Harris the Revolutionary: Phonemic Theory[*]

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Abstract

Chomsky and Halle's well-known attack on "taxonomic phonemics" does not apply to Zellig Harris's phonological theory. Bernard Bloch and others attempted to identify the phonemic contrasts of a language by analyzing the distribution of phonetic segments or features relative to one another. It is this that Chomsky (1964) characterizes as "taxonomic phonemics." For Harris, phonemic contrast is an observational primitive. In place of Bloomfield's "fundamental assumption of linguistics" he specified substitution tests which capture native speakers' intuitions of repetition/contrast in a controlled way. The most precise of these is the pair test. Because phonemic contrast is an observational primitive of the science, rather than something to be discovered or defined by distributional methods, even his initial segmentation of utterances is a phonemic representation of the contrasts, rather than a merely phonetic transcription. Early writings of Chomsky and Halle acknowledged the pair test for eliminating repetitions from a corpus, but not the use of it and other substitution tests for defining a segmentation. This paper analyzes the arguments against "taxonomic phonemics" in Chomsky (1964), with occasional references to other papers by Jakobson, Halle, and Chomsky. Whatever their intent may have been, we show that none of these arguments apply to Harris's phonemics. We show how the use of abstract phrase markers for syntax drives phonetic content out at the bottom of the grammar just as it drives semantic content out at the top, mandating a distinctive feature representation, and we show how in Harris's operator grammar the phonetic content associated with segments is present at every point of sentence construction, beginning in the base, just as the linguistic information and other meanings associated with words are inherently present.

1. Introduction

When we approach an unknown language, how do we know which utterances are the same and which are different? Leonard Bloomfield said that we can only tell by knowing their meanings.

> … The features of sound in any utterance, as they might be recorded in the laboratory, are the *gross acoustic features* of this utterance. Part of the gross acoustic features are indifferent (*non-distinctive*), and only a part are connected with meanings and essential to communication (*distinctive*). […] Since we can recognize the distinctive features of an utterance only when we know the meaning, we cannot identify them on the plane of pure phonetics. (1933:77)
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> To recognize the distinctive features of a language, we must leave the ground of pure phonetics and act as though science had progressed far enough to identify all the situations and responses that make up the meaning of speech-forms. In the case of our own language, we trust to our everyday knowledge to tell us whether speech-forms are "the same" or "different." … In the case of a strange language we have to learn such things by trial and error, or to obtain the meanings from someone that knows the language. (1933:77-78)
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> The study of *significant* speech-sounds is *phonology* or *practical phonetics*. Phonology involves the consideration of meanings. (1933:78)

But until there is an antecedent science of meaning, according to Bloomfield, contrast and repetition can be brought into linguistics only by a "special assumption":

> The study of language can be conducted without special assumptions only so long as we pay no

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attention to the meaning of what is spoken. (1933:75)

> The meanings of speech-forms could be scientifically defined only if all branches of science, including, especially, psychology and physiology, were close to perfection. Until that time, phonology and, with it, all the semantic phase of language study, rests upon an assumption, the fundamental assumption of linguistics: we must assume that *in every speech-community some utterances are alike in form and meaning*. (1933:78, emphasis in original)

But as far as possible, science should avoid special assumptions. How could linguistics bring in the fundamental data of contrast without this assumption about the correlation of form and meaning?

One way was to try to define contrast without reference to meaning, by analyzing the distributional relations among observed phonetic features in utterances. To many American linguists following Bloomfield, this seemed to be the only scientific approach. After all, if you are concerned with a relation of contrast, you must first identify, phonetically, the things that are contrasted. On this view, the "gross acoustic features" are the observational primitives, and the task is to define phonemic contrast by analyzing the distribution of these phonetic primitives relative to one another in a corpus.

Bernard Bloch exemplified this approach. "Contrast between sounds can be defined, I think, on the basis of distribution alone, without the customary appeal to meaning" (1953:59[224]). Since "the facts of pronunciation [are] the only data relevant to phonemic analysis" (Bloch 1941:95), phonemes had to be closely identified with their phonetic detail. In his carefully worked-out postulates, Bloch based the segmentation of utterances on articulatory movements (Bloch 1948, postulates 11-16), and required that all the members of a given phoneme must have some characteristic phonetic feature in common: "The class of all segments … containing a given feature is a *phoneme*. […] The feature common to all members of a given phoneme is the *characteristic* of the phoneme" (Bloch 1948, definitions 53.2, 53.12). This constraint appeared necessary in order to determine contrast. Without it, he proposed, one could not know what was in contrast with what.

It turned out not to be so easy to define contrast in this way. Problems arose, for example, when the membership of a given phonetic segment in one phoneme or another was indeterminate (due to neutralization) or ambivalent (due to overlapping). Bloch's (1941) follow-up brought these difficulties into focus, presenting a well-defined target for the well-known attack by Chomsky and Halle on "taxonomic phonemics" (Halle (1959), Chomsky (1964), Chomsky and Halle (1965)). However, it is important to realize that Chomsky agrees with Bloch et al. insofar as he "assume[s] that each utterance of any language can be uniquely represented as a sequence of *phones*, each of which can be regarded as an abbreviation for a set of features" (1964:78[407]), and that this segmentation of utterances into phones according to a matrix of universal features is the starting point for all work in phonology, whether "taxonomic" or Generative. The same assumption is found in related writings by Jakobson and Halle.

But the facts of pronunciation are not the only data relevant to phonemic analysis, nor even the uniquely fundamental data. During the same period, Zellig Harris proposed a more direct way to determine contrast without unsupported assumptions. Rather than try to define contrast, observe it. If you want to know which utterances are the same and which are different, *ask*—a native speaker can reliably tell you. Furthermore, that is the *only* way to find out.

Harris's aim is to disclose the correlation of linguistic form with meaning. The contrasts between utterances are the irreducible least elements of this correlation. To specify these fundamental elements of linguistics, the contrasts, Harris used a criterion of differential meaning in various substitution tests. The most precisely controlled of these substitution tests is the *pair test*. These tests distinguish contrast from repetition. Furthermore, and crucially, it is the substitution tests, not phonetic theory, that determine a "linguistically relevant" segmentation of utterances—linguistically relevant because the segments

represent the contrasts and locate them relative to one another within an utterance. A purely phonetic basis for segmentation is not linguistically relevant because it says nothing about the correlation of form with meaning. Because the segmentation is a segmentation of (records of) utterances, phonetic detail is associated with each segment. However, the facts of pronunciation do not determine the segmentation. And because vocabulary and utterances are unique to each language, this identification of the contrasts and of elements to represent them must be done separately for each language.

> The linguistic elements are defined for each language by associating them with particular features of speech—or rather, differences between portions or features of speech—to which the linguist can but refer. They are marked by symbols, whether letters of the alphabet or others, and may represent simultaneous or successive features of speech, although they may in either case be written successively. The elements will be said to represent, indicate, or identify, rather than describe, the features in question. For each language, an explicit list of elements is defined.
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> The statement that a particular element occurs, say in some position, will be taken to mean that there has occurred an utterance, some feature of some part of which is represented linguistically by this element. (1951:14)
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> Whereas the logicians have avoided the analysis of existing languages, linguists study them; but, instead of taking parts of the actual speech occurrences as their elements, they set up very simple elements which are merely associated with features of speech occurrences. (1951:16 fn 17)
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> [T]he ultimate elements of the phonology of a language [… are] the distinct (contrasting) segments (positional variants, or allophones) rather than the phonemes. The phonemes result… from a classification of complementary segmental elements; and this [can] be carried out in various ways. (1951:72 fn 28)

(Note that this last statement refers not to phones determined by universals of phonetic theory but to the linguistically relevant segmentation determined for the given language by speaker judgements of contrast and repetition.)

This makes a fundamental change in phonemics. It means that even the most preliminary linguistically relevant segmentation, even though it may display quite a bit of redundancy, is nonetheless a representation of the phonemic contrasts of the language. The purpose of subsequent phonological analysis is no longer to define contrast (which is already given), nor to define the phonemes, but rather to *refine* the phonemes so that the grammar may be stated more simply or more usefully.

Harris begins with an arbitrary segmentation — "arbitrary" because it is not necessarily relevant to the distinctions between utterances which we wish to represent. Purely phonetic considerations are arbitrary in this sense, that is, they cannot ensure the relevance of the segmentation, because the contrasts are socially determined (albeit within universal physical and perceptual constraints) and because the articulations and sounds of speech, such as are studied in phonetics, are continuous, and not discrete. The segmentation is accomplished in the course of (and by means of) the substitutions just mentioned:

> Fortunately, it is possible to represent each continuous speech event in such a way that we can then compare various speech events and say that the first is different from the second to such and such an extent. Our ability to do this rests on the observation that in each language we can substitute a close imitation of certain parts of one utterance for certain parts of another utterance without getting any consistent difference of response from native hearers of the changed second utterance. … We therefore set out to represent every utterance by segmental elements which are substitutable for segments of other utterances. (1951:25-26).
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> We represent an utterance by a succession of segments which end at arbitrary points along its

> duration. … Linguists usually select the segments [… by articulatory or acoustic criteria, or by perceived similarity to] what they have elsewhere (e.g. in English orthography) learned to regard as 'one sound.' However, neither these nor any other criteria can always show us what points of division will turn out later to be most useful (i.e. which will come out at the boundaries between the eventual phonemes). … This uncertainty leads to no loss in exactness, because later procedures will determine the boundaries of these segments. If the segment divisions arbitrarily selected here do not pass the test of the later procedures, they can be adjusted, and if necessary the utterance can be recorded, anew, with the symbols that will be chosen for the adjusted segments. (1951:26 & fn4)

In the substitution tests of Harris (1951, Chapter 4), we imitate an utterance, replacing one of the segments we heard in it with a phonetically different segment heard in other utterances, and we ask (directly or indirectly) whether the two pronunciations are the same; or we may record differently two utterances that a native speaker judges to be repetitions. The resulting segmentation is linguistically relevant because each segment corresponds one-one (biuniquely) to a contrast between the pairs of utterances.

