at the same time, constitutes a morph by itself (alternant of  $t$ ). But none of these analyses is compatible with the treatment of  $\bar{u}ssus$  as an actual or hypothetical form; it can therefore only be fictive.