LEONARD BLOOMFIELD AND THE PHONOLOGY OF THE MENOMINI LANGUAGE

by

THOMAS GORDON BEVER

B.A., Harvard College
(1961)

Submitted in partial fulfillment
of the requirements for the
degree of Doctor of
Philosophy
at the
Massachusetts Institute of
Technology
May 1967

Signature of Author _____
Department of Modern Languages and Linguistics
May 15, 1967

Certified by _____
Thesis Supervisor

Accepted by _____
Chairman, Departmental Committee
on Graduate Students

FRONTISPIECE

"The Menomini Language
by Leonard Bloomfield

The last complete work, and in many ways the chef-d'oeuvre, of one of the greatest of American linguists, the MENOMINI LANGUAGE is the end product of half a lifetime of study in the Algonquian family of languages, and the distillation of Professor Bloomfield's long and intimate personal experience with the Menomini tribe. As a description, the book is far more complete and detailed than most comparable studies; as a theoretical work it is unusual in its avoidance of theoretical discussion and its sober concentration on the facts of the language."

- On flyleaf of "The Menomini Language" by Leonard Bloomfield - (Italics not in the original)

DEDICATION

To each of the seventeen readers who care.

ACKNOWLEDGEMENTS

The author is indebted to many teachers who have aided in the formation of this work; in particular, M. Halle, G. H. Matthews, N. Chomsky, K. Teeter and P. Kiparsky.

ABSTRACT

This work concerns two interpretations of the sound system of the Menomini language. One interpretation was developed by Leonard Bloomfield over an extended period and presented in two publications, "Menomini Morphophonemics " (1939), and "The Menomini Language" (1956). A second interpretation reanalyses the phonological grammar, with the grammatical formulations recently developed by M. Halle, N. Chomsky and their associates. In the second chapter, an examination of Bloomfield's analysis of Menomini phonology shows that many of his techniques and assumptions implicity reflect certain explicitly formalized aspects of modern generative phonology. In the third chapter a skeletal generative analysis of Menomini phonology demonstrates that the Menomini language has only four vowels and no basic semi-vowels. This analysis also shows that several large sets of irregular forms have regular explanations.

Table of Contents

CHAPTER I

Introduction and Summary

This work concerns two interpretations of the sound system of the Menomini language. One interpretation was developed by Leonard Bloomfield over an extended period and presented in two publications, "Menomini Morphophonemics" (1939), and "The Menomini Language" (1956). A second interpretation reanalyses the phonological phenomena of Menomini in terms of a generative phonological grammar, with the grammatical formulations recently developed by M. Halle, N. Chomsky and their associates. In the next chapter, an examination of Bloomfield's analysis of Menomini phonology shows that many of his techniques and assumptions implicitly reflect certain explicitly formalized aspects of modern generative phonology. In the final chapter a skeletal generative analysis of Menomini phonology demonstrates that the Menomini language has only four vowels and no basic semivowels. This analysis also shows that several large sets of irregular forms have regular explanations.

Chapter II. Bloomfield's Analysis of Menomini.

There are at least two aspects of Bloomfield's writings. The best known is a behavioristic philosophy of linguistics and corresponding requirements for linguistic

descriptions (1933). In another aspect Bloomfield (1914, 1939, 1956) ignored all of this philosophy and most of its descriptive requirements. It is his descriptive practice that gives insight into this side of Bloomfield's views on linguistics and grammar.

It is impossible to determine which Bloomfield was the more basic, but it is clear that he was in conflict. Bloomfield the behaviorist is well-known and has been well studied. Bloomfield, the practicing linguist, however, has largely been ignored. The only exception to this lack of interest, (Hockett's "Implications ...," 1956), merely derives a set of methodological homilies on how to decide what is a usable 'fact' in the historical reconstruction of languages.

In this chapter I attempt to analyze Bloomfield's assumptions about the structure of a phonological analysis, what he thought "phonemes" ought to be, and whether he assumed that linguistic analyses are reflections of the psychological structure of human beings.

The basic facts about Bloomfield's views appear both in the explicit and implicit forms of his grammar. In some cases notational devices explicate his theory; in others it is necessary to search for chance statements which indicate the reasons for a given analysis. The discussion of Bloomfield's system considers the basic syntactic principles of word formation, the concept of descriptive simplicity, the

treatment of irregular forms, abstract segments, syntactic information in the phonology, the internal composition of abstract and concrete segments, the ordering of rules, the "phonemic" level, and the 'reality' of grammar. Briefly, Bloomfield's phonological system has the following properties. Basic roots and affixes are listed in the lexicon. Recursive structural processes operate on these basic forms and combine them into basic words. These are structurally labelled sequences of abstract phonological segments, "morphophonemes." The morphophonemes have no internal structure; they are indivisible theoretical units. The morphophonemeic component operates on a syntactically-labelled sequence of abstract morphophonemes and yields a broad phonetic transcription which maps directly onto concrete phonological segments. Further minor modification is governed by the "phonetic" component, to produce "the sounds of actual speech."

The morphophonemic system consists of about 25 rules, descriptively ordered to apply in a rigid sequence such that a later rule applies to the output of previous rules. The rules contain rewrite processes in which a particular symbol or sequence of symbols in a particular environment is replaced by another symbol or sequence. A single numbered rule can contain several such processes but contains only one environment statement. Processes in the same rule apply simultaneously.

The rules attain a single chain of at least 12 critically ordered statements (or 11 ordering conditions). The rules are sensitive to syntactic information in the environment statement, although they do not have the power to change the structural labelling. By convention, all the rules apply to sequences within word boundaries, except for the assignment of stress which applies to syntactic structural units below the level of whole sentences. The same stress assignment rules apply to single words as to phrases.

In general, lexical forms are set up at the convenience of a rule's particular analysis. Considerations of "descriptive convenience" are used to motivate apparent exceptions to morphological or morphophonemic generalizations. The exceptions are assumed to have special underlying abstract roots and word structure so that they are not exceptions to the descriptive rules themselves. This produces highly abstract claims: that roots exist for which there is no direct lexical evidence, or that sequences of morphemes exist for which there is no direct phonological evidence. In both cases these claims about lexical structure are made to minimize the number of exceptions to particular rules. Whenever possible, the underlying forms of exceptions are set up so that they are automatically correctly treated by the rules. Statements of the form "x is the exception to rule N," are explicitly avoided since they reduce the power

of the generalization expressed by rule N.

In many respects Bloomfield was utilizing principles which are currently formalized in generative phonology, e.g., ordered rewrite rules, abstract information, descriptive simplicity, and so on. The most striking similarity in Bloomfield's analysis to generative phonology is his explicit rejection of a taxonomic phonemic level and his rejection of the associated principles of complementary distribution and biuniqueness. This contradicts his general theoretical adherence to these principles in other works. Given the chance to follow them himself, he points out that it would be pointless and would complicate the grammar unnecessarily.

Finally, Bloomfield appeared to assume that a grammar is psychologically relevant; however, this appearance might only be due to carelessness. Nevertheless, it is true that he described local dialects by specific rules added to the basic grammar which is shared by all speakers of Menomini. Also, his analysis of various "nonce formations" can be understood only if one assumes that the abstract levels of the grammar are part of a speaker's knowledge. In the two major theoretical works by Bloomfield, "The Study of Language" (1914) and "Language" (1933), we can see this conflict over

the "psychological reality" of grammar. There is no doubt that in the earlier work Bloomfield assumed that speakers knew and used the rules of their language. Later he rejected this position on methodological grounds. It may also be the case that he rejected it because of the great complexity which he found in actual linguistic grammars. In his Menomini studies he wavers and makes many statements which can be understood only if the grammar is considered part of a speaker's knowledge. However, it is probably not legitimate to conclude that Bloomfield would claim the psychological reality of his analyses, only that he wanted to.

Chapter III. Phonological Problems in Menomini.

This chapter presents a brief discussion of some descriptive problems in Menomini phonology. Since the reanalysis is expressed in generative phonology, this discussion not only explicates certain phenomena of Menomini, but also highlights some of the differences between Bloomfield's techniques and those developed more recently. Although this section is primarily about Menomini, various problems are presented and discussed in the terms that Bloomfield used. The topics covered are: the major segment features, the theoretical segment /N/ and the history of Menomini, the basic four vowels, the phonological cycle, the assignment of vowel length, and the treatment of glottal stop.

1) The major segment features in the output of the grammar are:

	vowel	non-nasal consonants	nasal consonants	semi-vowels	glides
sonorant	+	-	+	+	-
consonantal	-	+	+	-	-
vocalic	+	-	-	-	-

2) A regular process softens /t/ to /c/ and a theoretical segment /N/ to /s/ before /-e/. If /N/ does not occur before /-e/, it appears as /N/. Distinctive feature analysis indicates that "N" is actually a /θ/ and that a general rule describes the mutation of /t/ and /θ/.

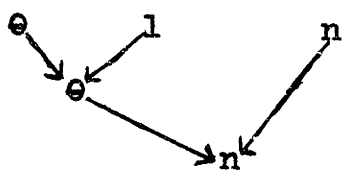
$$\begin{bmatrix} - \text{ nasal} \\ - \text{ grave} \end{bmatrix} \longrightarrow [+ \text{ strident}] \quad / \text{ before /e/}$$

A later rule transforms non-mutated /θ/ into /n/. This analysis agrees with the historical development from Proto Algonquin.

Proto Algonquin

pre-Menomini

Menomini



3) There are only four basic vowels, /e,æ, a,o/ and no semi-vowels. However, six vowels (twelve including long and short) and two semi-vowels can appear in the output of the grammar: long and short /i,e,æ, u,o,a/ and /y,w/. /i,u/ are predictable from sequences of semi-vowels and non-

high vowels. The semi-vowels /y,w/ themselves are predictable from /e,o/ since no sequences of vowels occur in basic forms, and since semi-vowels never directly precede a non-vocalic segment (except another semi-vowel). This leaves the basic Menomini segments unmarked for vocalicness, and the basic kinds of segments are:

	æ	e	a	o	consonants	glides	nasals
son	+	+	+	+	-	-	+
cons	-	-	-	-	+	-	+

This analysis also coincides with the history of Algonquin.

4) Words with a short initial syllable ending in a glottal cluster ("glottal words") are irregular with respect to several processes. The irregularities are resolved if we assume that the /#(C)Vq-/ sequence is actually /#(C)V̄qV -/. This is true for vowel length alternations, vowel raising, stress assignment, vowel reduction (and the assignment of vocalic "echo" following /q/). Several general morphologically determined exceptions are also simplified by this analysis.

5) The description of Menomini phonology in distinctive feature phonology involves several types of rules which have implications for general phonological theory. The most important is the need for phonological variables in rules which exchange segments. The semi-vowel-vowel assimilation rules require that /e/ be exchanged with /æ/; that is, all

vocalic segments $\begin{bmatrix} - \text{ long} \\ - \text{ comp} \\ - \text{ grave} \end{bmatrix}$ become $[+ \text{ comp}]$, and all vocalic segments $\begin{bmatrix} - \text{ long} \\ + \text{ comp} \\ - \text{ grave} \end{bmatrix}$ become $[- \text{ comp}]$. Two rules, (e → æ) (æ → e) can accomplish this result only if they apply simultaneously. If variables over features (e.g. "α" = "+" or "-") are part of phonological theory then the two rules can be stated in one simultaneous rule:

$$\begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ \alpha \text{ comp} \end{bmatrix} \longrightarrow [\sim\alpha \text{ comp}]$$

6) A second theoretical problem involves the notational conventions for expanding rules with optional environments. X(Y) is interpreted as two rules (a) "XY" and (b) "X" applying in that order. They apply disjunctively so no segment involved in (a) can be modified by (b) (although it can serve as part of the environment of (b)). This interpretation of disjunctive rules allows the semivowel assignment rules to be simply stated:

$$\text{e, o} \longrightarrow \text{semivowel} \;/\; [+ \text{ voc}] \_\_ \begin{cases} \text{(a)} \\ \text{(b)} \end{cases} \begin{matrix} [+ \text{ voc}] \\ + \end{matrix}$$

This is the notational form for a series of ordered rules, disjunctive in the above sense. But only with that sense of disjunction does the above rule work correctly.

CHAPTER II

General View of Bloomfield's Treatment of Menomini

At least three phonological investigations in Bloomfield's Algonquin Studies experiment with ordered phonological rules. One such article appeared in 1939, "Menomini Morphophonemics," (MM) and two books were published posthumously, "Eastern Ojibwa," (EO) and "The Menomini Language" (M).[1] Although these three works contain a meagre amount of explicit theory, Bloomfield's practice in them offers a fairly complete understanding of his methods and theoretical assumptions. The three morphological systems all present the same general view of phonological processes. Characteristics of this general system pertinent to the present work are summarized in Figure 1.