> [T]he representation of speech as a sequence or arrangement of unit elements is intimately connected with the setting up of phonemic distinctions between each pair of non-equivalent utterances. If each utterance were considered by itself, it might be represented as a continuum or as a simultaneity of features which change with time. […] However, if we match utterances [as described in chapter 4, Phonemic Distinctions], we obtain some individual difference between the members of each particular pair of utterances; that is, we obtain discrete elements each of which represents some particular inter-utterance difference [… and] which can be combined together. These elements are phonemic distinctions, rather than phonemes; i.e. they are the difference between /k/ and /p/ (more exactly, between *tack* and *tap*, between *sack* and *sap*, etc.) rather than being /k/ and /p/ themselves. However, for convenience, we will set up as our elements not the distinctions, but classes of segments so defined that the classes differ from each other by all the phonemic distinctions and by these only. […] In this way we define /k/ to represent all the paired distinctions in which [k] was a member, /l/ to represent all the distinctions in which [l] was a member, and so on. The classes, or phonemes, are thus a derived (but one-one) representation for the phonemic distinctions. The segmentation of Chapter 3 was carried out in order to permit the representation of continuously varying speech to express the discrete elemental phonemic differences. A phonemically written form therefore is not a direct record of some spoken form, but rather a record of its difference from all other spoken forms of the language. (1951:34-35)

So from the outset there is a one-one or biunique correspondence of segments to contrasts. Any correspondence of phones to phonemes is subservient to that. It is for this reason that phonemic overlapping is not a problem.

> Each element is identified with some features of speech in the language in question: for most of linguistic analysis the association is one-one (the features in question are associated only with element *X*, and element *X* is associated only with the features in question); in some parts of the analysis the association may be one-many (element *X* is associated only with certain features, but these features are sometimes associated with *X* and sometimes with another element *Y*). (1951:16, footnote suppressed)

We will now review the attack on segmental phonemes by Chomsky and Halle, as exemplified in Chomsky (1964). As we will see, contrary to the widespread view of Harris as the arch-taxonomicist, this attack does not apply to Harrisian phonemics. In some places Harris's views are misunderstood or misrepresented, but unless that is specifically noted the reader should assume that it may not have been

Chomsky's intent to include Harris under the "taxonomic" label. Of course readers must make up their own minds on this point.

2. The Four "Taxonomic" Conditions

A number of Chomsky's (1964) arguments hinge on the claim that socalled "taxonomic phonemics" adheres to four principles or conditions: linearity, invariance, biuniqueness, and a strong form of biuniqueness that he calls local determinacy. We will consider each of these in turn.

2.1 Linearity

There is a simple formulation of the linearity condition in Chomsky (1957a:346-347):

> [S]peech is taken to be literally constituted of a sequence of phonemes, each with its distinctive and redundant features; accordingly, the phonetic value of a sequence of phonemes is the sequence of phonetic values of these phonemes.

Chomsky (1964:76[407]) defines the linearity condition as follows:

> The linearity condition … requires that each occurrence of a phoneme in the phonemic representation of an utterance be associated with a particular succession of (one or more) consecutive phones in its representing matrix, as its "member" or "realization"; and, furthermore, that if A precedes B in the phonemic representation, then the phone sequence associated with A precedes (is to the left of) that associated with B in the phonetic matrix.

The linearity condition says two things. It says that each phoneme corresponds to a phone or to a sequence of consecutive phones, and that the linear order of phonemes in any given utterance is the same as the linear order of the corresponding phones. If phones a, b, and c correspond to phonemes x, y, and z respectively, then linear order abc can only correspond to linear order xyz, never yxz, yzx, and so on.

Harris violates the linearity condition whenever doing so is "convenient" for obtaining a simpler or more perspicacious grammar. Such violations are found, for example, in his treatments of simultaneous components (starting with intonation contours and other suprasegmental elements), and in his analysis of partial overlapping, of which we will see more later. In cases of vowel or consonant harmony, for example, a phonetic feature that is associated with a segment written at the end of a stretch of the utterance is spread by rule over the preceding segments of that stretch. The linearity condition does not apply to Harrisian phonemics.

2.2 Invariance

Invariance is merely a restatement of the requirement, made explicit by Bloch (in his Postulates, 1948, loc. cit.), that all members of a phoneme have some characteristic phonetic feature or features in common. Chomsky (1964:79[408]) says that the invariance condition

> [A]sserts that each phoneme P has associated with it a certain set f(P) of *defining features* (that is, P=Q if and only if f(P)=f(Q)) and that wherever P occurs in a phonemic representation, there is an associated occurrence of f(P) in the corresponding phonetic representation. The invariance condition has no clear meaning unless the linearity condition is also met; I will assume, then, that it is inapplicable when linearity is violated. […] Where linearity and invariance are both met by a taxonomic phonemic representation, the string of phones is segmented into successive segments, each of which contains, along with redundant (determined) features, the defining features f(P) of some phoneme (P), and the phonemic representation is just the sequence of these phonemes.

For Harris, invariance is merely one way of making the description simpler and more efficient:

> It is convenient to have the definitions of the various segments within a phoneme simply related

> to each other. We may try to group segments into phonemes in such a way that all the segments of each phoneme represent sounds having some feature in common which is not represented by any segment of any other phoneme. (1951:64)

If a phonetic feature is shared by all the segments that are grouped as members of a phoneme, then descriptive statements (rules) may refer to "the phoneme as representing this common feature, rather than as being a class of segments. Relations between phonemes would then represent relations between sound features" (1951:65). For Harris, this is a useful desideratum for formulating a grammar, but not a requirement. At the end of this paper we will consider why Chomsky was compelled by his commitment to PSG to elevate it to the status of a requirement for Generative grammar.

Harris says that this formulation is intended to be equivalent to the distinctive feature theory of Trubetzkoy, Jakobson, and their followers (Harris 1951: 125fn4, 146-149), with the crucial proviso that the elements must be defined relative to one another, as representations of contrast, rather than according to any absolute scale. This point is articulated clearly in Harris's review of Trubetzkoy (Harris 1941:346), which to my knowledge is never cited in Chomsky's writings:

> [I]t is pointless to mix phonetic and distributional contrasts. If phonemes which are phonetically similar are also similar in their distribution, that is a result which must be independently proved. For the crux of the matter is that phonetic and distributional contrasts are methodologically different, and that only distributional contrasts are relevant while phonetic contrasts are irrelevant.
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> This becomes clear as soon as we consider what is the scientific operation of working out the phonemic pattern. For phonemes are in the first instance determined on the basis of distribution. Two positional variants may be considered one phoneme if they are in complementary distribution; never otherwise. In identical environment (distribution) two sounds are assigned to two phonemes if their difference distinguishes one morpheme from another; in complementary distribution this test cannot be applied. … [T]he distributional analysis is simply the unfolding of the criterion used for the original classification. If it yields a patterned arrangement of phonemes, that is an interesting result for linguistic structure.

Chomsky distinguishes a strong and weak form of invariance. The difference that is most germane to phonological issues is that the weak form admits partial phonemic overlap and the strong form, attributed to Bloch, forbids it. However, Chomsky gives more weight to a distinction in the specification of f(P). He says that the strong form of invariance (e.g. Bloch) specifies f(P) with absolute phonetic descriptors, and the weak form of invariance (e.g. Jakobson) specifies f(P) with scalar values of phonetic parameters:

> One can distinguish two versions of the invariance condition, depending on whether the features are taken to be *relative* (i.e., more or less along a certain phonetic dimension) or *absolute*. (1964:79[408])

Chomsky's use here of the term "relative" has nothing to do with what Harris means when he says that phonological elements must be defined in relative terms, i.e. relative to one another. Harris's elements representing the contrasts are associated with phonetic data just because his analysis starts with a segmentation of phonetically specified utterances. It does not matter whether or not the *phonetic* specification associated with the segments is given as differentiated values on scales of phonetic measurement (Chomsky's sense of "relative"), or in terms of absolute phonetic data, as nearly as one could approach that. The crucial thing is that the phonological elements—the contrasts, and the marks, features, etc. by which we locate them in utterances—are defined relative to one another, that is, as contrasts.

In his discussion of biuniqueness, Chomsky (1964:82) appears to attribute to Harris and to Jakobson the weaker "relative" form of invariance that admits partial overlapping. This does not mean that Harris's

phonology was bound by the invariance condition, as taxonomic phonemics is said to be. Chomsky says (1964:79) "The invariance condition has no clear meaning unless the linearity condition is also met; I will assume, then, that it is inapplicable when linearity is violated." It follows that for Harris's phonology invariance is not required (since linearity is not), and indeed is possible only when he happens to conform also to the linearity condition. Harris sees both conditions as useful when they enhance the integrity of the grammar as a whole, so long as the one-one relation of phonemes to contrasts is preserved. We will return to this in the section on his criteria for grouping segments (a part of the discussion of complementary distribution, below).

To the extent that the distinctive features are phonetically specified, the notion of contrast in generative grammar entails the weak form of invariance. The distinctive features are sometimes spoken of as though they were the contrasts, e.g. +/-voice is "the voicing contrast," etc. This step of reification is seductive, but unwarranted. The feature [+/-voice] is a representation of a contrast in most, perhaps all, languages. However, that contrast might be represented instead by [+/-delayed VOT] or by some other phonetic parameter. The point is that neither representation is the contrast itself. Generative phonology proposes that a set of phonetic descriptors suffices to identify the contrasts of any language, universally. However, the features of this "universal alphabet" are still labels or representations of the contrasts, not the contrasts themselves. Indeed, they can only be thought of as the contrasts themselves on a presumption of phonetic invariance. If this supposition is correct, then Chomsky's use of the term "contrast" presumes weak invariance with respect to universal phonetic parameters such as [+/-voice], and identifies those parameters with the contrasts themselves.

Undoubtedly for Harris (as for any linguist), phonetic invariance applies to the initial segmentation of utterances. Once an utterance is segmented according to its differences with other, contrasting utterances, the resulting segments can be recognized in other utterances by their phonetic attributes, and recorded in the same way as for the first utterance. (These are not the "phones" of a phonetic transcription, because only those differences that make a difference between words are recorded.) And after segments with restricted distribution have been grouped into a set whose combined distribution is relatively unrestricted (a phoneme), a given phoneme alternant (allophone) is phonetically invariant whenever it occurs, with respect to those phonetic features that are linguistically relevant.

In summary, clearly the invariance condition does not apply to Harrisian phonemics in the way that it is used to characterize "taxonomic" phonemics.

2.3 Biuniqueness

Harris says that a number of criteria are "more powerful" than invariance (1951:65), and foremost among them is biuniqueness. The reason is obvious: the phonemes are a representation of the fundamental data of linguistics, the contrasts. Whatever is done to refine or redefine the phonemes, it must remain possible to identify from them the contrasts between utterances.

A conflict between biuniqueness and invariance is the crux of phonemic overlapping. Phonemic overlapping is a problem if you believe that invariance and linearity are preconditions for defining contrast. For Bloch this was an irresolvable problem. If he relaxed the requirement for biuniqueness (a relation between phonemes and phones), he was unable to recover the phones from the phonemes. If he relaxed the requirement for invariance he could recover the phones, but he no longer had a principalled basis for defining the phonemes in the first place.

Chomsky assumes Bloch's sense of biuniqueness. He says (1964:80[408]) that biuniqueness

> asserts that each sequence of phones is represented by a unique sequence of phonemes, and that each sequence of phonemes represents a unique sequence of phones.

When Harris introduced the term "bi-unique relation" in his paper on phonemic long components (1944a:187-188, footnote suppressed), it sounded like a correspondence of phones with phonemes.

> Finally, if we are ready to admit partial overlapping among phonemes, we may agree to have different components in different environments represent the same phonetic value. So long as we do not have a component in one environment represent two phonetic values which are not freely interchangeable, or two components or component-combinations in the same environment represent the same phonetic value, we are preserving the bi-unique one-to-one correspondence of phonemic writing. (The term bi-unique implies that the one-to-one correspondence is valid whether we start from the sounds or from the symbols: for each sound one symbol, for each symbol one sound.)

This statement is consistent with the 1945-1946 formulation published in (1951) because the "sounds" are the phonetic properties associated with each linguistically relevant segment, and the "symbols" are the marks in phonemic writing that represent those segments. Not any "sound" will do, but only those that are associated with the contrasts as a consequence of segmenting utterances.

Harris identifies his initial elements not by consulting phonetic theory or an inventory of universal features, but by consulting the linguistic intuitions of native speakers in the substitution tests (including the pair test) that first establish the contrasts, and then establish a linguistically relevant segmentation of utterances. The segmentation defines the phonemes of a language by isolating the contrasts, locating them relative to one another, and identifying them with phonetic properties found at those places in the segmented utterances. Phonetic properties are associated with each segment and with each phoneme because, after all, this is a segmentation of recorded utterances.

Biuniqueness is not *achieved* by subsequent procedures, it is *entailed* by this method of identifying the contrasts. There is intrinsically a one-one correspondence between these segments and the contrasts that they represent. Each distinct utterance is represented by a different sequence of segments, and each different sequence of segments represents a distinct utterance. The "biuniqueness condition" is therefore not a formal condition holding between representations at two different levels of description, a phonetic level and a phonemic level. Rather, it is a methodological requirement that one not lose or obscure the fundamental observational data for a science of language, namely, judgments by native speakers as to which utterances are repetitions and which are not.

The "sounds" of Harris (1944a) are equivalent to the segments that Harris (e.g. 1951:65fn14, 80.0, 85fn16) groups into a given phoneme while preserving a one-one correlation of phonemes to segments. The segments (with their associated "sounds") were set up at an earlier stage of analysis to be linguistically relevant by virtue of their one-one correspondence to the contrasts (either directly or by way of the segments used in still earlier stages of analysis). In other words, the biunique relation of representations to contrasts is transitive through successive reformulations of the representations. Any biunique correspondence of phonemes with "sounds" preserves the previously established biunique relation of those linguistically relevant "sounds" with the contrasts. Harris (1951) occasionally speaks of a one-one relation between phonemes and segments. This is a telegraphic usage, to avoid awkward repetition of the definition of relationship (1951:34-35) quoted earlier, where, after all, he had said "for convenience, we will set up as our elements not the distinctions, but classes of segments so defined that the classes differ from each other by all the phonemic distinctions and by these only."

When Harris describes the grouping of segments into a phoneme, it might appear that one of the requirements involves creating a biunique relation between the phoneme and its member segments, as though he were talking of a biunique relation of phonemes to phones. In fact, the requirement is not to create but to preserve the biunique relation between the phoneme and the contrasts that its member segments had. We will return to this under the topic of complementary distribution.

The biuniqueness condition, as it is used to characterize "taxonomic" phonemics, does not apply to Harrisian phonemics. In "taxonomic" phonemics, biuniqueness is a one-one correspondence of phones to phonemes; for Harris, it is the contrasts that have a one-one correspondence to the phonemic symbols (and associated phonetic properties) that locate the contrasts relative to one another in utterances.

2.4 Local Determinacy

Local determinacy is a context-free form of local determinacy: "neighboring sounds" cannot be used in defining a phoneme and partial overlapping is disallowed as well as complete overlapping. Chomsky says (1964:81-82[409]) that he is attempting to restate in clear and explicit form a widely held but inchoate view of what "taxonomic" linguists thought was necessary to maintain linguistics on a scientific footing. Local determinacy is a one-one correspondence:

> such that the unique phonemic representation corresponding to a given phonetic form can be determined by "purely phonetic" considerations, or perhaps, considerations involving only "neighboring sounds."

Chomsky says that local determinacy can be deduced from linearity and absolute invariance. He complains that the condition of local determinacy is difficult to state precisely, because the linguists whose views he is attacking have been frustratingly vague as to what they intended by it. And yet he claims that this strong form of local determinacy is the basic and most widely held sense of the biuniqueness condition. Apparently, "biuniqueness" signifies "local determinacy" thereafter, with no further discussion, except that to Harris and Jakobson specifically he attributes the weaker form that admits partial overlapping.

It is also possible to define local determinacy in negative terms as biuniqueness with no "mixing of levels":

> LD. Local determinacy prohibits recourse to the results of morphological or syntactic analysis, since they can be carried out only after the phonological analysis is complete.

This is Chomsky's way of bringing in the then widely held proscription against separation of levels. Separation of levels was the concern (which was indeed widely prevalent in post-war American linguistics) that the work of determining the phonemic system would be unscientific if it made use of morphology or other information from "higher levels" of the grammar. This appears to have arisen from an acute awareness of the essential abstractness of linguistic patterning, and a determination that conclusions about it should be reached from a solid, physical foundation. Thus, this concern is quite consistent with phonetic invariance and linearity, and might almost be thought of as following logically from them, or from the same premises as they. On this view, each step of linguistic analysis must be firmly anchored, through an explicit and rigorously defined succession of preceding steps, to the phonetic "facts of pronunciation." One of the benefits of identifying contrasts as the observational primitives of linguistics was to free the methodology of linguistics from this constraint with no loss of rigor.

Chomsky's reason for defining local determinacy as he did is that separation of levels is a *methodological* condition, and local determinacy is a *substantive* (or formal) condition. What does this mean? At the outset of Chomsky (1964), he set up a dichotomy between acquisition models and perceptual models. An acquisition model determines the correct choice of a phonemic system in accord with methodological conditions. A perceptual model relates a phonemic system to speech sounds in accord with substantive or formal conditions. Separation of levels is a methodological condition for learning the phonemic system, or for a linguistic discovery procedure. Local determinacy is a formal or substantive condition for recognizing phonemes in the phonetic continua of speech once the phonemic system has been determined (or learned). Chomsky argues that the former can shed no light on the latter. Setting aside this rather peculiar sense of "methodological"—he has told us that he is "not concerned with … methods of

investigation (analytic procedures)" (1964:7)—we may still wonder at this claim that speech recognition and speech production are not subject to constraints of the same sort.

However, this interesting and now forgotten bit of polemical scaffolding has no bearing on our present discussion. Harris is very much concerned with the methodology of linguistics in the sense of methods of investigation, not language acquisition. The only indication of local determinacy in Harris's work is as a practical matter: one should extend the environments that one tests no farther than is sufficient. Indeed, a rigid condition of local determinacy would contravene the characteristic "bootstrapping" approach to linguistic analysis that Harris followed in all his work, in which a first approximation is later refined by criteria that could not be applied or could not be defined at the earlier stage, in which tentative guesses as to the results of later stages of analysis (e.g. morphology) are used as guides at an earlier stage, subject to correction when the later work is carried out more fully, and in which earlier results are subject to re-evaluation in the light of results at a later stage, always with an eye to the overall simplicity of the grammar. This is what Harris means when he says that operations must be "carried out for all the elements simultaneously" without any "arbitrary point of departure" (1951:7). Thus, subsequent rephonemicization could take into account the results of later stages of analysis, including phonemic juncture and the boundaries of morphemes and words.