Explicit in this morphological system is the requirement that the components of the grammar operate in a specific order.[2] The dictionary contains the "basic constituent morphemes." These are first combined by the syntax and morphology into "basic words," then converted into "phonemes" by the processes of internal combination. Finally the "phonemes" are interpreted into "actual phonetics" by rules of speech.

This kind of description requires a theoretical base form for each morphological element. These basic forms are contained in a constituent dictionary. For instance, the

FIGURE 1

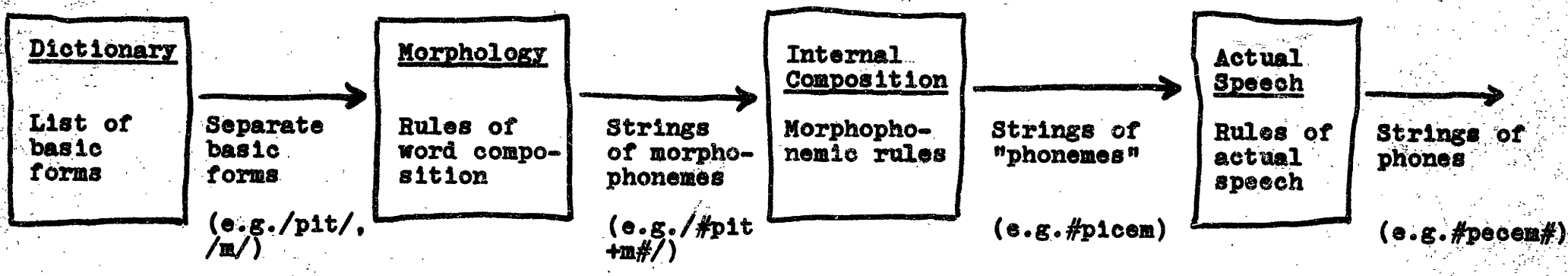


FIGURE 2

Rule N: X is rewritten as Y, in the environment Z
P is rewritten as Q, in the environment Z

$$\begin{matrix} X \longrightarrow Y \\ \\ P \longrightarrow Q \end{matrix} \quad / \quad \text{in environment } Z$$

morphemes /+pit+/ and /+m+/ are listed in the dictionary in the form shown at the left box in Figure 1, although in particular phonological contexts they can appear in somewhat different forms. The next grammatical stage, the affixation or "morphological" component, combines the basic roots into strings of morphophonemes. The rules of affixation can combine base constituents only in syntactically allowable orders. For instance, they allow /+pit+/ and /+m+/ to become the compound /#pit+m#/ but not the compound /#m+pit#/.

The string of morphophonemes produced by the morphology are subsequently converted into "phonemes" by the group of morphophonemic rules (represented in the next box in Figure 1). Discussing these rules, Bloomfield writes:

> We describe the various shapes in which the base constituent appears by saying that this base form is altered according to various habits of internal combination. (MM6)

The example shows the conversion, by the component of internal combination, of the morphophonemic sequence /#pit+m#/ into the "phonemes" /picem/.

At the end of these rules of internal combination Bloomfield writes:

> The forms now arrived at are phonemic forms of the actual Menomini language. Menomini phonetics, however, allows a great deal of latitude to some of its phonemes and of some overlapping between phonemes. (MM 33)

Thus there is one more step in the interpretation of the

basic strings of morphophonemes into actual speech; there is a phonetic component. This transforms /picem/ into (pecem) for many speakers of Menomini.

This chapter concerns primarily the form and use of the last two parts of the phonology, the morphophonemic and phonetic rules, and most specifically the structure of the components which interpret the base strings into sequences of phonetic symbols.

Syntax.

It is necessary first to review the essentials of Bloomfield's account of syntax and morphology. In addition to its intrinsic interest it provides some grammatical perspective on the structure of the phonology. In the book, "The Menomini Language " (M) there are two chapters explicitly devoted to the general description of sentences. There is no apparent indication in this book of any notion of sentence derivation, although a complete analysis of what is implicit in the descriptive statements might show some evidence for this. While there is a distinction between fully grammatical sentences ("major sentences") and regular distortions of sentences ("minor sentences") (M.23), this distinction does not have any theoretical or descriptive implications within the syntax itself.[3] Bloomfield invokes principles of "stylistic variation" to account for the many

similar and obviously related sets of sentences (M22.18), but even here he makes no explicit statement that the stylistic variants are derived from some common abstract form (as would be the case in a transformational grammar).

In addition to this descriptive enumeration of different types of sentences, Bloomfield develops an account of phrase structure which is based on the principle of substitution class. This technique is the basis for two types of phrase relations:

> All phrases can be viewed as either attributive or coordinative. Hence, every phrase can be classified according to the form-class of its head or of its members. We use the term expression to cover words or phrases of any one kind. (e.g. a verb, clause, and participle are all members of the same expression). (M22.7)

Thus "syntax" consists in a presentation of the different sentence types which can occur, accompanied by a minimal classification of the different types of syntactic relations which can occur among lexical items.

Morphology.

This taxonomic concept of syntax was, of course, exactly that formulated by Bloomfield in "Language" (1933) and practiced by many linguists since. According to this view the goal of syntax is classifying and enumerating the varieties of constructions which are possible in the actual sentences of a particular language. The notion that some

sentences can be shown to share underlying abstract forms would seem to be entirely beside the point.

Bloomfield, however, did consider it relevant that different lexical items, which play a different syntactic role in actual sentences, could be derived from some common abstract source. For example:

> ... beside the noun stem mahkaesen- in mahkæ:sen 'moccasin', 'shoe', there is a medial suffix -ahkæsen- with the same meaning, which appears for example in the ... verb ki:qwahkæsenæw, 'he takes off his shoes,' and in the secondary derivative noun mæqtakwahkaesen 'wooden shoe,' from mæqtek 'wood.' We say that the medial (affix) -ahkæsen- is a deverbal suffix derived from the noun stem mahkæsen- (emphasis on whole sentence is mine). (M 3.57)

The major part of "Menomini" is devoted to descriptions of the regular processes by which stems and words are derived from other stems and from roots. These processes combine basic forms (roots) into grammatically correct underlying forms of words. These, in turn, are the input for the morphophonemic rules.

> Many roots, suffixes, and inflectional endings appear in shorter and longer forms. We describe this by saying that the longer forms are extended forms derived from the shorter ... (emphasis mine) (M 3.49)

Forms which act as though they are basic are in fact often derived:

> Many of the roots, medials, and finals that appear in stems are themselves derivatives rather than single morphemes. There is a great variety of such complex roots and suffixes. (M 3.42)

A complete interpretation of the morphological analysis proposed by Bloomfield would require a thorough understanding of Menomini syntax. Even a cursory consideration, however, indicates that there is a great deal of sentence derivation embedded in this morphology. This is clear since many "major" sentences consist of single words, whose derivation from isolated lexical roots is accounted for by processes formulated under the rubric of "morphology." Thus in some cases sentence description in Bloomfield's grammar is quite similar in approach to generative grammar, in that sentences and words are derived by processes from underlying forms.[4]

The order and application of the processes of morphological derivation are more plentifully exemplified but not nearly so rigorously arranged as in the phonology. Bloomfield makes only a few general statements which outline the overall configuration of the morphological component of grammar:

> The morphologic features of Algonquian appear in three layers; inflection, secondary derivation, and primary formation. (MM 6)

This schematic statement of 1939 was amplified in 1956 (M):

> The three morphologic processes appear in a great variety of patterns. If we begin with words and describe their immediate constituents, then describe in turn the make-up of these constituents, and so on until we come to unanalyzable elements (morphemes), we find in many words layer upon layer of morphologic constructions. (M 3.8)

"Inflection" denotes the processes by which "syntactic" affixes are attached to stems or stems undergo syntactically indicated

phonological processes (that is, those affixes (or processes) which indicate syntactic features: gender, number, mood, possession, person and so on). Of course, single lexical items can contain more than one inflection:

> When several inflectional affixes appear on a stem, we can often distinguish layers; the inner affixes form a theme, to which further affixes are then added, quite as they are added to a stem. (M 3.13)

We can offer the following constituent representation of the example which Bloomfield provides:

```
se:qse:p-.....'duck'
næ-..........'I'
-æm..........'possessed form'
ø.............'singular'
-ak..........'plural'

New theme = (næ (se:qse:p) æm)-.....'my duck'
            ( (næ(se:qse:p)æm) ø).....'my duck'
            ( (næ(se:qse:p)æm) ak)....'my ducks'
```

Bloomfield points out (M 3.15) that inflectional endings cannot always be differentiated from the suffixes of secondary derivatives. "Secondary derivation" is a process by which new stems are derived from existing stems. The general difference between "inflection" and "secondary derivation" seems to be that secondary derivation is usually optional while most stems require at least some inflection to appear as words. "Secondary derivation" also generally changes the meaning from that of the original stem and can change the part of speech of the original stem.

Bloomfield also recognized that no clear line can be drawn between the process of "secondary derivation" and "primary

formation." In fact "primary formation" is simply described as that process of forming stems which is not "secondary derivation" (M 3.30). The two processes seem to be differentiated mainly by the immediate constituent layer at which they occur:

> Final suffixes appear at the end of primary stems. They are largely the same as those which appear in secondary derivation, and like them characterize the stem as a noun as a verb or one of the four classes, e.g. as a particle. (M 3.31) (emphasis mine)

> ...secondary derivation consists in the addition of suffixes to the stems of nouns or verbs .... In primary formation suffixes are added to a root. (MM 9)

Most examples show both processes as well as that of "inflection", e.g., (M 3.19)

ni:mi	'to dance'
-aw	'he' (inflectional ending) (appears as -w after a vowel)
-ewæ:-	'people' (secondary derivation suffix)
-k-	'causative verb form' (primary formation suffix)
ni:miw	'he dances' (inflection)
ni:mihaw	'he is made to dance' ((ni;mi-h-)aw) (inflection + primary formation)
ni:mihewæ;w	'he makes people dance' (((ni;mi-h) ewæ;)aw) (inflection + secondary derivation)

A rough summary of the possible morphological derivations of a single lexical root (based on Bloomfield's analysis, not necessarily on Menomini itself) would be:

(inflecting affix ..... (af(af(root)suffix)suffix) ..... inflecting suffix)

Note that an inflecting suffix can occur more than once in

the derivation of a single word. Bloomfield's notion that "repeated layers" of the same processes of suffixation and inflection can occur indicates that he was aware that a single set of morphological rules plus the principle of structural 'layering' can account for all the actual words of Menomini (and therefore for many of the sentences). By this principle, a different set of morphological rules is not necessary for each structural level, rather a single set of affixing rules applies recursively.

Simplicity and Phonological Analyses.

This recursive analysis of Bloomfield's statements is motivated by the above considerations. However, such an interpretation implies a more important theoretical notion which demands thorough documentation if we are safely to impute it to Bloomfield: the notion of simplicity of grammatical description. Before showing that Bloomfield understood the force of this principle, let me briefly outline its theoretical significance, since we shall return to it often in consideration of Bloomfield's phonology in this chapter and of Menomini phonology in Chapter Three.

There are several uses of the concept of simplicity. The first and most general has been a vague but compelling principle of scientific enterprise: 'simple' descriptions of phenomena are preferred to more complicated ones. For

instance, in a linguistic analysis if there were two types of grammars which accounted for all the known facts of a language and there were no immediate way of expanding the empirical base to motivate a decision between the theories, then the simpler theory would be chosen for the description of the language.

What are the units in which simplicity is measured? Somehow two competing descriptions must be evaluated in comparable terms so that we can accurately state that one of the descriptions is the less complex. In many fields of science, a particular kind of notation is chosen as the language in which to specify all competing theories; in those cases the simpler description is the one which involves fewer basic assumptions, or fewer computations, or some other measure in terms of the notational language common to the theories.[5]

In linguistic science this use of simplicity evaluates grammars in terms of a particular theoretical framework. Thus, given a particular grammatical apparatus, or a particular set of assumptions about the form of grammar, a grammar of a language is chosen which exploits those principles most efficiently. In brief, there are two steps in linguistic analysis: devise a general grammatical theory which can account for any language, and specify a criterion of simplicity which defines what an efficient use of that theory is.

The use of the term 'simplicity' in generative linguistics denotes the particular simplicity criterion used to decide among competing grammatical descriptions. Generative grammar imposes general requirements on what a possible description of a language is, and simplicity in generative grammar is defined in terms of the total number of symbols used in a particular analysis. The analysis which uses the smallest number is considered the simplest available grammar.