The local determinacy condition does not constrain Harrisian phonemics. Harris did not have qualms about the scientific status of invoking such entities as junctures and boundaries, and even morphophonemic alternations, both in preliminary guesses and also later for the sake of rephonemicization, because all his results refer back to the data of contrast (biuniqueness, properly understood). Given this touchstone of validity and scientific rigor, Harris was free to "bootstrap" his description by later refinements of early approximations and guesses without loss of methodological rigor. This freedom is unavailable to linguists for whom contrast is not an observational primitive, but rather something to be defined by distributional analysis of phonetic primitives. We will turn next, then, to the procedures of distributional analysis.

2.5 Summary

These four conditions are obligatory if one has only "the data of pronunciation" to work with—without linearity, invariance, biuniqueness (in the phone-phoneme sense), and local determinacy, one would be at a loss to say what might be in contrast with what. They are optional for Harris because his fundamental data are native speakers' intuitions of contrast, identified and located in elements of a representation by the substitution tests, including the pair test. The question is not what contrasts with what, but rather what can be used to represent the contrasts that are observed (this utterance is not a repetition of that one), locate them relative to one another, and associate them with phonetic features of speech. In Harris's (1991) view, the same question faces the child learning its first language.

3. Complementary Distribution

Chomsky says that complementary distribution is "the central concept of taxonomic phonemics as developed, for example, by Jones, Troubetzkoy, Harris, and Bloch," and attacks it as (1964:91[414]):

> […] basically, the principle of biuniqueness converted into a procedure. Regarded as an analytic procedure, its goal is to provide the minimally redundant representation meeting the conditions of biuniqueness and local determinacy.

Talk of a procedure as "providing" or "leading to" the correct representation suggests that it is a practical discovery procedure, such as might be implemented in a computer algorithm. Harris explicitly states that this is not what he is after, e.g.

> These procedures are not a plan for obtaining data or for field work. (1951:1)

> These procedures also do not constitute a necessary laboratory schedule in the sense that each procedure should be completed before the next is entered upon. […] The chief usefulness of the procedures … is … as a reminder in the course of the original research, and as a form for checking or presenting the results, where it may be desirable to make sure that all the information called for in these procedures has been validly obtained. (1951:1–2)

More importantly, distributional procedures do not and cannot *produce* biuniqueness in Harris's sense, they preserve it, exactly as operations in mathematical logic preserve truth value. It is essential to preserve the correspondence of representations to contrasts as one wrestles the representations into a form that supports the simplest grammar.

But we already know that Chomsky's concept of biuniqueness refers to a correspondence of phones to phonemes, rather than a correspondence of contrasts to segments of contrasting utterances, and we have seen that local determinacy refers to qualms about mixing of levels that did not concern Harris.

From this unpromising beginning, we will step through Chomsky's argument against complementary distribution.

3.1 Tentative Phonemes

Chomsky describes Harris's application of complementary distribution as follows (1964:92[414.3], italics in original), claiming to summarize Harris (1951: Chap. 7):

> Given a set of representations in terms of phones, let us define the distribution D(x) of the phone x as the set of (short-range) phonetic contexts in which x occurs. The relation of complementary distribution holds between phones x and y if D(x) and D(y) have no element in common. […] A *tentative phoneme* is a class of phones related pair-wise by the relation of complementary distribution. A *tentative phonemic system* is a family of tentative phonemes meeting a condition of exhaustiveness. We find *the* phonemic system (or systems) by applying additional criteria of symmetry.

The chief difficulty, as above, is Chomsky's assumption that Harris is manipulating phones to arrive at contrastive phonemes, equivalently to Bloch. Setting that aside, Chomsky's use of "pairwise" could occasion some confusion. Except for the first pair of segments compared, the two items being compared, x and y, are not of equal status. Chomsky might be understood as comparing the distributions of each pair of phones [*x*] and [*y*] in the set comprising a tentative phoneme /*z*/. However, Harris describes the comparison of distributions of a segment [*x*] and a "tentative phoneme" in the making, /*y*/, e.g. "We then look for a segment which is complementary to the first two" and so on, comparing a segment each time with the set of segments whose distributions had already been found to be mutually complementary (1951:61). Chomsky is characterizing the result in mathematical terms: a set of phones such that for each pair the distributions are complementary. After all, he told us at the outset (1964:7) that he is not concerned with procedural matters. In place of Harris's methodological basis for knowing that one's results bear a valid relation to fundamental data, Chomsky has substituted a reliance on universals.

However, this shift of perspective has a serious consequence for his reading of Harris. The comparisons of D(x) and D(y) are recursive, not merely successive, pairwise comparisons of phones. Chomsky describes a linear sequence. One imagines a sort of distributional analysis component that outputs a set of tentative phonemic systems as alternative candidates. These candidate phonemic systems are input to a test component, where they are subjected first to a test for exhaustiveness, then to "additional criteria of symmetry". The output from the test component is the winner, "*the* phonemic system (or systems)". Chomsky objects (1964:92-93[414-415]) that in some cases "the class of 'tentative phonemic systems' … will not include the optimal biunique system as a member, so that no supplementary criteria will suffice to select it from this class."

But Harris describes a massively parallel recursive process, not a linear sequence. The criteria are not applied to a set of alternative phonemic systems that are the outputs of distributional analysis, they are applied at every step of merging a segment with restricted distribution into a partially defined phoneme, whose distribution it complements and therefore adds to, resulting in a new phoneme whose distribution is less restricted.

The comparison of [*x*] and /*y*/ is one step of this recursive process, where [*x*] is a segment and /*y*/ is a phoneme-in-the-making. If the environments of segment [*x*] are complementary to those of phoneme /*y*/, and if the criteria indicate that an [*x*]- /*y*/ grouping is superior to other possible combinations (which are being tried in parallel), then [*x*] is merged into /*y*/. That is, the environments of /*y*/ now include those in which segment [*x*] occurred. It is to the now even less restricted tentative phoneme /*y*/ that other segments [*z*], etc. are subsequently compared.

The result in the end is of course just as Chomsky describes (on one reading of Chomsky 1964:92, anyway): each pair of the member segments of any given phoneme are complementary to each other, since complementarity is transitive over this succession of comparisons. However, the critical issue concerns not the end result but the recursive process of attaining it. At each step of the process, the environments of a tentative phoneme /*y*/ are augmented by those of a new segment [*x*]. Then, before proceeding further, all the environments that formerly contained the now-included segment [*x*] must be restated in terms of the redefined phoneme /*y*/ ("Adjusting Environments in the Course of Phonemicization", Harris (1951:62)). Chomsky reframes this rather obvious housekeeping step as an ad hoc procedure brought in just to save taxonomic phonemics from its flaws. In the light of the above discussion, the error can be clearly seen, for example, in (Chomsky 1964:87):

> Harris's proposal [resolving the overlapping of writer/rider] appears to involve an inconsistency with respect to the notion "distribution". Phonemes are to be established in purely distributional terms. If the distribution is with respect to *phonetic* contexts, then the definition of "phoneme" is violated by his assignment of [a] and [a·] to /a/, since these phones contrast in the phonetic context [—yD]. If the distribution is with respect to *phonemic* contexts (an assumption difficult to reconcile with a procedural approach, as noted above), then the definition is violated by the assignment of [D] to either /t/ or /d/, depending on the phonetic context, in this case.

On a correct reading of Harris, as shown above, this dilemma does not arise.

3.2 Criteria for Grouping Segments

The "additional criteria of symmetry" referred to in the above quotation of Chomsky (1964:92[414.3]) are not criteria for evaluating alternative "tentative phonemic systems" produced by analysis of the complementary distribution of phones relative to one another. They are criteria for making each choice in the course of grouping segments, one by one, into partially defined phonemes (Harris 1951:62-63). Another quotation affords a convenient context for reviewing these criteria. Chomsky argues (1964:77[407]) that the "phonetic substance" of phonemes cannot be supplanted by distributional or other criteria for grouping segments into phonemes:

> No procedure has been offered to show why, for example, initial [ph] should be identified with final [p] rather than final [t], in English, that does not rely essentially on the assumption that the familiar phonetic properties (Stop, Labial, etc.) are the "natural" ones. Harris might be interpreted as suggesting that a non-phonetic principle can replace reliance on absolute phonetic properties when he concludes (1951:66) that "simplicity of statement, as well as phonetic similarity, decide in favor of the p-ph grouping"; but this implication, if intended, is surely false. The correct analysis is simpler only if we utilize the familiar phonetic properties for phonetic specification. With freedom of choice of features, any arbitrary grouping may be made simpler.

Turning to the indicated place in Harris (1951), we find ourselves in the midst of his discussion (section 7.4) of criteria for grouping segments into phonemes. By now, of course, we are aware that Harris's segments (identified in Chapter 5, with extraction of suprasegmental contours in Chapter 6) are not phonetic primitives, they are representations of phonemic distinctions, albeit as yet inefficient representations. As representations, they are logical symbols (1951:8, 16&fn17, 18) serving to represent the contrasts; it is the contrasts that are the primitive elements (1951:34-35).

> It should be clear that … the criteria of 7.4 are not essential 'rules' for phonemicization, nor do they determine what a phoneme is. … [A]ny grouping of complementary segments may be called phonemic. … [T]he ultimate elements of the phonology of a language [… are] the distinct (contrasting) segments (positional variants, or allophones) rather than the phonemes. The phonemes result… from a classification of complementary segmental elements; and this [can] be carried out in various ways. … The linguistic requisite is not that a particular arrangement be presented, but that the criteria which determine the arrangement be explicit. (1951:72 fn 28)

Phonetic properties are associated with these logical symbols for the contrasts because they represent a segmentation of the speech stream. Various marks or symbols may be used for these symbols, to indicate the contrasts. Among the alternatives are marks that name the associated phonetic properties, so that the phonetic properties may themselves be made to serve as symbols for the contrasts in a given language or for classes of contrasts. Systems of distinctive features are perfectly equivalent to systems of segmental phonemes, and, even more, from this most general, formal point of view, there is no reason that "initial [ph] should be identified with final [p] rather than final [t], in English". Segmental phonemes are awkward for some statements of grammar in many languages; feature notation is extremely awkward for recording or analyzing texts, etc.; a grouping of initial [ph] with final [p] rather than final [t], in English, is very awkward for predicting the correct pronunciation of writing or for recording what is spoken.

When we undertake the work leading to a more efficient representation for the contrasts, "in most cases there will be more than one way of grouping segments into phonemes […] It is therefore necessary to agree on certain criteria which will determine which of the eligible segments go together into a phoneme" (Harris 1951:63). Harris's concern at this stage of analysis is to guide the process of grouping segments so that a simpler and more useful description is possible. The criteria that he applies to this end may be thought of as evaluation metrics, with the caveat that we have just noted in the preceding section: one should not think of some sort of 'distributional analysis component' churning out a set of candidate tentative phonemicizations, followed by an 'evaluation component' that applies the criteria and selects a winner as *the* phonemic system.

Most of the evaluation criteria by which Harris proposes to guide distributional analysis (section 7.3) to a more efficient representation for the phonemic distinctions (contrasts) are stated in terms of symmetry in the representation of sounds (section 7.42) and symmetry of environment (section 7.43), but in each case Harris clearly and unequivocally states that the motivation for the given criterion is not merely symmetry for its own sake but rather the simplifications that symmetry makes possible in the descriptive statements (rules) of the grammar. One metacriterion (condition for applying the other criteria) concerning the simplicity of the description is as follows:

> M1. Number and freedom: as few phonemes as possible with maximum freedom of occurrence among the phonemes (section 7.41).

A second metacriterion is as follows:

> M2. Effect on the phonemic system as a whole: "In all cases of associating segments […] the final decision rests with the way the grouping in question affects the whole stock of phonemes" (1951:71).

As we shall see, many of Chomsky's examples turn out to be straw men because they do not meet this metacriterion.

The three criteria that hinge on phonetic considerations ("symmetry in the representation of sounds") are as follows:

1. "Identity of representation among segments," that is, their having phonetic features in common (section 7.421). This is "convenient" because it makes for a simpler phonological description to be able to "speak of the phoneme as representing this common feature, rather than as being a class of segments. Relations between phonemes would then represent relations between sound features."
2. "Identity of inter-segmental relation among phonemes," that is, having the same phonetic difference between parallel pairs of allophones (section 7.422). "It is also convenient to have the relation among segment definitions within one phoneme identical with the relation in other phonemes." This makes for great simplification in the phonological description, because a single statement may account for the parallel allophony of multiple phonemes.
3. Choosing phonetic features that apply across the "complete phoneme stock" (section 7.423). "If the objective is a minimal stock of phonemes, the definition of each of which is to be as simple as our other criteria permit, it follows that the selection of the common features should be governed by the generality of these features and differences among all the segmental elements of the language." This is "convenient" because it broadens the set of phonemes to which a statement (rule) affecting a given feature can potentially be made to apply, simplifying the grammar. "We can discover which groupings [of segments] will yield the most simply defined phonemes by testing the differentiation, upon which we propose to assign particular segments, throughout all the segments."

Harris presents two other kinds of criteria which are ignored in Chomsky's (1964) argument. These criteria are also to be applied so as to increase the generality of statements (rules) and simplify the grammar. The first is the criterion of environmental symmetry (section 7.43). This is not mere formalism for its own sake:

> In all cases of associating segments on the basis of environmental symmetry, as in associating them by phonetic symmetry, the final decision rests with the way the grouping in question affects the whole stock of phonemes. Assigning a segment, in some environment, to a particular phoneme not only affects the membership and environmental range of that phoneme, and its similarity in these respects to other phonemes, but also prevents any other phonemes from having that segment in that environment.

Let us now examine the context from which Chomsky extracted the quotation, "simplicity of statement, as well as phonetic similarity, decide in favor of the p-ph grouping" as opposed to a possible grouping of [t] and [ph] into a single phoneme. This occurs in Harris (1951:66), section 7.422, criterion 2 (parallel allophonic differences). Harris says:

> This [criterion] requires that the segments be grouped into phonemes in such a way that several phonemes have correspondingly differing allophones (i.e. segment members) in corresponding environments. E.g. English [p, t, k] all occur in /s___V/, as in *stone*; [ph, th, kh] all occur in #___V/ as in *tone*. We could have grouped [p] and [th] together, since they are complementary. But the above criterion directs us (barring other relevant relations) to group [p] with [ph] into /p/, and similarly for /t/, /k/. For if we do so, we can say that the /#___V/ member of all these phonemes is virtually identical with the /s___/ member except that [h] is added; such a simple general statement would not have been possible if we had grouped the segments differently.

At the close of this passage occurs the footnote from which Chomsky has quoted:

> Symmetrical statements can often be made for several alternative arrangments of segments. For instance we can group [p] with [th], [t] with [kh], [k] with [ph] and say that the [#___V] member of each phoneme involves aspiration plus a shift of the point of closure one place back or two places forward ("place" being defined in terms of the tongue-palate contact positions recognized for the other phonemes). However, simplicity of statement, as well as phonetic similarity, decide in favor of the [p]-[ph] grouping.

In context, then, we can see that anyone who interpreted this quoted passage in the way that concerns Chomsky here would be distorting Harris's obvious intent. "Simplicity of statement" in the quoted sentence means that it is much simpler to talk of the group of sounds having an added [h] in the #___V environment than it is to talk of them having this same [h] plus a shift of place of articulation. In other words, Chomsky's major point of contention, that simplification of the grammar should be the overriding criterion for evaluating alternative analyses, is precisely what Harris had been advocating, and is indeed what Harris means by the disputed phrase "simplicity of statement". The phrase "as well as phonetic similarity" does not mean "that a non-phonetic principle can replace reliance on absolute phonetic properties", as Chomsky fears someone might read it to mean, but on the contrary refers to the fact that the case in hand would already have been decided by the immediately preceding criterion of 7.421, namely, that segments should preferably have a phonetic feature in common. At the place in the disputed text where this quotation occurs Harris has himself already made the point that a phonetic-feature criterion is not only relevant but that it is (of course) logically and methodologically prior to the criterion of phonetic parallelism (7.422) then under discussion.

When one reads what Harris was actually saying, Chomsky's interpretation of it as "suggesting that a non-phonetic principle can replace reliance on absolute phonetic properties" in this way seems at least far-fetched. Nevertheless, it is also clear that for Harris the phonetic properties of segments are subordinate to the fundamental relationship of contrast.

> If phonemes which are phonetically similar are also similar in their distribution, that is a result which must be independently proved. For the crux of the matter is that phonetic and distributional contrasts are methodologically different, and that only distributional contrasts are [linguistically] relevant while phonetic contrasts are irrelevant [for grammar]. (Harris 1941:346)

Chomsky, like Trubetzkoy and Jakobson, and also Bloch and the "taxonomic" phonologists, believes that phonetic contrasts are primary. They do not "intentionally select … these rather than any other. [They] merely use … them as though they were the natural and necessary ones to consider." (ibid.)

There is another criterion that Chomsky neglects to mention, namely, the criterion of morphemic identity (appendix to 7.4) with the obvious benefit of simplifying morphophonemics.

> Frequently, when we have to choose which of two segments to include in a phoneme, it happens that the choice of one of them would make for much simpler phonemic composition of morphemes than would the choice of the other. E.g. [t] and [p] are each complementary to [t^h]; which shall we group with [t^h]? If we associate [t^h] with [p] in one phoneme /T/ and [p^h] with [t] in another /P/, we would have /Teyk/ for *take* but /misPeyk/ for *mistake*, /Pä zes/ for *possess*, /disTä zes/ for *dispossess*. This would mean that later, when we set up morphemes, we would have /Teyk/ and /Peyk/ as two forms of one morpheme, the latter occurring after /s/. It is clearly preferable to group the segments [t^h] and [t] together into /t/, so that there should be a single morpheme /teyk/ having the same form after both # and /s/; this makes for a simpler description of the morpheme *take*. (Harris 1951:76)

In a nod to those who are concerned about "separation of levels", Harris observes that this criterion is not necessary for phonemics, though helpful, and that assignments based on this criterion are necessarily

tentative at this stage, based on "guesses" as to the shapes and boundaries of morphemes, subject to revision when the morphological analysis is carried out in full. He notes the obvious corollary that if on the other hand phonemic analysis is done first ("in order of rigorous analysis, not of time" (1951:196)) the phonemes are subject to adjustment later anyway, during the course of morphemic analysis. Because he had the data of contrast as his scientific bedrock, mixing levels was for Harris merely a matter of preference for the "order of rigorous analysis", and no bugbear.

Clearly, Chomsky's claim that "the correct analysis is simpler only if we utilize the familiar phonetic properties for phonetic specification" is false, and betrays either a misunderstanding or a misrepresentation of Harris.