Every grammar is devised to account for a set of assumed linguistic facts. If we claim that the simplest grammar is also the one with the greatest adequacy for the description of those facts (that is, if simplicity is taken to be the empirically valid metric), the entire process of devising a theory and a simplicity criterion is subject to empirical verification. If the correct form of grammar is set up and the correct simplicity criterion applied to particular descriptions which use that form, then these descriptions can be assumed to make correct empirical claims about the facts of a given language.[6]

Thus in generative grammar the term simplicity has combined the general scientific bias in favor of parsimonious description and the grammar-evaluation criterion needed in any formal system in which more than one formally consistent account of the same facts is possible.

"Simplicity" in Bloomfield's Work.

We can now examine Bloomfield's statements for the answer to three questions. Did he recognize the need for some criterion for choosing among competing descriptions offered by the grammar? Does this criterion coincide with some general notion of simplicity? Did he take seriously the possibility that the form of the grammar and the decision criterion can be taken as having direct empirical force? Bloomfield's treatment of morphology and phonology justifies an affirmative answer to the first and second questions. Consider the following:

> Some primary stems contain no overt final suffix: It is convenient to say that they contain a theoretical final of the shape zero. (M 3.3?) (emphasis mine).

The invocation of "descriptive convenience" to motivate a phonologically empty morphological position is, of course, not unique to Bloomfield. Notice, however, that there is an entirely acceptable alternative solution: to assume that such forms in fact lack the particular morphological position and that consequently no phonological form can be expected. The rejection of this formally possible solution is based on a tacit assumption that it would be inelegant to state that particular morphological positions do not exist under certain circumstances. The underlined portion of the above quotation indicates that Bloomfield was more than tacitly aware of this issue. The use of phonological zeros and of "descriptive convenience" leads to some rather radical solutions:

> Very few words consist apparently of inflectional affixes without any overt stem; it is convenient to say that they contain a stem of the shape zero. Thus, the stem pi:t- yields the inflected forms listed on the left, and a stem of the shape zero yields, with the same affixes, the forms listed on the right:
>
> pi:ta:w.....a:w
> pi:to:k.....o:k
> payito:k.....ayo:k
> nepi:to:n.....neto:n
>
> (The/t/ in the last form in the right-hand set is regularly added to prefixes before the stem-initial vowel (M 3.12) (see chapter three).)

Later Bloomfield points out that the verb, "to use" never has any shape:[7]

> The extreme instances of (the occurrence of 'short stems') are those in which the stem shows nothing that could be called a root. The ... verb awæ:w' 'he uses him,' has a stem aw- which consists merely of a ... verb final suffix. The root is zero .... The forms of this verb consist entirely of inflectional affixes, so that both stem and root are zero. (M 3.41)

These kinds of statements indicate that the concept of descriptive simplicity was quite apparent to Bloomfield, and we can read into his use of it the fact that he was concerned not only with a general notion of simplicity (the first types of use of the term presented above), but with the specific use of simplicity within the framework of a particular form of grammar. Some of his other statements clarify his sensitivity to the interaction between "descriptive convenience" and the general form of the grammar:

> Some words which have the aspect of secondary derivatives imply [i.e. would have to be derived from] underlying stems which are morphologically impossible, and we

> are forced, instead, to set up complex finals. (M 3.46) (emphasis mine)

What is a "morphological impossibility"? In what sense are we forced to a particular analysis? Surely the grammatical theory is powerful enough to allow the statement of any morphological combination. What Bloomfield must have meant is that nowhere else in the language can such morphological combinations occur, and that it is descriptively more efficient to treat these cases with an entirely different grammatical mechanism than to lose the universality of the forms of morphological constraints.

> A few roots are best described as deverbal from stems. (examples) ... Forms like these could, of course, be described as secondary derivatives ... but then we should have to say that secondary derivatives are freely made from this verb with suffixes which otherwise appear only in primary word formation. (M 3.61)

> Pseudo-dependent noun stems are in structure the same as ordinary nondependent noun stems .... However, there are some cases where alternative interpretations are possible .... Hence, we prefer to describe (them) as containing medials which (are) deverbal. (M 3.38) (emphasis mine)

Whether we agree with the form of these solutions or not, it is clear that the considerations which indicated them were in each instance the overall complexity of the entire grammar.

Bloomfield's consistent application of the principle of "descriptive convenience" leads to some startling formulations: for instance, the claim that certain roots have absolutely no phonological shape at any level. Not only are roots proposed

which have no phonological shape, but also stems are set up for which there are no words as direct derivatives.

> ... for many stems which are formed entirely like secondary derivatives no underlying word can be found. We shall call them unbased secondary derivatives, and we shall say that the underlying stem is deficient (or unused), appearing only in a secondary derivative, not in actual inflected forms. For example:
>
> stem: ke:skæs-; ke:skesam- "he cuts it through"
> derivative: ke:skæs-ekan; ke:skæsekan "scythe"
> deficient stem: næqnos-: (no direct derivative)
> unbased derivative: næqnos+ekan: neqnosekan - "ring"
> (M 3.21)

So "descriptive convenience" can motivate the decision that stems exist for which there is only indirect evidence. Bloomfield offers some speculations about the reasons for which some stems never appear except in a derived form.

> The underlying stem is in some instances deficient because it is semantically improbable. Thus the noun ni:swana:qsiw is formed with the agent noun suffix -w, which is freely added to intransitive verb stems. In this instance, however, the ... verb stem ni:swanaqsi-, while regularly and transparently formed, would mean something like 'he writes himself or is written as two'. it would be hard to find a situation which demanded a verb of this meaning. (M 3.21) (see also M 3.45) (M 3.60)

The significance of this conscious step cannot be over-emphasized. It shows that when actual words do not exist to indicate a particular stem, forms that presuppose the stem motivate the claim that the stem exists. Of course, this motivation has real force only in light of some prior notion of 'simplicity', e.g., if one attempts to minimize the

number of exceptional forms and to maximize the use of already motivated grammatical processes. [For example, in English the words sanctify, sanctity, sanctimony, sacrosanct, sanction, can all be taken as evidence that there is a root 'sanct' although no actual word of this form occurs.] To use such indirect evidence to motivate particular stems demonstrates a belief that the grammar is not arbitrary and that descriptive consistency should be maintained even if it involves the postulation of entirely theoretical forms.

These considerations show that Bloomfield was aware of the need for a decision criterion to force a choice between competing descriptions in a single formal theory and that the criterion he used informally was "descriptive convenience" for which the apparent complexity of the grammar was the measure.

The most important question concerns the empirical reality of the form of grammar and of the simplicity criterion. Bloomfield did not treat this question specifically. However it is crucial to linguistic theory since it determines whether linguistics is viewed as an arbitrary game or an investigation into the nature of man. I think that Bloomfield assumed the psychological reality of grammar (his 1933 statements notwithstanding), but to demonstrate his assumption I must refer to particular phonological rules. I will return

to this at the end of this chapter, following a detailed discussion of his phonological system.

This concludes the discussion of Bloomfield's analysis of Menomini syntax and morphology. I have shown that he was concerned with describing well-formed strings in the language, not only with listing the "actual facts" of speech utterances, as he requires elsewhere in his theory. The morphology has an abstract level and decisions about which particular formulation occurs are based on overall grammatical complexity. There is a recursive set of processes which take basic, theoretical roots and combine them into underlying word structures. These structures themselves constitute the abstract input to the morphophonemic component. The same issues arise in the morphophonemics as in the morphology. What is the structure of the particular kinds of phonological rules? What is their general arrangement in the grammar? And what kinds of factors motivate a particular analysis?

Morphophonemics and Phonology.

The morphophonemic component transforms the structures from the morphology into sequences of phonemes. This is effected by an ordered series of phonological re-write rules. The form of the morphophonemic rules is summarized in Figure 2 (on same page as Fig. 1). Each rule has a number "N" which determines where the rule applies with respect to the other rules. There is a re-write process or processes, "X" is

re-written as Y," "P is re-written as Q." Also there is an environment, "Z", which specifies where the re-write process or processes can occur. Rules 1-8 are examples of such rules taken from M and MM.

"P" ⟶ "Q" in the environment "Z"

1)	$\bar{a} \longrightarrow æ\bar{}$	#ahs$\bar{a}$m —— +w (M 3:7)
2)a)	$æ \longrightarrow \bar{æ}$	#(—— ; in relative clause
b)	$\bar{æ} \longrightarrow$ ay$\bar{æ}$	" " " " "
3)	aw+æ $\longrightarrow \bar{o}$	—— $)V^{+}_{\text{suffix}}$ (——
4)	$\emptyset \longrightarrow$ e	....C+ —— +C....
5)a)	n $\longrightarrow$ s	—— $\begin{cases} e \\ y \\ i \end{cases}$
b)	t $\longrightarrow$ c	
6)	$\left.\begin{matrix} wæ \\ yæ \end{matrix}\right\} \longrightarrow \bar{i}$	....C ——
7)	$\bar{v} \longrightarrow \check{v}$	$\bar{V}C_1^2\check{V}C_1^2$ —— C_1^1
8)	i $\longrightarrow$ e	everywhere

The morphophonemic rules are divided into two basic sections. First, the processes of "modification" apply and then the rules of "internal combination." Roughly, "modification" consists of phonological changes which are peculiar to particular lexical items undergoing particular morphological derivational processes. The rules of "internal combination" are those that are relatively independent of morphological processes.

"Modifications" are themselves divided into two types: Arbitrary "morpholexical variation" and general "morphological modification." Morpholexical variation is restricted to

isolated lexical items (e.g. rule(1)). It thus contains a list of the irregular stem alternants for all stems which have them. Since they are isolated exceptions, morpholexical variations "do not depend on the phonetic shapes" of the forms (M 3.1). Each change is completely arbitrary with respect to the general phonological patterns. Morphological modification, on the other hand, may depend on certain local phonological conditions which attend particular derivational processes (e.g. rules (2-4)). Thus in morphological "initial change" of a word, a short vowel in the first syllable is lengthened, but a long vowel inserts a preceding /ay/ (M 4.79). Instances of morphological modification are intended to be just those where the morphological structure affects phonological processes. In brief:

A) morpholexical variation ---- isolated instances of particular phonological changes, morphologically conditioned in single lexical items. (morpheme alternants)

B) morphological modification - general phonological changes which occur only in particular derivations.

C) internal combination ------- general phonological changes which are independent of any particular morphological derivation.

Bloomfield explicitly recognized that this abstract

tripartite analysis of the types of processes is not reflected directly by divisions in the actual grammar. Thus,

> The line of demarcation between morpholexical variation and ... modification is not sharp. (M 3.7)

He elaborates this point by noting that the decision to treat a case as variation or as general modification is often a matter of "descriptive convenience."

The theoretical distinction between morpholexical variation (A and B above) and general phonological combination (C) is also not clearly revealed in an actual grammar:

> No sharp line can be drawn between morpholexical variation and the effects of internal combination, for the latter are in part irregular, taking place in some combinations but not in others. We speak of morpholexical variation, rather than irregular habits of internal combination when an alternation occurs only under highly limited conditions or is in some other way out of time with the predominant habits of internal combination. (M 3.41)

The Phonological Rules.

What is the formal nature of a rule in Bloomfield's phonological system? The answer can be fragmented into several smaller issues. What are the units which the rules affect? How are the rules combined? How are they arranged with relation to each other? To what grammatical information are they sensitive? The discussion of these particular questions, of course, often involves consideration of the particular simplicity criterion which Bloomfield applied.

Abstract Morphophonemes and "Theoretical Segments."

The output of the morphology is a set of structured sequences of morphophonemic segments. The rules of the phonology operate on these sequences and yield sequences of phonetic segments as their output. The input to the phonology is abstract, a set of theoretical forms which are set up only so the rules can operate on them to produce the correct output:

> The process of description leads us to set up each morphological element in a theoretical basic form and then to state the deviations from this basic form which appear when the element is combined with other elements. (MM 4)

Considerations of simplicity similar to those discussed for the morphology lead to solutions which fully utilize the fact that the underlying segments are abstract. The exact form of these phonological segments can be manipulated so that the overall system is as efficient as possible.

There are many examples of the construction of underlying phonological segments for which there is no direct phonetic evidence. These special underlying forms are set up to account for apparent exceptions by utilizing already well-motivated rules. For instance, there are several suffixes which begin in /+i/ which do not cause the mutation of a preceding /n/ or /t/, as is the general case shown in rules (5a, 5b). There are several descriptive options for the

treatment of these exceptional suffixes. In the first place, they could simply be listed as exceptions. To do this would, of course, destroy the generality of rules (5a) and (5b).

On the other hand, we could set up two separate kinds of suffixes in /+i:-/, those which produce n-mutation, and those which do not. This would be equivalent to claiming that there are two kinds of /i/, those which cause n-mutation ("i_1"), and those which do not ("i_2"). This would not only complicate the underlying vowel system, but would also make rules (5a) and (5b) less general; they would now read:

9)a) n ⟶ s
b) t ⟶ c

——— { y, e, i_1 } (as opposed to "i_2")

The solution in (9) is, of course, perfectly possible within the general phonological framework, but to avoid its complication Bloomfield postulated two types of suffixes which eventually become /i:-/ by other, independently-motivated, rules. The suffixes to which rule (5) applies are written in their underlying abstract form as /+yæ:-/. First they cause t-mutation by rules (5a,5b), and then they are changed to /+i:-/ by rule (6), a rule which is required to account correctly for many independent cases. For example:

wa:pet-yæ;k-at ..... 'it is white cloth'
wa:pecyækat .....rule (5b)
wa:pecikat .....rule (6)

Suffixes which begin phonetically in /+i:-/ but which do

not cause t-mutation (5a,5b) are written in their underlying forms as /+wæ:-/. Since /+w/ does not cause t-mutation these suffixes will not cause it. Rule (6) subsequently merges /yæ:/ and /wæ:/into /i:/ so that the ultimate phonetic shape of these irregular suffixes is also /i:-/. For example:

pyæ:t-wæ:w-æ:w ..... "the sound comes hither"
pyæ:twæ:wæ:w ..... rule 5 (has no effect)
pi:ti:wæ:w ..... rule 6

Other exceptions to this rule are handled in a similar manner; an arbitrary and otherwise unmotivated form of a suffix is set up just so that it will not be affected by a particular rule, but the suffix is set up so that other, independently motivated, rules will transform it into the correct phonetic output. The ultimate phonetic shape of the regular and irregular suffixes cannot be differentiated. In fact, the only phonological difference between them is that one causes t-mutation and the other does not. Rather than setting up two kinds of /+i:-/, Bloomfield simply claimed that the suffixes are not identical at the underlying level and that they converge phonetically due to the effects of rule (6). This abstract claim is motivated only by the desire to maximize the generality of the rules and the efficiency of the grammatical system. This particular solution implies that Bloomfield considered a change in the lexicon to be less complex than explicitly setting up exceptions to general

rules. He dealt with phonological exceptions by making them follow automatically from the shape of their underlying form, rather than by listing them separately.

In the above example Bloomfield represented a particular phonetic segment ("ī") with different underlying morphophonemic sequences /"+yāe" and "+wǣ-"/. However, it is often not possible to make use of independently motivated rules to convert such theoretical sequences of segments into the correct output. Consider, for instance, rule (5b). There are, in fact, many instances of phonetic /n/ which do not follow this rule. That is, certain underlying stems end in a segment which appears as phonetic /n/ even when it precedes /y,e,i/ (either phonetically or in the underlying phonological derivation). We might attempt to account for these cases by postulating that those /n/s which do not change are represented by different sequences of phonemes at the underlying level from those /n/s which do mutate. Thus we could claim that non-mutating /n/s are in fact /nw-/ and that the /w/ blocks the application of rule (5) and then subsequently is dropped so that it never appears. Although it could probably be made to work correctly, this solution would involve a great many exceptions to other rules of the grammar, as well as requiring a special rule to drop the /w/ following /n/ (assuming that /nw/ doesn't occur anywhere else, which in fact is a false assumption).

Rule (6) would now have several exceptions. Since the /n/ of the stem næ:hn-,'breathe', does not mutate it would have to be represented næ:hnw-; but rule (6) would have to be blocked for this form because it would produce næ:ni:w from the regular underlying structure, næ:hnw-æ:-w,'he breathes,' rather than the correct form, næ:hnæ:w.[8] There are similar objections to representing those /n/s which do not mutate by any other particular sequences of underlying morphophonemes.

In this case, then, we are forced to postulate that there is a morphophoneme in addition to mutating /n/s which converges with /n/ in the phonetic output, but which is distinct from morphophonemic /n/ at the time of the application of rule (5). This was Bloomfield's conclusion:

> Certain n's are not subject to this alternation (n-mutation); we designate these in our basic forms by N; in actual speech this theoretical N is replaced by n. (MM 13)

Here again there was an alternative solution: to mark those lexical items with non-mutating /n/s as not subject to rule (5). As in the previous case, when faced with the alternatives of adding lexically marked exceptions to phonological rules, or of setting up the underlying morphonemic forms so that the rules would automatically treat them as exceptions, Bloomfield chose the latter course, even at the cost of increasing the number of assumed underlying segments.

Phonological Rules and Structural Information.

Bloomfield repeatedly refers to the fact that the underlying level of the morphophonemic system is theoretical, devised only so that the correct output will result. In view of this it is easy to understand that he does not segregate phonological rules sensitive to structural information from those which are sensitive to 'phonological' information only. Such a distinction would have no real force since all the information which forms the input to the phonology is abstract. The phonology of any grammar in which phonological and syntactic information interact is thus a complex mixture of some stem alternations, some derivational processes and some purely phonological processes. Bloomfield has no notion of a separate component which deals exclusively with cases in which syntactic information is relevant to the phonological rules. Since it would be perfectly possible to set up a system of rules in which the distinction would be made, its absence must be taken as a substantive claim that it would serve no purpose.

Abstract syntactic structure is referred to briefly in a startling manner in the description of Menomini stress-assignment:

> Most compounds and many types of syntactically unitary phrases are treated as to stress like single words. (M 1.51)

There are two types of stress assignment, primary and secondary.

Until these rules apply all vowels are unstressed. Primary stress rules apply only to long vowels in certain positions:

10) $\bar{V} \longrightarrow$ primary stress a) $\longrightarrow C_1^2 V C_1^2 \#$ (i.e. in next to last syllable)
b) $\longrightarrow C_1^2 \breve{V}$ (i.e. preceding a syllable with a short vowel)

Secondary stress is part of the general quantity syncopation system and applies to long and short vowels (this occurs throughout the Algonquin languages).[9]

11) syllable $\longrightarrow$ secondary stress / in even numbered syllables except in constituent final.

For example the form neta:ka:wa:ta:nan 'we enter' is stressed:

netä:ka:wä:tä:nan (' over a vowel indicates primary stress. " over a vowel indicates secondary stress.)

These rules apply to any syntactic unit, not just to words. Thus, although final syllables cannot receive either primary or secondary stress, we see the compound form kë:sp-pi:w, 'he has come' and the phrase ó:s-ëneh, "that canoe" in which several word-finals have stress although no phrase final does. That the stress on the words is determined by the application of rules (10) and (11) to the phrase as a whole appears if the words are in the reverse order (a stylistic version of the same phrase).

Compare: ó:s ëneh (literally "canoe that")
enëh o:s (literally "that canoe")

Bloomfield's observation that the stress rules in Menomini

apply to syntactic units of varying size is extremely striking in view of recent analyses of stress in English (see "The Sound Pattern of English," N. Chomsky and M. Halle). However, since the stress rules apply only once there is one problem: how is it determined in a phrase whether the rules are to apply to each word separately or to the words taken together? It appears from the examples that the phrase always has pre-eminence: that is, rules (10, 11) account for the stress of all syllables when applied to the highest available phrase unit below the level of a sentence. In many instances that unit is in fact a single word, but in other cases it is several words. In any case, it is the <u>syntactic</u> unit which defines the range of the rules and not a phonologically defined unit.

Even the "phonetic" level is not entirely free of rules which depend on structural information, e.g.:

> The forms now arrived at are <u>phonemic</u> forms of the actual Menomini language. Menomini phonetics, however, allows a great deal of latitude to some of its phonemes and of some overlapping between phonemes. Thus phonetic /æ/ is rather widely replaced by /e/ except where /h/ ... plus consonant follows. (MM 38)

> However <u>in the personal prefixes</u> before h plus consonant the usual variety is the high variety of /æ/, coinciding with /e/. (M 1.21) (emphasis mine) (from the section on "sounds of Menomini")

Thus it appears that <u>at all levels</u> the phonological rules are sensitive to syntactic information.

<u>The Internal Composition of Segments.</u>

Now we must ascertain the structure of the phonological

units themselves. In particular, are the abstract morphophonemic segments divisible into abstract component characteristics? Bloomfield was aware of the phonetic concept, "distinctive feature," and he readily uses such terms as; "consonant, vowel, short, long, syllabic-nonsyllabic, high vowel, semi-vowel, stop, affricate, continuant," and so on. But these concepts clearly do not play any formal role in his theoretical apparatus. They are used occasionally as a shorthand in which to present rules, but not as part of the formalism in which the grammar is expressed. Thus, to Bloomfield, the morphophonemes are theoretically indivisible units. For example, he could find no reason to consider a rule which could apply to /y/ and /w/ to be any more general than a rule which applies to /y/ and /p/. Of course such an approach leads to some surprisingly cumbersome statements:

> Whenever the high vowel i, i:, u, u: or the semi-vowels y, w occur later in the word, then e: is raised to i:, the vowel o: to u: .... (M 4.66, MM35)
> (see chapter 3, on vowel raising, for a fuller analysis of this process)

It is clear that several generalizations are missed by this formulation; e.g., that long mid-vowels are raised when followed by high non-consonantal segments. The resultant arbitrariness of the arrangement of the underlying morphophonemes was not lost on Bloomfield. In fact, he was quite aware that the interrelations of the morphophonemes were

quite unmotivated:

> Only the contrast between uəh ... and wa:h ... prevents a description of w, y as mere positional variants of certain vowels, as u and i. Even without this one contrast, it is best to take the contrast of syllabic and nonsyllabic phonemes as basic. On a purely positional reckoning any consonant could be chosen as positional variants of vowels. (M 1.29) (emphasis mine)

That is, since there are no sequences of syllabic segments, a vowel at the abstract level could represent any kind of phonetic segment (syllabic or non-syllabic) with equal justification since any two morphophonemes are as closely related as any other two. There can be no criterion to decide what a given morphophonemes actually is; it could as easily be a number as a phonological symbol.

Since the phonological component ultimately produces the "facts of actual speech," there must be some point in the derivation at which the abstract segments become concrete and can be described in terms of physiological-phonetic characteristics. In general this transformation is the role of the so-called "phonetic" component. In MM Bloomfield provides a long footnote which describes how the various segments produced by the system of rules are actually pronounced. In his book (M) there is a fairly detailed section on the "sounds of actual speech." We can interpret these "notes on pronunciation" as a set of rules which maps the theoretical morphophonemic segments onto concrete phonetic segments. That is, it is at this point that the morphophonemes acquire phonetic substance.