3.3 Complementarity and Biuniqueness

Chomsky characterizes complementary distribution (1964:91[414]) as a procedure whose "goal is to provide the minimally redundant representation meeting the conditions of biuniqueness and local determinacy." Minimal redundancy is indeed an important aim of Harris's procedures, in order that the correlation of form with meaning should be as direct and transparent as possible. However, a set of elements that correspond one-one to contrasts between utterances is not necessarily minimally redundant. Many potential systems of representation might bear a biunique relation to the contrasts between utterances, including an initial segmentation determined (non-uniquely) by Harris's substitution tests.

All such representations are 'phonemic' in the essential sense that the contrasts are phonemic distinctions. Most of these possible systems of representing the contrasts have more elements than are needed, and the elements are more restricted than necessary in their combinations with one another.

Harris himself said (1951:62-63) that complementary distribution alone is not a sufficient criterion to guide the recursive process of grouping segments into phonemes to a preferred or optimal representation, and as we have seen he deployed a range of criteria for grouping segments so as to represent the phonemic contrasts more efficiently, that is, so as to simplify the grammar ("in most cases there will be more than one way of grouping segments into phonemes […] It is therefore necessary to agree on certain criteria which will determine which of the eligible segments go together into a phoneme" (1951:63)). It is difficult, therefore, to motivate Chomsky's demand that complementary distribution, reduced to a mechanical discovery procedure, should alone "provide the minimally redundant representation".

This is nonetheless the only possible construal to put on Chomsky's ensuing discussion of complementary distribution, as he turns to an example of phonemic overlapping due to Bloch. In the dialect that Bloch describes, alveolar flap [D] occurs intervocalically after stress in e.g. "Betty", and after θ in e.g. "throw". Chomsky says (1964:92[414]):

> The requirement of biuniqueness is preserved if we set up the phonemes /t/, with the allophone [D] in intervocalic, post-stress position, and /r/, with the allophone [D] after dental spirants. Given a phone in a phonetic context, we can now uniquely assign it to a phoneme; and given a phoneme in a phonemic context, we can uniquely determine its phonetic realization (up to free variation). However, this solution, which is the only reasonable one […] is inconsistent with the principle of complementary distribution. In fact, the allophones [D] and [r] of /r/ are not in complementary distribution since they both occur in the context [be-y] ('Betty', 'berry'). Hence complementary distribution is not a necessary condition for biuniqueness.

The sleight-of-hand here is in the phrase "the allophones [D] and [r] of /r/ … both occur in the context be-y]". The [D] that occurs medially after stress in 'Betty' is of course *not* an allophone of /r/. Chomsky's argument here goes through only if one insists that all occurrences of the phone [D] be assigned to one and only one phoneme, either /r/ or /t/. Without notice, Chomsky is assuming the strong form of the invariance condition prohibiting even partial phonemic overlapping. Underlying the invariance condition,

especially clearly in its strong form, is the familiar presumption that biuniqueness is a relation between phones (e.g. [D]) and phonemes (e.g. either /r/ or /t/). But Harris showed that the relation of biuniqueness instead properly holds between distinctions (e.g. ‘Betty’ vs. ‘berry’ vs. ‘throw’) and various means of representing them. See e.g. Harris (1951:34-35) on segments representing distinctions, "the representation of speech as a sequence or arrangement of unit elements is intimately connected with the setting up of phonemic distinctions between each pair of non-equivalent utterances," etc., and the discussion of contrast in section 1, above.

The relation between contrasts and representations in this example may be considered as follows:

Word Contrasts:	**"Betty"**	**"berry"**	**"throw"**
Representation #1:	beDiy	[beriy]	[θDow
Representation #2:	betiy	[beriy]	[θrow]

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In Representation #1, the distribution of the segment D is restricted to two environments, intervocalic and following θ. At the same time, the environment of the element t is restricted because it lacks the intervocalic environment, and the environment of the element r is restricted because it lacks the environment after θ. In Representation #2, all these restrictions are removed by adding to /t/ the intervocalic environment where D occurs and by adding to /r/ the environment after θ where D occurs. (We will discuss the formal basis for dividing the occurrences of D presently.) The segments in beDiy, beriy, θDow constitute a less efficient representation of the contrasts between words in English (including these three words) than do the segments in betiy, beriy, θrow, but both representations preserve a biunique relation to the contrasts. Chomsky is either misrepresenting Harris, or he has not understood him.

3.4 Neither Necessary Nor Sufficient

Chomsky continues (1964:92-93[414-415]):

> Furthermore, the class of "tentative phonemic systems" as defined in the preceding paragraph will not include the optimal biunique system as a member, so that no supplementary criteria will suffice to select it from this class.

This passage betrays the linear, non-recursive conception that Chomsky has of distributional analysis, in which he sees evaluation criteria as selecting one out of a set of phonemic systems output by a kind of complementary distribution module. In this case, to be sure, the evaluation criteria are not those that apply at each step of distributional analysis. These "supplemental procedures" are described in Harris (1951) chapter 8, Junctures, and chapter 9, Rephonemicization. Even so, the "supplemental procedures" resolve

problems of overlapping and neutralization such as these, not by "selecting" one of the tentative solutions given with distributional analysis and Harris's criteria of Chapter 7, but by generating new solutions not otherwise available (although in some cases they may confirm "guesses" as to the results of morphological analysis).

Crucially for this example, Chomsky ignores Harris's description of dividing the distributional range of a segment. We divide the [D] segment into two distributionally defined (but phonetically identical) elements, and assign the one that occurs after [θ] to /r/ and the one that occurs intervocalically after stress to /t/. This procedure is a further extension of distributional analysis, yielding a new system that had previously not been considered. Harris describes this procedure and its justification as follows (1951:91-92):

> The phonemic representation of a language may be simplified by means of this operation ["dividing the segment"] when the segment *A* cannot be put into any phoneme without disturbing the over-all symmetry, and when it is possible to partition *A* into such segments *A*1 and *A*2 as would fit well into the phonemes of the language. Assignment of both *A*1 and *A*2 to some other phonemes should yield a more symmetrical or otherwise convenient phonemic stock than assigning the original *A* to some phoneme. [This last sentence is a criterion, not a prediction.]

As we have seen, contrast is a primitive observation of the science, and the goal of determining or defining contrast was met at the outset. This is why complementary distribution is not necessary for determining contrast. Indeed, no criteria for identifying contrasts are necessary at this stage, since the contrasts were established by the pair test. Complementary distribution of *segments* is a criterion for the segments to be grouped into a phoneme, but only under a condition of phonetic invariance could this be construed as complementary distribution of *phones*. Under a condition of phonetic invariance, the phone [D] could not have been split into two distributionally defined but phonetically identical segments, one in one phoneme and one in another.

However, the thrust of Chomsky's argument against complementary distribution is that it is not sufficient to determine contrast. This is explicit in his next example (415.1):

> But now observe further that the class of tentative phonemic systems, as defined, will contain systems that fail the principle of biuniqueness. Thus, for example, [k] and [a] are in complementary distribution in English (and, furthermore, share features shared by nothing else, e.g., in Jakobson's terms, the features Compact, Grave, Lax, Non-Flat). Hence they qualify as a tentative phoneme, and there is a tentative phonemic system in which they are identified as members of the same phoneme /K/.

He goes on with examples of word pairs, e.g. "socked" and "Scot", that would have indistinguishable representations under this proposal, in violation of biuniqueness. From this he concludes that "the principle of complementary distribution does not even provide a sufficient condition for biuniqueness." But this is scarcely a discovery, since Harris himself motivates his criteria for grouping segments with the observation that complementary distribution by itself is not sufficient (1951:62-63):

> The operation of 7.2-3 [i.e. complementary distribution] determines whether segment *X* can be associated with segment *Y* in a single phoneme. But it is not sufficiently selective to determine which of two complementaries, *X* and *Z*, shall be included with *Y* (if *X* and *Z* are not mutually complementary, so that only one of them, but not both, can be associated with *Y*). […] It is therefore necessary to agree on certain criteria which will determine which of the eligible segments go together into a phoneme.

Further, Chomsky's way of stating the issue reverses the priorities. Biuniqueness is a one-one relation between contrasts (utterance-utterance distinctions) and a representation of those contrasts. It is a

requirement or condition only in the tautological sense that anything that does not preserve this relation is ipso facto not a representation of the contrasts. The logical relation of complementarity guarantees that if you group elements whose distribution is complementary into a new element, the new element necessarily retains the biunique relation that held between the original elements and the utterance-utterance distinctions. It is a logical operation that preserves biuniqueness in a way analogous to the manner in which operations in mathematical logic preserve truth value.

There is a perhaps more obvious problem with Chomsky's example of a complementary grouping of [k] and [a] into /K/, however, and that is that it would never be pursued very far, even by a mechanical discovery procedure (if there were such a thing), because it does not generalize. A tentative phonemicization that groups [k] with [a] exploits the complementarity of consonants with vowels. But having exploited it for the [k]-[a] pair, that complementarity is no longer available for all C-V pairs as a class. Major distributional regularities would be lost in favor of a smaller and more restricted grouping that adds to the complexity of the description. Descriptive statements (rules) could no longer apply to the class of vowels, or of consonants, or of stops, and so on. Thus, it is scarcely surprising that this socalled "problem has received little attention" (Chomsky 1964:93[415]).

Every step of this argument having fallen apart, Chomsky's conclusion falls too (1964:93[415]):

> Since it provides neither a necessary nor a sufficient condition for biuniqueness, and, apparently, has no motivation except for its connection with biuniqueness, the principle of complementary distribution appears to be devoid of any theoretical significance.