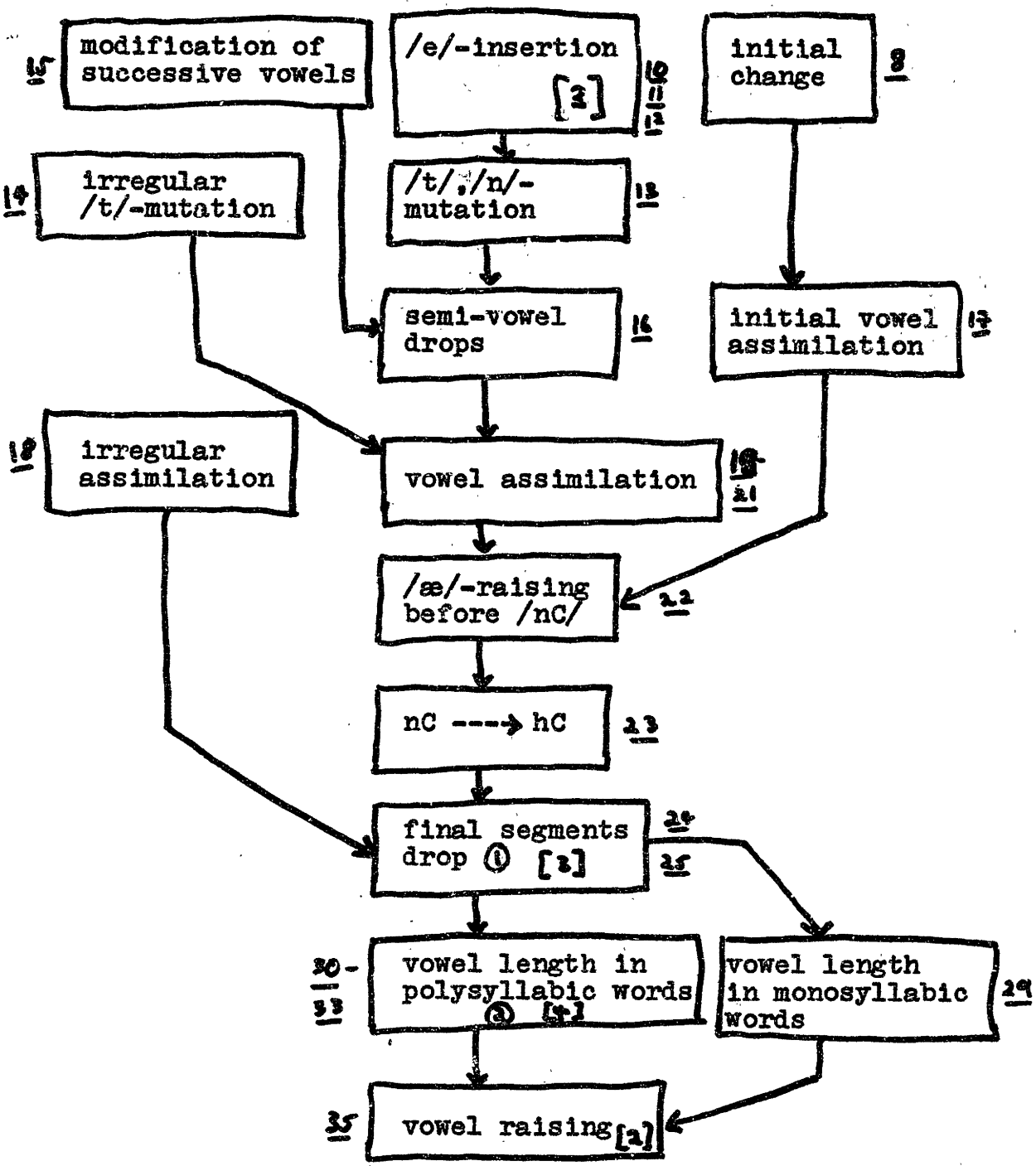
In discussing this component Bloomfield used terms like "labial," "palatal," "syllabic" to refer to their physiological correlates. Since he regarded phonetic segments as "bundles of features" the different feature names acquire concrete reality at this stage of the phonological derivation. Bloomfield left up to the reader's intuition many details of the transfer from abstract indivisible segments to concrete segments composed of physiological-phonetic features. For example, he does not state that the morphophoneme /p/ (which, after all, might have been represented as a number) is expressed phonetically as a stopped bilabial segment; that he left to linguistic convention.[10]

In sum, the phonology employs two types of segments. One type is entirely abstract and not divisible into component characteristics. These abstract segments are mapped by phonological rules onto concrete segments. The concrete segments ("phonemes") are directly related to particular physiological and acoustic qualities. In general we are concerned here with the morphophonemic rules, and not with the "phonetic" rules that interpret the output of the morphophonemic system into concrete segments.

The Order of Phonological Rules.

Bloomfield states that the phonological re-write rules (e.g. 1-8) are ordered in several specific cases:

FIGURE 3

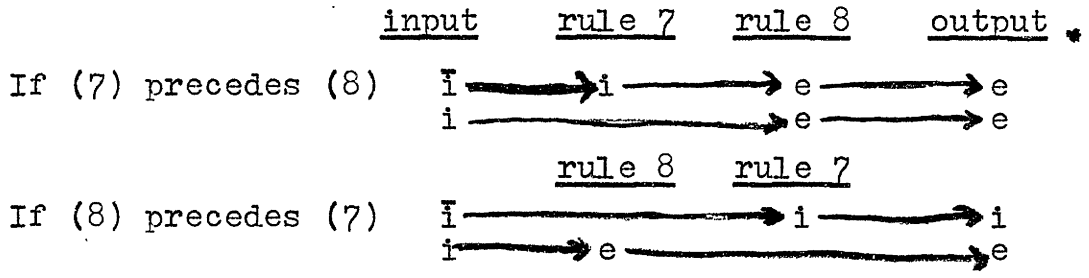


Ordering constraints on groups of rules in "Menomini-Morphophonemics". Numbers in circles indicate the ordering constraints on rules within the group. Brackets indicate the number of rules per group. Underlined numbers refer to the rules in "Menomini Morphophonemics".

> If one starts with the basic forms and applies our statements in the order in which we give them, one will arrive finally at the forms of words as they are actually spoken. (MM 4)
>
> ...we shall state the habits (of internal combinations) in such order as to lead from these basic forms to the shape of the actual words. (M 4.2) (see also M 4.48)

Also it is clear that if the rules are not applied as he presents them incorrect results are produced. This is the case, for instance, in the relation of e-insertion (4) and t-mutation (5b). Rule (4) inserts an /e/ between all constituents separated by consonants. Thus /poN+m/ and /pit+m/ become /poNem/ and /pitem/. Rule (5), t-mutation, then changes /pitem/ to /picem/. Why must rule (4) precede rule (5)? What is the effect if we reverse the order specified by Bloomfield and t-mutation (5) is allowed to apply before e-insertion (4)? Both examples are affected by the e-insertion rule. The first example, /poN+m/, is not affected by t-mutation, so reversing the order of the rules does not change the output. But the second example, /pit+m/, is affected by t-mutation. In the correct order, rule (4) inserts /e/ after /t/, and rule (5) subsequently changes that /t/ to /c/. If t-mutation precedes e-insertion, e-insertion will set up the proper environment for t-mutation to occur, but the t-mutation rule will already have been passed. The /t/ will not undergo mutation and the incorrect form, /pitem/, will be generated.

If one rule precedes another descriptively we may refer to its "ordering depth." A phonological system without any order among its rules has a depth of zero. The example just presented has one ordering condition, "/e/-insertion must precede t-mutation," and therefore exhibits a depth of one. There are many similar examples of ordered pairs of rules in Bloomfield's phonology, e.g., rules (5) and (6). If (6), semi-vowel assimilation, preceded (5), then stems with underlying /-wæ:/ would also cause t-mutation in preceding /t/ which is exactly what the stems are set up to avoid. Similarly, if rule (7), vowel shortening, preceded (6), then in certain positions /æ:/ might be shortened to /æ/ and rule (6) couldn't apply. Finally, the dialect rule (8), i-lowering, must follow the shortening rule (7) because the dialect rule applies only to all short /i/. If it preceded the vowel shortening rule then the dialect would incorrectly have some short /i/s, those shortened from /i:/ by rule (7).



No ordering of these four rules other than the one given will give the correct output. These examples show a total ordering depth of four, since there are four ordering conditions.

In MM, in which the rules are carefully ordered, the

highest ordering depth for the 23 rules is a sequence of 11 ordering conditions. In Figure 3 the actual ordering conditions are briefly outlined; in all cases the rules were ordered by Bloomfield so that they would meet these constraints.

The value of the ordering of Bloomfield's rules and the abstractness of their underlying forms has been questioned by Zellig Harris.[11] He points out that the stem from 'canoe' is generally /o͞n/, but that in isolation 'the canoe' is phonemically /o͞s/. Bloomfield accounted for this by setting up the underlying theoretical form as on+e; the /e/ conditions the mutation of /n/ to /s/ by rule (5a). A subsequent general rule which drops all terminal vowels drops the /e/ to give the correct output. Harris observes that this analysis involves a rule depth of only one and in such cases there is always a simple solution which would not require ordered rules. In general his observation is, of course, correct. Some cases where the depth of rules is only one can be simply represented with unordered rules. For example, if n-mutation and vowel-dropping were not ordered then we could represent the above example in the same form lexically, on+e, and assume that all rules apply simultaneously to the underlying form. In this case n-mutation would apply since the /e/ is present in the underlying stem, and vowel dropping would also apply since it is word-final in the underlying stem.

Harris was incorrect, however, in stating that only two rules are involved in the ordering of n-mutation and vowel-dropping. In the first place, n-mutation and final-vowel-dropping are part of an ordered series of rules far deeper than one condition. Figure 3 shows that the series of which they are part has a depth of at least 11 conditions. Although I have not found a single example which utilizes all of the twelve rules involved, there are many which use three or more at a time. Consider a form which is quite similar to the one above, pæ:qc, 'by error.' Since in its other alternations the stem acts like pæqt-, Bloomfield (MM 29) sets up the underlying structure for the monosyllabic form so that t-mutation can apply, pæqt+e. The derivation works here exactly as it did for on+e cited above. First, /e/ causes t-mutation and then the /e/ drops, but there is a later rule which lengthens all vowels in monosyllabic words, so that the output is not pæqc, but pæ:qc. In this case then, there are two ordering conditions on the three rules:

(12) pæqt+e ----:input
a) pæqc+e ----:t ⟶ c / ___ e (t-mutation)
b) pæqc ------:v ⟶ ø / C___# (vowel dropping)
c) pæ:qc -----:v ⟶ V: / #C___C_1# (monosyllabic lengthening)

Notice that monosyllabic lengthening cannot precede vowel-dropping, because the form pæqce is not a monosyllable until

after the application of vowel-dropping. (In fact, the length adjustment rules would apply to lengthen the second vowel, /e/, and leave the first vowel short.)

There are many other examples which demonstrate that t-mutation and vowel-dropping are embedded within many ordered rules. Suppose, however, that we wanted to interpret the same data in a phonological system in which rules are not ordered. Harris points out that for cases in which only one direct ordering condition is required (i.e. two rules) and the second rule does not utilize segments which are the output of the first rule, the same rules can apply unordered. This simple conversion from ordered to unordered rules is not possible for the above case since there are at least two ordering conditions. Monosyllabic lengthening would be more complex to state if the rules are applied simultaneously since it must apply not only to all forms which are monosyllabic at the input to the rules, but also to the first syllables of all bisyllabic forms which are going to be made into monosyllables by the (now simultaneous) vowel-dropping rule. This monosyllabic lengthening in an unordered system would read:

13) $V \longrightarrow \overline{V}$ / #C____C# - or - #C____C V#

That is, failure to order the rules involves increased complexity in many rules.

The increased complexity of rules often results in blatant duplication of grammatical information. For instance I showed that e -insertion must precede t-mutation. What would happen if these rules applied simultaneously to the underlying form pit+m, to give the output picem? /e/-insertion would not be complicated but t-mutation would now have to include as part of its environment statement the environment for e -insertion, since it must be sensitive to /t/s which are going to be before /e/ even if they do not precede /e/ in the underlying form. The unordered rules would read:

14) pit+m ---- input
pite+ m -- ∅ ⟶ e / -C____+C-
picem t ⟶ e / ____e, - or - ____+C

This gives pit+m two derivational pathways: pit+m, pic+m, picem
pit+m, pitem, picem

In general such duplication of information and ambiguity of derivation occurs in an unordered system of rules whenever in the corresponding ordered system the output of a prior rule is directly involved in a later rule. Since every instance of a direct ordering condition can be unordered only by the addition of some kind of complexity to the rules, and there are at least thirty such conditions in Bloomfield's analysis of Menomini there would be considerable loss of descriptive efficiency if the rules were unordered. Nevertheless, such a theoretical convention could be made and still account for the same set of facts; an ordered system of rules can always be translated into some unordered system in which all the conditional developments automatically

characterized by the order of the rules are characterized by disjunctive statements in the environments of each unordered rule. Hence, Bloomfield's rejection of such a possible descriptive system must be interpreted as a theoretical claim about the structure of grammar.

The Combination of Processes Within Rules.

A rule is labelled by a number, N, which designates its order relative to the other rules of the grammar; it consists of a re-write process and an environment in which that process occurs. Rule (5a,5b) demonstrates that more than one process can occur in the same rule. How are several processes included in the same numbered "rule" to be ordered among themselves? Do they apply in the order given, e.g., t-mutation before n-mutation, or are they intended to be applied simultaneously? In (5a,5b) the results would be the same in either case. However, this is not true for other rules which contain several processes. Consider (15) a rule from MM (rule 8 in MM); it expresses a heterogeneous set of processes which are associated with the morphological process of "initial change."

15) a) #(C)æ ⟶ #(C)$\bar{æ}$
kæ meɯ+ah ⟶ k$\bar{æ}$ mewah

b) #(C)$\bar{V}$ ⟶ #(C)ay$\bar{V}$
p$\bar{o}$neqtat ⟶ pay$\bar{o}$neqtat

Clearly these two processes (15a, 15b) must apply simultaneously or incorrect results can occur. If (15a) actually

precedes (15b), then /ay/ will be inserted before long /æ:/ created by (15a) and the incorrect form kayæ: mewah will be generated. So, within a numbered rule, separate processes are intended to apply simultaneously. This, of course, is equivalent to the constraint that they are mutually exclusive. If one process of a rule applies, then no other process in that rule can apply.

It is apparent from this that rules are not combined according to the re-write processes they share. There are several instances when the same re-write processes occur in separate rules with different environments, for instance rule (16) (17 in MM) and rule (17) (20 in MM):

16) w+o: ⟶ o: in word initial
w+æ ⟶ o

17) w+o: ⟶ o: following a consonant
w+æ ⟶ o

The only apparent reason for keeping these processes separate is that they do not occur in the same environment. (Notice that the general ordering constraints do not separate them; see Fig. 3.) Conversely, there are examples of processes which appear to share no characteristics except the environments in which they occur. (Of course, given that the morphophonemes have no internal characteristics there is no reason to assume that t-mutation and n-mutation are similar, except that they occur in the same environment and with the same ordering constraints.) This is true of rules (2a) and

(2b). Another example is the full set of vowel-semi-vowel assimilations which take place after a consonant (18) (the organization into three sets is mine).

18)

A	B	C
ye: ⟶ e:	ye ⟶ i	yo: ⟶ o: (no actual case to be found)
we: ⟶ o:	we ⟶ i	wo: ⟶ o:
yæ ⟶ e	yǣ ⟶ i:	
wæ ⟶ o	wǣ ⟶ i:	

There are three different processes lumped together in this rule: Column A is progressive front-back assimilation; in column B, the vowels are simply raised, and in column C,(only) the semivowels are dropped. Several facts might motivate including these different processes in one rule. They all involve the dropping of semi-vowels, they occur in the same environment, or they have the same ordering restrictions with respect to the other rules of the grammar. From the way Bloomfield states the rule (MM 20), it is clear that the most important factor is their occurrence in the same environment. The fact that they share semi-vowel dropping is not mentioned, nor are the rules expressed in such a way as to reflect this.

Several facts indicate that Bloomfield thought of the morphophonemics primarily as a sequence of ordered environments in which processes operate, rather than as a set of ordered processes. The first point is the above observation that opportunities to combine rules according

to their processes were avoided when the environments differed. Dissimilar processes were combined apparently only because they shared an environment. Furthermore, an attempt to simplify the overall system, using the general constraints on rules employed by Bloomfield, but allowing rules to be combined according to the processes they share as well as according to shared environments, does reduce the number of processes but does not reduce the number of different environment statements.[12]

A set of morphophonemic rules may be considered an input-output device which accepts strings of morphophonemes and prints out derived strings of phonemes. There are many sets of ordered morphophonemic rules which have the same input-output characteristics. What considerations led Bloomfield to choose one set of ordered rules over another? How did he decide which of the many possibilities was the optimal synchronic descriptive grammar?

One basis for a decision might be the relation of the competing synchronic grammars to the history of the language, but he explicitly avoided as a possible technique his knowledge of the historical development of Menomini and emphasized that the descriptive rules are purely synchronic.

> Our basic forms are not ancient forms, say of the proto-Algonquian parent language, and our statements of internal sandhi are not historical but descriptive, and appear in a purely descriptive order. (MM 4)

Nowhere does he discuss a formal simplicity criterion, but I have pointed out several instances in which one was used implicitly. The number of rules is governed by the smallest possible number of different environment statements. Exceptions to the sequence of rules are treated by creating for them underlying forms which automatically indicate them as exceptions, and make use of already motivated rules to produce the correct output. When this is not possible new underlying segments are set up and special rules written to transform them into the correct result. In general, then, a basic set of rules is motivated by a large number of clear cases; exceptions to the rules are treated as having exceptional underlying forms.

"Phonemes."

In many works Bloomfield characterized the notion of a "phonemic" level and these formulations of "phoneme" and "phonemic" level were refined by his students into the concept known today as 'taxonomic phonemics'. (See Chomsky, 1961.) The taxonomic level in phonology is considered the stage between morphophonemics and phonetics at which only the "minimally-distinct" segments are specified. Taxonomic phonemic analyses are supposedly based on a universal set of principles and procedures which automatically produce the "phonemic level" when applied to the phonetic level. Important among the proposed principles have been 'complementary

distribution' and 'biuniqueness'. In Bloomfield's practice these principles are seriously violated by the relation between the level which he calls "phonemic" and the phonetic structure of Menomini. In fact there is no phonological level in the Menomini grammar which does follow the taxonomic constraints on a phonemic level.

Bloomfield consciously violated one of the most powerful principles of taxonomic phonemics, complementary distribution. For instance, in Menomini all phonetic [o̅] and [u̅] are in complementary distribution since all [u̅] are derived from /o̅/ by rule 19, (M 4.66).

19) $\begin{matrix} \bar{o} \dashrightarrow \bar{u} \\ \bar{e} \dashrightarrow \bar{i} \end{matrix} \quad / \text{——....C} \begin{Bmatrix} w \\ y \end{Bmatrix}$

Bloomfield writes:

> Since the occurrence of /u:/ is normally confined to the forms in which it replaces /o:/ under the regular alternation of (5) it might be viewed as a mere positional variant of /o:/ . In this alternation, however, the difference of /o:/ and /u:/ is parallel with that of /e:/ and /i:/. Two sounds which unmistakably figure as separate phonemes. (M 1.16) (emphasis mine)

He was faced with a dilemma. Although it would be possible to set up a formal taxonomic "phonemic" level which would represent the complementary distributions in the phonetic level, the "phonemic" level would be asymmetrical and would serve no purpose. For example, Bloomfield presented the forms below in two stages, the underlying morphophonemic and phonetic levels.

nēmw ---- "dance"
kony ---- "now"
-w ------ "he"
-t ------ "when he"
ak ------ "lumps of"

Morphophonemic		Phonetic	
kōny	⟶	kōn	"snow"
kōnyak	⟶	kūnyak...	"lumps of snow"
nēmw+w	⟶	nēmow ...	"he dances"
nēmw+t	⟶	nīmit ...	"when he dances"

Since [ō] and [ū] are actually in complementary distribution, the taxonomic "phonemic" level would be:

	MP	taxonomic phonemic	phonetic
kōn	ō	ō	ō
kūnyak			ū
nēmow	ē	ē	ē
nīmit		ī	ī

This analysis would follow the principles of complementary distribution and biuniqueness between the phonetic and "phonemic" level. But it is a construct which complicates the series of morphophonemic rules. In order to maintain the taxonomic "phonemic" level it would be necessary to split (19) arbitrarily into two rules, (19a) and (19b). The "phonemic" level would be the output from (19a):

19) long mid-vowels are raised in the environment ——.... C{ī, w, y}

19a) /ē/ is raised in the environment ——.... C{i, w, y}

19b) /ō/ is raised in the environment ——.... C{i, w, y}

Although this division is obviously without descriptive or any other formal value, it is exactly what the principle of complementary distribution demands. In his practice Bloomfield avoided this division demanded in his name by his students.

In the previous example, Bloomfield ignored the principle of complementary distribution in setting up a "phonemic" level. The "phonemic" level in M and MM also explicitly violates the principle of biuniqueness between phonemic and phonetic levels of phonological representation. Roughly, biuniqueness requires that a given phonetic segment represent only one phoneme in a particular environment. (Just as a given phoneme can represent more than one phonetic segment if the phonetic segments are in complementary distribution.) Such a requirement is basic to the taxonomic phonemic program since, if it is not met, the phonemic level will not be directly discoverable from the phonetics. If a given sound, "X", in a given environment "P .... Q", can represent either the phoneme X_1 or X_2, then phonemic analysis cannot proceed from examination of the phonetic level alone.

The relation between the "phonemic" and phonetic levels in M and MM explicitly violates biuniqueness repeatedly. For example:

> Initial short vowels ... are often spoken with tongue position indifferent as to height and distinct only as to front and back. (M 1.17)

Thus in the word pronounced [osām] it is not clear whether the initial vowel represents the "phoneme" /o/ or /a/, both of which would be possible in that environment. The difficulty of describing unstressed vowels in taxonomic phonemics is well-known since it causes similar problems in English. Indeed, Bloomfield wrote:

> The determination of the short vowels in the normal (phonetic) form is the greatest difficulty of Menomini phonetics. This difficulty is not entirely due to the foreign ear, but would remain for a native recorder, much as in the similar case of the English unstressed vowels. (M 1.17)

After presenting the "phonemes" of Menomini, Bloomfield states:

> There is a great deal of variation in the sound of words, especially in rapid speech, but also in solemn rhetorical or expository utterance. These surface variations (sic) however, center round what we may call a normal form (note: this is not to be confused with the "basic forms" which are the input to the morphophonemic system. TGB) .... Once a word is familiar... the surface variations become less noticeable and assume the role of subsidiary signals of the speaker's mood, distinct from the strictly formal context, much like many features of melody, drawl, slurring and the like in English sounds. (M 1.3)

Application of taxonomic principles does not solve these problems since it is exactly taxonomic conventions which these instances violate. Rather it is necessary (just as in English) to appeal to the alternations and syntactically related forms to determine the exact status of the reduced vowel:

> In rapid speech ... when another long vowel follows in the next syllable, (long vowels) are often relaxed and shortened and may then coincide ... with short vowels. That this is really the case (i.e. that these short vowels are 'really' shortened long vowels - TB) appears from occasional nonce-formations. (M 1.9)

From these examples it is clear that Bloomfield does not use true "phonemic" levels which would satisfy the theoretical principles of taxonomic phonology in his description. In fact, he recognizes that it would be arbitrarily complex to maintain such a level. His actual formulation of the "phonemic" level shows the beneficial effect of descriptive practice, where the formal distinction between "phonemic" and phonetic levels does not seem so important as in theoretical discourse. That is not to say that Bloomfield did not make the distinction, only that it did not play the role required by taxonomic phonological theory.

"Phonèmes" and Phonetics.

To call the intermediate descriptive level in his Menomini works "phonemic" is thus misleading since that level does not follow taxonomic principles. The "phonemic" level seems instead to represent a broad phonetic description of the standard Menomini dialect. "Surface fluctuation" in dialects and subdialects is explained as further modification of the phonetics of the standard dialect represented by the "phonemic" level.

As I demonstrated above, the "phonemic" level is the stage in the phonological derivation at which the phonological segments become concrete. At this point in Bloomfield's phonology, the indicated physiological-phonetic features of segments (i.e., "consonant, vowel," etc.) have more than typographical significance. That is, in MM what Bloomfield calls the "phonemic" level is really the first stage of the phonetic level of speech. Nevertheless the phonetic rules of "actual speech" often cannot be clearly differentiated from the morphophonemic rules of internal combination. Bloomfield writes:

> Thus phonemic æ is rather widely replaced by e ... some speakers partially and some quite constantly replace i by e. (MM 38)

In M these changes are presented as a different dialect, in general restricted to the younger speakers of Menomini. These speakers are thought of as having the same "phonemes" but a different pronunciation of them.

This example also indicates that the descriptive role of the "phonemic" level was intended to serve as the base dialect around which individual variance and restricted local dialects may modify the actual phonetics.

In his preoccupation with an effective descriptive system, Bloomfield ignored the constraints of taxonomic phonemics. He clearly did not notice that this brought him into conflict with the requirements of his general theoretical approach and of his students' theories. Because these

theories have themselves been recently attacked it is important to see that Bloomfield did not follow them in his own descriptive work.

Summary of Bloomfield's Grammar.

Basic roots and affixes are listed in the lexicon. Recursive structural processes operate on these basic forms to combine them into basic words. The basic words are structurally labelled sequences of abstract phonological segments, "morphophonemes." The morphophonemes have no internal structure; they are indivisible theoretical units. The morphophonemic component operates on syntactically-labelled sequences of abstract morphophonemes and yields a sequence of units which are directly mappable onto concrete phonological segments, a broad phonetic transcription. Further minor modification is governed by the "phonetic" component, to produce the sounds of actual speech.

Bloomfield's morphophonemic system consists of about 25 rules descriptively ordered to apply in a rigid sequence such that a later rule applies to the output of previous rules. The rules contain re-write processes in which a particular symbol or sequence of symbols in a particular environment is replaced by another symbol or sequence. A single numbered rule can contain several such processes but contains only one environment statement. Processes in

the same rule apply simultaneously. The rules attain a single chain of at least 12 critically ordered statements (i.e. 11 ordering conditions). They are sensitive to syntactic information in the environment statement although they do not have the power to change the structural labelling. By convention all the rules apply to sequences within word boundaries, except for the assignment of stress, which applies to syntactic structural units below the level of whole sentences. The same stress assignment rules apply to single words as to phrases.