3.5 Adjusting Environments in the Course of Phonemicization

Chomsky next takes up Harris's discussion (1951: 62, section 7.31) of the need to redefine environments during the course of distributional analysis. When a segment being tested against environments is merged with others in a phoneme, before one can proceed with further analysis the environments for further testing must be rewritten, so that this segment is replaced by the phoneme everywhere that it occurs. We briefly discussed this recursive property of distributional analysis earlier. In a footnote (1951:62fn10, substituting small caps for subscript [û]), Harris points out the consequences of overlooking what is after all an obvious requisite for carrying out the work of linguistic analysis in a systematic and logical way:

> If we did not do this, but had included [*R*] and [r] in one phoneme /r/ ([*R*] after [*T*], [r] after [k]) and [*T*] and [k] in one phoneme /T/ ([*T*] before [*R*], [k] before [r]), we would have *try* and *cry* both phonemically written /Tray/. This would conflict with a basic consideration of phonemics, namely, to write differently any two utterances which are different in segments [so that the writing preserves the biunique relation that the segments had to the primitive distinctions — BN]. This inadmissible situation does not arise if we group [*R*] and [r] into /r/ while keeping [t] and [k] phonemically distinct from each other, since they contrast before the new /r/.

As we have seen (3.1, Tentative Phonemes), this is essentially a housekeeping step that must be taken each time a segment is combined with an existing phoneme-in-process (under the criteria identified in Chapter 7). However, Chomsky reframes it as an ad hoc procedure brought in to save taxonomic phonemics from its flaws. He proposes a "tentative phonemic system" (sic, see caveat earlier) in which (1964:94[415.3):

> […] we could have a phoneme /T/ with allophones [*T*] before [*R*] and [k] before [r], and a phoneme /R/ with allophones [*R*], [r]. But now both 'try' and 'cry' would be represented /TRay/. To avoid this, Harris suggests that we first group [*R*] and [r] into /r/, and then redefine distributions in terms of the newly specified contexts, in which [*T*] and [k] now contrast before /r/. This procedure will avoid the difficulty in the particular case of 'try', 'cry', but not in the cases described above.

The "cases described above" to which he refers are the pseudo-problems with pairs like "socked" vs. "Scot" that we have just seen evaporate upon examination.

3.6 Ou Tout Se Tient

There is a broader methodological issue lurking behind this discussion, concerning the handling of data in relation to emerging results. Chomsky's attack on distributional analysis continues (ibid.):

> Furthermore, the same procedure could just as well be used to group [t] and [k] into /T/, thus keeping [*R*] and [r] phonemically distinct (in further justification, we could point out that this regularizes distributions, since now /t/ occurs neither before /r/ or /l/, instead of, assymetrically, only before /r/). Hence, as in the case of the procedures discussed above, it fails to distinguish permissible from impermissible applications.

The same difficulty faces this pseudo-proposal as did Chomsky's earlier suggestion that [k] and [a] should be grouped in one phoneme. The analysis of distributional patterning cannot be done atomistically by treating one isolated example at a time, but rather, as Sapir taught and exemplified, only by holding the emerging structure of the whole always before one. Furthermore, what Chomsky touts as a gain in symmetry by increasing the restrictions on /t/, in fact goes against Harris's stated aim of eliminating as many restrictions as possible. Again, it is not clear whether Chomsky has misunderstood Harris or is misrepresenting him.

Having diminished a broadly applied housekeeping principle to the status of an ad hoc "procedure" aimed at rescuing distributional analysis from awkward counterexamples like the grouping of [t] and [k] into /T/, Chomsky argues that such a procedure violates a global requirement that Harris must retain in order to avoid use of rule ordering. Continuing (ibid.):

> Finally, the procedure [sic] as stated is inconsistent with Harris's general requirement on the set of linguistic procedures (1951:7), namely, that operations must be "carried out for all the elements simultaneously" without any "arbitrary point of departure."

Turning to Harris (1951:7), we find the following:

> In both the phonologic and the morphologic analyses the linguist first faces the problem of setting up relevant elements. To be relevant, these elements must be set up on a distributional basis: *x* and *y* are included in the same element *A* if the distribution of *x* relative to the other elements *B*, *C*, etc., is in some sense the same as the distribution of *y*. Since this assumes that the other elements *B*, *C*, etc., are recognized at the time when the definition of *A* is being determined, this operation can be carried out without some arbitrary point of departure only if it is carried out for all the elements simultaneously. The elements are thus determined relatively to each other, and on the basis of the distributional relations among them.

One could wish that Chomsky had read this passage more carefully. It does not express a requirement imposed by Harris, but rather a requirement imposed by the character of the material being worked with, for there is no a priori basis for identifying the elements of language other than relative to one another, no metalanguage external to and prior to language itself.

Harris continues (1951:7, emphasis added):

> It is a matter of prime importance that these elements be defined relatively to the other elements and to the interrelations among all of them. The linguist does not impose any absolute scale upon a language, so as to set up as elements, for example, the shortest sounds, or the most frequent sounds, *or those having particular articulatory or acoustic properties*. Rather, … he sets up a group of elements (each by comparison with the others) in such a way as will enable him most

> simply to associate each bit of talking with some construction composed of his elements.

When Harris talks of the elements of language being relatively defined, and not absolutely, he is referring as Sapir did to the patterning and configuration that characterizes and indeed constitutes language. Chomsky has shrunk this global perspective down to an ad hoc demand placed upon mechanical discovery procedures. It is precisely the need to consider all the elements together in a systematic whole that precludes absurdities such as Chomsky's proposed merger of [k] with [t] or with [a], as we have seen. Recall that the elements being defined are logical symbols with which phonetic properties are associated (1951:8, 16&fn17, 18, discussed above in 3.3, Criteria for Grouping Segments). The issue cannot be predetermined by the phonetic properties associated with these elements (although phonetic likeness is a desirable optional criterion), precisely because of cases, such as the one cited above, in which we wish to divide a phonetically defined element like [D] into two distributionally defined elements, [D] after [θ] vs. intervocalic [D], so as to yield by their subsequent inclusion into more general elements a systemically simpler and more useful result.

Chomsky's rather curious suggestion that Harris wishes to avoid rule ordering is in his next sentence at the cited place (1964:94[415]):

> In fact, this requirement [that linguistic patterning be dealt with as a whole, that elements be defined relative to one another without any arbitrary starting point defined in absolute terms] was what made it possible for Harris to avoid Bloomfield's use of descriptive order. But it is violated by the procedure just discussed.

We will take up the question of rule ordering in section 4, noting here only that it would be absurd to suggest that Harris abjured Bloomfield's use of ordered rules. The relevant passages in Harris (1951) are in the Appendix to 14.32 (237-238), where an "exact statement of the representation of the morphophonemes" is an alternative way of stating an example from Bloomfield's account of Menomini, and in the Appendix to 16.21 (283), where the use of descriptive order is given as the alternative. They are presented as alternatives, with prejudice to neither. Harris (307-308 fn 14) also suggests that descriptive order is essentially connected with his overarching goal of simplicity, in discussing the selection of a morpheme alternant as the base form for morphophonemic descriptions: "The criteria for selecting a basic alternant are not meaning or tradition, but descriptive order, i.e. resultant simplicity of description in deriving the other forms from the base."

3.7 Chomsky's "Condition C"

Chomsky closes his survey of "taxonomic phonemics" in general and of complementary distribution in particular with the following generalization, labelled "condition C" (1964:95[416]):

> C. If phone sequences X and Y contrast, then their phonemic representations must differ.

Condition C is followed by the claim that "there are no known distributional procedures for defining phonemes that guarantee that this condition will be met, and, in particular, the principle of complementary distribution fails in actual cases." These statements nicely summarize the principal misconceptions (or misrepresentations) of Harris's work that pervade this discussion.

Chomsky's Condition C states the case in terms of phone sequences that contrast. This amounts to substituting Chomsky's "universal phonetic alphabet" in place of Harris's segmentation based upon substitution preserving contrast/repetition. Harris's initial segments are defined relative to one another, but Chomsky assumes the initial segments are "phones," elements defined in phonetic terms. Harris of course uses terms of phonetic theory as descriptors of phonetic properties associated with the segments, but the phonetic properties do not determine the segmentation or the linguistic relevance of the segments. Harris's segmental representations of the contrasting utterances always necessarily differ, no matter

whether they count in Chomsky's reckoning as "phone sequences," as "tentative phonemes," or as phonemic representations. They always differ because Harris's representations of utterances are representations of contrasts between utterances, and therefore necessarily have a biunique correspondence to the contrasts between utterances. Chomsky's Condition C is met from the outset.

The satisfaction of Condition C is preserved under distributional redefinition of the phonemic elements, not created by it. The procedures of distributional analysis ensure that each subsequent redefinition, refinement, and rephonemicization of the representation preserves the biunique correspondence that the prior one held with respect to the contrasts. The relation of Biuniqueness is transitive all the way back to the initial representation, such that each new representation of utterances X and Y *a fortiori* has a one-one correspondence to the primitive contrasts between utterances X and Y. As a consequence, "if phone sequences X and Y contrast", then the representations of X necessarily differ from the representations of Y under all these redefinitions, so long as Harris's procedures are followed. The criteria of simplicity and symmetry (in the several senses of 7.421, 7.422, 7.423, and 7.43) help to determine one of the solutions that best meet the overarching criterion of simplicity or efficiency.

4. The Argument From Rule Ordering

Surrounding the discussion of "taxonomic phonemics" is a presentation of Halle's argument (Chomsky, 1964:88[412-413]) "that it is generally impossible to provide a level of representation meeting the biuniqueness condition without destroying the generality of rules, when the sound system has an assymetry." To demonstrate this, derivations of different forms are laid out in parallel, showing a segmental representation after each application of rules. (In the following adaptation of Halle's example, diacritics are omitted.)