In general, lexical forms are set up to make the phonological rules as general as possible. Considerations of "descriptive convenience" motivate apparent exceptions to morphophological or morphophonemic generalizations; the exceptions are treated as having special underlying abstract roots and word structure so that they do not constitute exceptions to the descriptive rules themselves. This approach produces highly abstract claims, e.g., that roots exist for which there is no direct lexical evidence, and that sequences of morphemes exist for which there is no direct phonological evidence. In each case these claims about lexical structure are made to minimize the number of exceptions to particular rules. Whenever possible underlying forms for exceptions are set up so that they are automatically correctly treated by the rules. Statements of the form, "x is the exception to rule N", are avoided

since they explicitly reduce the power of the generalization expressed by rule N.

Empirical Reality of Grammar.

There is a philosophical issue of far greater importance for linguistic science than the particular form of a grammar. What is the data for which a grammar must account? What facts should a linguistic description analyze? De Saussure formulated a distinction which has dominated most linguistic research, the distinction between langue, the formal structure of a language, and parole, the expression of that structure in actual speech.

Bloomfield in 1927 and 1933 sketched a requirement for linguistic investigation which essentially contravened De Saussure's distinction. Rather than deal with an abstract set of data, Bloomfield demanded that linguistics treat the "actual facts of speech," using rigorous scientific methods to classify and describe actual utterances. Even so he tacitly admitted that coughs, sneezes, yawns and so on are not properly considered to be utterances, although it is not clear what automatic scientific principle could rule out these vocal productions.

His practice as revealed in the Menomini studies shows that he did not take the formal requirements to consider only "actual speech" very seriously. In the "syntax" Bloomfield defined two types of utterances, fully grammatical

sentences (major sentences) and regular distortions of such sentences (minor sentences). It is important to note that he describes the derivation of minor sentences in terms of general classes of departures from major sentences. In this description Bloomfield implicitly presents a brief theory of 'parole,' a set of generalizations which describe how fully grammatical sentences are regularly deformed in actual speech:

> Any non-predicative expression can figure as a minor sentence. (23.146)
> In a minor sentence unlinked expressions may have no syntactic bonds other than the lack of pause intonation.
> Parataxis is made between a phrase mentioning speech and a direct quotation. (23.157)
> Often a sentence is built by new starts and repetitions. (23.163)

Throughout the morphology and morphophonemics a similar distinction is implicit in terms like "aberrant," "rhetorical stress," "loan words," "surface fluctuation," "effects of rapid speech," and so on. It is clear that he was not concerned with the description of all the facts in actual speech, and he certainly did not take actual utterances as his primary data. Rather, he started by providing a formal description for a highly stylized version of well-formed utterances and then briefly stated some of the regular distortions of these which occur in actual speech.

The use of this distinction raises another issue which is central to linguistics. What is the general relation between the formal grammar for such a stylized set

of utterances and what speakers actually do when they talk? There are three general positions on this question. A formal grammar is a model of behavior. Grammar is entirely divorced from behavior except that it happens to have roughly the same output (sentences). Or, grammar is not a literal model, but to every formal distinction there corresponds a behavioral distinction. What position did Bloomfield hold?

Did he think that formal linguistic structures have any bearing on reality, on what speakers actually do? Certainly his theoretical statements in "Language" (1933) are properly interpreted as claiming that grammatical devices characterize the language and not the speaker. In MM he refers to the rules as purely "descriptively ordered." Nowhere can any statement be found which contradicts his statements of 1933, that the order and form of grammatical rules is entirely arbitrary with respect to the manipulations performed by actual speakers when they use the processes which the grammatical rules describe abstractly. His statements on this subject give the impression that he objected to the view that formal grammar was a literal and direct model of psychological speech processes. This objection seems quite reasonable, but he apparently did not consider explicitly the alternative of interpreting the grammar as a constraint on a speaker's performance. From this point of view the best grammar would be one which accounts for

the sentences of the language and can be mapped onto performance in the simplest manner.

In any case, it is clear that in his theory Bloomfield viewed grammar as an arbitrary descriptive device which enumerates the correct forms of a language but which has nothing to say about the speakers of the language themselves.

His descriptive practice, however, shows several indications of the contrary position that grammar is a direct characterization of what the speaker knows. The treatment of minor dialects suggests that he felt that all speakers use the main grammar and add a few peculiar rules of their own to it. For instance, he placed the dialect rule (8), which lowers /i/ to /e/, in the final phonetic component of the morphology. (MM, a rule of "actual speech!") Since the ō - raising rule is in the morphophonemic component, the dialect rule does not precede it.

(20) Raise {/ō/ to /ū/, / ē/ to /ī/} if /i/ follows anywhere:

ō ⟶ ū in env. /____Xi/

mōskamit ⟶ mūskamit

Bloomfield writes:

> One of the conditioning factors for the raising is the occurrence of i later in the word. Some

> younger speakers have no i, replacing it everywhere by e; but these speakers maintain the alternation as regularly as do older ones, saying for instance, mu:skamit 'if he emerges' (mo:skomow 'he emerges') even though in their speech the vowel of the last syllable is the same as that, say, in po:semet 'if he gives me a ride.' (M 1.8) (M 1.22)

If the dialect rule (8) which replaces all /i/s by /e/s preceded rule (19) synchronically, then rule (19), the raising of /ō/ to /ū/ before /i/, could not operate correctly since the dialect rule destroys the requisite environment (after the dialect lowering there are no /i/s left). To characterize the speakers of a dialect in terms of the grammar, and in terms of the addition of another formally constructed dialect "rule" to the common grammar, is to accept implicitly the notion that the basic grammar is held in common to the speakers, not just the utterances.

In another case conclusions about speakers' fluctuations between forms clearly rest on the assumption that speakers actively use the grammar.

> Initial a is in part indistinguishable from o (in actual speech).
> Younger native speakers make nonce-formations which show uncertainty; all those I have noted consist in speaking a as o. For instance neto:hkæ:hkopene:kan, 'my basket' instead of the usual neta:hkæ:hkopena:kan, shows the speaker treating as /o/ the initial /a/ of a normal ahkæ:hkopena:kan. Similarly wæ næ:cemyakwah, 'one that smells decayed' instead of æ næ:cemyakwah shows the speaker treating as o the normal initial a of anæ:cemyakwat. (M 1.19)

The latter example requires a high degree of abstract analysis. Initial short /#o/ does not occur in any underlying forms, but initial /#wæ/ is changed to /#o/ by rule

(17); thus, phonetic initial [#o] must be /#wæ/ at the underlying level. In the form cited the first syllable undergoes initial change which lengthens the vowel (see rule (2a)). This lengthening precedes descriptively the assimilation to /o/ so that the initial form put out by the rules is /#wæ/ (and not /#o/).

In brief then, Bloomfield's account of these phonetic confusions requires that the speaker manipulate the grammar in a particular way. First he confuses the initial phonetic /#a/ with initial phonetic /#o/ although he does not produce the form with initial /#o/. We "know" that he has made this confusion because in other forms, where the initial syllable is lengthened, he does not produce a long /ā/ but produces a lengthened version of what "represents" initial /#o/ at the abstract level, namely, /#wǣ/. Thus we have evidence that he is representing the first vowel of this form as /#wæ/. Since such a representation is supposed to be the result of confusing [o] and [a] at the phonetic level it could be postulated that this phonetic confusion would result from the underlying form /#wæ/ only if the speaker himself were able to deduce the underlying form /#wæ/ from the confusion of phonetic [#o] and [#a]. The apparent ability to deduce and use confused underlying forms from confused phonetic forms means that a speaker is using a knowledge of the grammar, not just a knowledge of what the grammar describes. Since native speakers make these

complicated confusions, they must themselves be using the abstract grammar which Bloomfield has described.

It is impossible to know how Bloomfield would react to being shown that his analysis of these confusions depends on the assumption that native speakers use the same descriptive grammar that he has devised; he might then repudiate this example on the ground of theoretical inconsistency. In any case it is clear that, at least temporarily, he was assuming that the grammar is real and not arbitrary and that speakers use it when they use the language.

CHAPTER III

Some Phonological Problems in Menomini and Their Solution

In the preceding chapter I characterized the type of grammar which Bloomfield used in his Menomini studies. I showed that many aspects of his phonological theory correspond to concepts of present-day generative phonology. Some apparent differences in recent theory are in fact only refinements over Bloomfield's original constructs, e.g., the use of a phonological cycle of rules which apply to successively larger syntactic units, the technique of collapsing rules according to similarities in their processes as well as their environments, and the formal application of a simplicity criterion which values the best grammar as the one that uses the smallest number of symbols.

In brief, a generative phonology consists of an ordered series of rules which applies to lexical items to produce phonetic sequences. The lexical items are specified as sequences of sound segments. Each segment is itself defined by a set of two-valued phonological distinctive features. Each rule has processes which operate in a certain environment to change the feature composition of particular segments. Like lexical items, the processes and environments are expressed in terms of phonological segments specified by the two-valued distinctive features that they contain. These distinctive features are abstract. There is only

one constraint on their form and the relations between the abstract segments which they represent: at the end of a phonological derivation the abstract features are mapped onto multi-valued concrete features. Thus, the abstract features are set up so that they can be mapped onto the concrete features in a simple, direct manner.[1]

In this chapter I shall discuss an analysis of Menomini phonology using the general form of grammar proposed by Bloomfield but with the refinements introduced by generative phonology. I shall examine some problems in Menomini phonology either directly or indirectly noted by Bloomfield and show that the introduction of techniques from generative phonology does not conflict with Bloomfield's conception of phonology and its empirical bases. On the contrary, it maintains and refines his intuitions about the phonology. It provides a motivation for decisions in cases where he explicitly sought motivation, and it solves descriptive problems of which he was aware.

The first topic is an analysis of the basic types of Menomini segments. The second is the effect of generative analysis on the relation of the synchronic and historical description of the Menomini consonantal system. The third topic is the demonstration that Menomini has a four-vowel system. The next section demonstrates that semivowels are

predictable from the vowels /e, o/. The final section deals with some late phonological rules and the analysis of glottal stop.

Major Classes of Segments in Menomini.

Before discussing Menomini phonology in detail it is necessary to specify the major kinds of phonological segments which play a role. The basic morphophonemic distinction set up by Bloomfield is between syllabic and non-syllabic segments. This distinction does not have the kind of theoretical force that it has in distinctive feature notation, since all morphophonemes are indivisible. If the morphophonemes are viewed as a bundle of features, as they are in generative phonology, then it becomes immediately apparent that this distinction must be supplemented. For the abstract level Bloomfield proposes these morphophonemes:

Syllabics:

short vowels: a, æ, e, i, o, u, E, (The classifications are as shown in M.)

long vowels: ā, ǣ, ē, ī, ō

Non-syllabics:

semi-vowels: y, w

consonants: c, h, k, m, n, p, q, s, t, N

Distinctive feature notation requires that the various classes of segments be differentiated according to whether or not they share some feature markings. I propose that the above system be represented as:

	vowels	"consonants" (except h,q,y,w)	semi-vowels	glides (h,q)	nasals (m,n)
Sonorant	+	-	+	+	+
(1) Consonantal	-	+	-	-	+
Vocalic	+	-	-	-	-

Each distinction is, of course, motivated by particular groupings of segments or 'natural classes' which play a role in the phonological system. The feature distinctions are set up just so that it is possible to specify those sets of segments which act together. Throughout this chapter, the general descriptive value of these basic distinctions in Menomini will become apparent. In the next few paragraphs I briefly present some of the motivations for each distinction.

"+ - sonorant :" groups:

nasal consonants, semivowels, vowels ..... +sonorant

non-nasal consonants, glides ..... -sonorant

One of the most general distinctions in the phonology is between consonant clusters and single consonants. Clusters consist of sequences of two non-sonorants (including h/q). First, it is a characteristic of the morphophonemic system that no root begins with any cluster, although it can begin with a sequence of a consonant followed by a semivowel or by two semi-vowels. We can represent this fact about roots by the rule:

(2) $[\ ] \longrightarrow \begin{bmatrix} + \text{ son} \\ - \text{ cons} \end{bmatrix} / + \text{ —— } [- \text{ son}]$

Furthermore, the assignment of vowel length depends on several statements of clusters as part of the environment for the shortening of vowels: e.g., a vowel is shortened after a cluster and before a non-cluster:[2]

(3) $[+ \text{ voc}] \longrightarrow [- \text{ long}] \quad /[- \text{ son}]_2 \text{ —— } [- \text{ voc}]$

"+, - vocalic:" groups: vowels ..... "+ vocalic"

all other segments ..... "- vocalic"

We see above (3) that the natural class [- voc] is needed to represent any single non-syllabic segment. This feature also is employed in the insertion of /e/ between morphemes: (This is a refinement of rule (4) in Ch. 2.)[3]

(4) $\emptyset \longrightarrow e \quad / [- \text{ voc}] + \text{ —— } + [+ \text{ cons}]$

That is, /e/ is inserted between any two morphemes the first of which end in any non-vowel segment and the second of which begins any segment which is a consonant.