	Levels	**Rules**	**Stop**	**Affricate**
1.	"Systematic phonemic"	(underlying forms)	d'at, l,i d'at, bi	z'ec l,i z'ec bi
2.	"Taxonomic phonemic"	Morphophonemic rule	d'at, l,i d'ad, bi	z'ec l,i z'ec bi
3.	"Systematic phonetic"	Allophonic rule	d'at, l,i d'ad, bi	z'ec l,i z'ej bi

In Russian, voicing is contrastive for stops but not for the affricate. (This is the "assymetry" in Chomsky's statement.) A rule that voices obstruents before voiced obstruents is morphophonemic for stops, but allophonic for the affricate. The morphophonemic and allophonic rules are identical in form, they differ only in their scope. Because there is no voicing contrast for affricates, the voicing rule affecting them is allophonic, whereas the rule affecting stops is morphophonemic. For each segmental representation that we might propose as the phonemic "level of representation", it is shown that before that level some rule applies as a morphophonemic rule to some forms, and that after that level an identical allophonic rule applies to other forms.

This difficulty dissolves as soon as you realize that the distinctive features *are* the representations of contrasts. Harris had observed that his simultaneous components in general (1944a:205, 1951:133.3) and distinctive features in particular (unit-length components defined for the whole stock of phonemic contrasts of a language, 1951:147.2) may supplant the segmental phonemes.

Chomsky proposes to eliminate the phonemic "level" of representation:

i. physical phonetics

ii. systematic phonetics (distinctive features)

~~iii. "taxonomic phonemics"~~ (segments, eliminated)

iv. systematic phonemics (morphophonemic representation)

In fact, the representation of phonemic contrasts is simply shifted from "taxonomic" segmental phonemes to distinctive features. What Chomsky calls "systematic phonetics", using distinctive features, is no less phonemic than the segmental representation that it supplants. The effect of the actual changes in representation of sound systems is as follows:

i. phonetics

ii. contrasts: segmental representation → feature representation

iii. base (morphophonemic) representation

If you state your rules in terms of distinctive features, then your phonemic representation is distributed throughout the successive stages of a derivation — in fact, everywhere that the distinctive features are used. The question "where are the phonemes" is sensible only if one sees the task of phonology as *defining* contrast; when contrasts are the primitive data of the science, this is a non-issue.

5. Consequences for Grammar and for a Theory of Language

Halle (1954:335) and Chomsky (1957:234[343]) refer to the pair test as a fundamental starting place for identification of repetitions, but they do not recognize that the substitution tests (including the pair test as a special case) are the basis for segmentation of utterances. Nor are the ramifications of contrast being given in advance developed in Generative phonology. Instead, the notion of contrast is presented just as in the work of Bloch and other "Neo-Bloomfieldians": a function of phonetic differences between physically defined segments, as given by an antecedent study of phonetics. Chomsky (1964) does not say how the segmentation is done. Halle (1954) seems to suggest that to define an inventory of segments we should (1) use the pair test to partition the set of utterances into repetitions and non-repetitions, (2) create an exhaustive roster of minimal pairs, (3) project matrices of universally distinctive features onto the minimal pairs.

The shift from a segmental representation to a distinctive feature representation changed the character of descriptive statements of phonology and in particular the character of rules deriving phonetic descriptions from morphophonemic representations. It is true that Bloomfield (1933) had conceived of the phoneme as a bundle of distinctive features, but it appears that he thought of the bundle (the phoneme) as the fundamental thing, an "indivisible unit" (1933:79), and the features as a part of their descriptive analysis. In the proposals of Jakobson, Fant, Halle, and here Chomsky, the converse is true: the distinctive features were seen as fundamental, and segmental (alphabetic) representations were seen as convenient notational abbreviations. Indeed, Chomsky & Halle (1965:472) argue that a segmental representation may be dispensed with entirely:

> We conclude, therefore, that only feature notation has linguistic significance, and that segments are simply to be regarded as conventional abbreviations, utilized to cope with the exigencies of printing but having no linguistic significance in themselves.

Harris's position was that the contrasts are fundamental, and the choice of representation is a matter of

notational convenience. To illustrate this, consider the following example of a reconstructed sound changes:

IE */te/ > Indo-Iranian */ta/
IE */to/ > Indo-Iranian */ta/
IE */k^we/ > Indo-Iranian */ča/
IE */k^wo/ > Indo-Iranian */ka/

Conventionally, the vowel merger (IE */e/, */o/ > Indo-Iranian */a/) is seen as the condition for a split of IE */k^w/ into Indo-Iranian */č/ and */k/. But here our predisposition to a familiar alphabetic segmentation obscures what is going on. Did the vowel merger precede a split in the consonant segments? Presumedly, a non-contrastive palatalization of consonants before front vowels became contrastive with the merger of the vowels. The palatalization became the locus of the contrast of Indo-Iranian */ča/ vs. */ka/, but when the palatalization of */t/ was lost a contrast was lost with it.

IE *[t'e] > Indo-Iranian */ta/
IE *[to] > Indo-Iranian */ta/
IE *[k'^{w}e] > Indo-Iranian */ča/
IE *[k^wo] > Indo-Iranian */ka/

It is somewhat more obvious with feature notation (but possible in either notation) to speak of palatalization spreading synchronically from the IE */e/ to the preceding consonant. However, conventional feature notation conforms to the same conventional CV segmentation, and leads us to perceive a shift of the feature (in base forms) from the V segment to the C segment, together with a loss of the spreading rule. This imposes a discrete punctuality on the continuity of history. Using a fairly recent incarnation of distinctive feature theory (Clements & Hume 1995, Nevin 1998):

	t'	e	t	o	k'^{w}	e	k^w	o	
laryngeal									
[spread]	+		+		+		+		
[constricted]									
[voice]		+		+		+		+	
[nasal]									
oral cavity									
aperture									A_0
[open]		+		+		+		+	A_f
[open]		+		+		+		+	A_{max}
[open]		+		+		+		+	mid
[open]									low
[labial]				+	+		+	+	
[coronal]									
[anterior]	+		+						
[distributed]	(+)	+			(+)	+			
[dorsal]				+				+	
[posterior]					+		+		

As a notational abbreviation, parentheses show leftward spread of the [+distributed] feature. The corresponding matrix for the Indo-Iranian CV sequences is easy enough to construct, so that I won't belabor the obvious point that this notation is rather less convenient for writer and reader.

Harris could define IE */e/ so that it includes a long component of palatalization that extends over a preceding consonant. This is functionally equivalent to the leftward spread of a feature, differing only in

where in the representation of contrasts the information is located (the definitions of segments vs. rules that apply to feature matrices that specify segments).

The salient point is that palatalization, or the [+distributed] feature, is retained in the CV sequence IE */k^we/ > Indo-Iranian */ča/ *in its entirety*, (i.e. the vowel */a/ of the latter is presumably palatalized or has a palatalized onset), and it is lost from the CV sequence IE */te/ > Indo-Iranian */ta/ *in its entirety*. The perceived shift of the feature from the V segment IE */e/ to the C segment Indo-Iranian */č/ is a notational artifact, a decision in each case as to the location of the contrast that holds between *utterances* in which these segments occur.

IE	*/te/ *[t'e]	*/to/ *[to]	*/k^we/ [k'^{w}e]	* /k^wo/ [k^wo]
Indo-Iranian	*/ta/		*/ča/	*/ka/

A purely phonetic basis for segmentation is not linguistically relevant because it says nothing about the correlation of form with meaning.

Re Halle's Russian example, it is the same rule for a difference that marks a contrast and a difference that does not, but who cares? There is still a difference between contrastive and non-contrastive forms.

In Harris's view, neither the features nor the segments have any privileged ontological status. It is the contrasts that are "real". This broaches the peculiar ontological status of language. In the familiar Berkeleyan example, if a tree falls in a forest and no one is there to perceive it, we nonetheless assume the reality of the tree and of the event, and, insofar as sound is defined in physical terms as pressure waves in the atmosphere, there is a sound. However, if a tape recording of the Gettysburg Address is played in the forest and no one is there, there is *only* sound. There can be no language present—no words, no contrasts or distinctive features—in the absence of a hearer who controls perceptions of the words, contrasts, etc. of English. The contrasts may be represented by phonemic segments, phonemic components, distinctive features (unit-length phonemic components), or in some other way, but they cannot be defined absolutely, in purely physical terms. They can only be defined relatively, in terms of the contrasts between utterances that they represent. And the contrasts are not physically given, they are socially given. This is why the pair test is necessary for determining the phonemic distinctions or contrasts in a language. The means for making contrasts may be universal; the contrasts are as language-particularized as the vocabulary in which they may be located.

In Chomsky's view, the features are real in the sense that they are built into the human brain according to inherited properties of the human genome. They are genetically given. But the features are the available means for making contrasts. The contrasts themselves must be determined for each language by the pair test.

For Harris, phonology is encapsulated, in the sense that to work on syntax and semantics it does not matter what representation is used for the phonemic contrasts, ordinary orthography will do; and clearly this is also the case in practice for Generativist syntax.

For Chomsky, feature notation is required because PSG drives phonetic content out at the bottom just as it drives semantics out at the top. In operator grammar, phonetic content associated with segments is present from the moment of word entry in the base. For Chomsky, phonology, morphology, and syntax are interimplicated in a fragile structure of great complexity.

Features are useful for stating universals.

The purpose of this paper has been to to set the record straight and to explicate Harris's insights into the nature of linguistic contrast. The consequences of reinstating these insights appropriately in the theory and practice of linguistics today go beyond what it is possible to consider here.

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