A second use for the vocalic distinction is in the determination of vowel length and stress. (See the discussion of glottal stop, below.) These depend on syllable counting

in which a "syllable" is defined as any vowel optionally preceded by a segment or word boundary and followed by a non-vocalic segment. We can represent this sequence as in (5):

(5) $[-\text{ voc}]_0 \quad [+\text{ voc}]_1 \quad [-\text{ voc}]_1$

Menomini words have the property of ending in one and only one non-vocalic segment. Vocalic and non-vocalic segments are dropped until there is only one final non-vocalic segment left preceded by a vowel. This can be stated in two rules (as Bloomfield does):

(6) a) $[+\text{ voc}] \longrightarrow \emptyset \quad / \text{ ——} \#$

b) $[-\text{ voc}] \longrightarrow \emptyset \quad / [-\text{ voc}]_1 \text{ ——} \#$

That is, first any final vocalic segments are dropped and then any sequences of final non-vocalic segments are dropped following a non-vocalic segment.[4]

"+, - consonant:" groups:

true consonants (excluding h/q) .... "+ consonant"

other segments ..... "- consonant"

This allows the glides and semi-vowels to act as a natural class in (7); i.e. /æ/ is not raised before /h,q,w,y/:

$$(7)\quad æ \longrightarrow e \;/\; \begin{bmatrix} +\text{voc} \\ +\text{long} \end{bmatrix} [-\text{voc}]_1 \;\_\_\; [+\text{cons}]$$

This represents the process of raising /æ/ except before /h,q,w,y/. Another use for this distinction is in the specification of initial segments or roots: An initial non-sonorant is always consonantal since /h,q/ do not occur initially. This can be represented:

$$(8)\quad [-\text{son}] \longrightarrow [+\text{cons}] \;/\; +\;\_\_$$

Historical and Present Analysis.

There are various observations made by Bloomfield which are sharpened by distinctive feature analysis. He provides some interesting observations on the general relation between the synchronic morphophonemic system and the history of the modern language. As I pointed out in Chapter 2, Bloomfield noted that there was a correspondence between the basic forms and early rules of the independently derived synchronic grammar on the one hand and the corresponding components of the grammar of the ancient form of the language on the other hand. He also noted that the rules toward the end of the synchronic grammar systematically reflect the development of the modern language from the ancient.

To understand how distinctive feature technique and criteria affect this observation, consider the systematic treatment of the "hypothetical morphophoneme," /N/. Since morphophonemes are indivisible units in Bloomfield's system, he had no way of systematically specifying its position in the morphophonemic pattern. He presents, however, the palatal and dental systems in this form:

(9) c, s, t, n, N

Here we have no idea of what characteristics /N/ actually has.[5] In fact, as we saw above, it can be placed anywhere in the system and represented by any symbol. Distinctive feature analysis, however, does provide motivation for describing /N/ as a particular phoneme with particular features. Below is a simple feature analysis of the consonantal system of Menomini:[6]

(10)

	p	t	k	s	c	n	m	N
Nasal	-	-	-	-	-	+	+	?
Grave	+	-	+	⊖	⊖	-	+	?
Strident	-	-	-	+	+	⊖	⊖	?
Continuant	-	-	-	+	-	-	-	?
Compact	-	-	+	-	-	-	-	?

Distinctive feature analysis allows a precise formulation of the notion, 'natural class' of morphophonemes: All the morphophonemes which share the feature markings $[\alpha X, \ldots \delta Y] = \sigma$ are members of the natural class σ. For example, /t/

and /c/ are members of the natural class, - nasal, - grave - continuant, and /c/ and /s/ are members of the class, - nasal, - grave, + strident.[7]

We can use the notion of 'natural class' to motivate particular analyses of underlying phonemes. For instance, Bloomfield sets up two kinds of underlying /n/ phonemes, those that can mutate to /s/, ("/N/"), and those that cannot, ("/n/"). Below I show that the solution of this problem in generative phonology indicates that "/N/" is actually a /θ/ at the abstract phonological level.

The Distinctive Feature Analysis of /N/

/N/ plays a role in two ordered rules (see rule 5a in Chapter 2):

(11) a) $N \longrightarrow s \quad / \quad \_\_ \begin{Bmatrix} e \\ y \end{Bmatrix}$

b) $N \longrightarrow n$

Suppose we assumed that /N/ was actually an /n/ and that there was another "n", /n_2/, which was not affected by rule (11a). If the two /n/s were kept distinct by some feature, "±x" then rules (11a) and (11b) would be written:

(12) a) $\begin{bmatrix} + \text{ nasal} \\ - \text{ grave} \\ + \text{ x} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ nasal} \\ + \text{ strident} \\ + \text{ continuant} \end{bmatrix} / \_\_ \begin{bmatrix} - \text{ cons} \\ + \text{ son} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix}$

b) $[+ \text{ x}] \longrightarrow [- \text{ x}]$

This solution has several formal disadvantages. For one thing it now requires that an additional feature "±x", be entered for some lexical items. Its lexical value is predictable ("-") for all except $\begin{bmatrix} + \text{ nasal} \\ - \text{ grave} \end{bmatrix}$ segments, but even that prediction involves the use of several features. Furthermore we are given no insight into what the feature "x" might be, and therefore we have no more understanding of what segment /N/ represents than without using feature notation. The simplicity criterion in distinctive feature phonology requires that each rule be stated with the smallest number of features. Suppose that we use this constraint as the basis for the initial hypothesis that /N/ differs from /s/ only in <u>one</u> of the feature markings "-nasal", "-strident", "-continuant". In this way rule (12a) could be simplified to read:

$$(13)\quad \begin{bmatrix} + \text{ nasal} \\ - \text{ grave} \\ + \text{ x} \end{bmatrix} \longrightarrow \begin{bmatrix} \alpha F_i \end{bmatrix} \quad / \quad \underline{\qquad} \quad \begin{bmatrix} - \text{cons} \\ + \text{son} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix}$$

where "αF_i" is one of the feature markings which define /s/: "-nasal", "+strident" or "+ continuant". Clearly /N/ must also be maximally close to /n/ so that rule 12b can be modified to:

$$(14)\quad \begin{bmatrix} +X \end{bmatrix} \longrightarrow \begin{bmatrix} \beta F_j \end{bmatrix}$$

where "βF_j" is one of the feature markings which define /n/:

"+nasal", "- grave", "- strident", "- continuant". Certain general constraints aid in the assignment of which features /N/ and /n/ could have in common if only <u>one</u> feature change is necessary to transform /N/ to /n/. For instance in Menomini (and probably universally) all consonantal segments marked "+ nasal" are marked "- strident" and "- continuant". This can be expressed by the redundancy rule:[8]

(15) $\left[+\ \text{nasal}\right] \longrightarrow \left[\begin{matrix}-\ \text{strident} \\ -\ \text{continuent}\end{matrix}\right]$

Such rules reduce the complexity of lexical entries since predictable features can be left unspecified. (Predictable features are circled on the distinctive feature chart, (16).) Thus if /N/ were a <u>nasal</u> which differed from /n/ in either its <u>stridency</u> or <u>continuance</u> the generality of the above rule would be lost and the lexical entry system would be correspondingly complicated. This alone is sufficient to argue that /N/ is the non-nasal counterpart of /n/, if they are to be differentiated by only one feature. Not only is /N/ marked "- nasal", it must also be marked "+ continuant" to distinguish it from /t/. When /N/ is made "+ nasal" by (11b), then rule 15 automatically makes it "- continuant". Then the feature analysis of /N/ is:

		/N/
(16)	Nasal	-
	Grave	-
	Strident	-
	Continuant	+

That is, "βF_j" in (14) is "+ nasal" and /N/ is actually /ɵ/. Rule (11b) is represented as:

(17) $\begin{bmatrix} - \text{ strident} \\ + \text{ continuant} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ nasal} \end{bmatrix}$

This is further supported by the fact that mutation (rule (11a)) can also now be explained as one feature change since /ɵ/ and /s/ are differentiated only by stridency: (αF_i in (13) is thus "+ strident").

(18) $\begin{bmatrix} - \text{ nasal} \\ - \text{ grave} \\ + \text{ continuant} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ strident} \end{bmatrix} / \text{——} \begin{bmatrix} - \text{ cons} \\ + \text{ son} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix}$

This analysis of rule (13) is also supported by the occurrence of an adjacently-ordered rule which changes /t/ to /c/ before /e/ ((5a) in Chapter 1):

(19) $\begin{bmatrix} - \text{ nasal} \\ - \text{ grave} \\ - \text{ continuant} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ strident} \end{bmatrix} / \text{——} \begin{bmatrix} - \text{ cons} \\ + \text{ son} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix}$

In distinctive feature phonology this ordering yields a more highly valued grammar since the process and environments of the two rules can be collapsed into one statement. This

statement in itself is simpler, requiring fewer features than either of the two statements it replaces:

$$(20)\quad \begin{bmatrix} -\text{nasal} \\ -\text{grave} \end{bmatrix} \longrightarrow [+\text{strident}] \Big/ \_\_\_ \begin{bmatrix} -\text{cons} \\ +\text{son} \\ -\text{grave} \\ -\text{comp} \end{bmatrix}$$

(Rule (17) must follow rule (20), to transform all non-mutated /θ/ to /n/ in the phonetic output.) Thus the assumption that /N/ is /θ/ not only leaves the lexical pattern as simple as possible, it also allows the phonological rules themselves to be simplified.

<u>The Menomini Clusters and /N/.</u>

Final synchronic support for the analysis of /N/ as /θ/ is found in the cluster system. The Menomini clusters are:[9]

(21)						
	cp		ck			
	hp	ht	hk	hc	hs	hN
	qp	qt	qk	qc	qs	qN
	sp		sk			

Assuming the feature analyses (1) and (10) the cluster occurrences (excluding hN, qN) are summarized:

$$(22)\quad \begin{bmatrix} -\text{voc} \end{bmatrix}_2^2 \quad \text{corresponds to} \left\{ \begin{matrix} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \end{bmatrix} \begin{bmatrix} +\text{cons} \\ -\text{nasal} \end{bmatrix} \\ \\ \begin{bmatrix} +\text{consonant} \\ +\text{strident} \\ -\text{grave} \\ -\text{son} \end{bmatrix} \begin{bmatrix} +\text{cons} \\ -\text{nasal} \\ +\text{grave} \\ -\text{strident} \\ -\text{continuant} \end{bmatrix} \end{matrix} \right\}$$

(Note that (22) assumes that consonant-semivowel sequences are basic consonant-vowel sequences; see pp. 107-116)

These constraints can be utilized on some early phonological rules which allow certain features to be lexically unmarked:

(23)

$$\left[-\text{ voc}\right] \rightarrow \begin{cases} \left[\begin{matrix}+\text{ cons}\\ -\text{ nasal}\end{matrix}\right] / \langle\!\longrightarrow \left[-\text{ voc}\right] \langle\!\longrightarrow \text{(i.e. "before or after [- voc]")} \\ \left[\begin{matrix}+\text{ grave}\\ -\text{ strident}\\ -\text{ continuant}\end{matrix}\right] / \left[+\text{ cons}\right] \text{ ——} \\ \left[\begin{matrix}+\text{ strident}\\ -\text{ grave}\end{matrix}\right] / \left[+\text{ cons}\right] \quad \left[+\text{ cons}\right] \end{cases}$$

If /N/ were marked "+ nasal", then the above rules and the lexical system would have to be more complex. If /N/ is actually /ɵ/ it fits into the above system without any added complexity.[10]

On the Use and Misuse of Simplicity.

In the preceding sections I have shown that the theoretical segment /N/ is best described in distinctive feature phonology as a basic /ɵ/. This decision is based on the fact that any other solution would result in a synchronic phonology which uses more symbols. In all later discussions of particular phonological problems in Menomini I shall use the same principle of simplicity to motivate decisions about the precise form of description, so it should be made clear at the outset how this principle is to be understood.

Simplicity of description is used as a criterion for choosing among competing analyses which satisfy all the other criteria of distinctive feature phonology. If the other a priori constraints on the form of grammar are correctly formulated then it is a claim of phonological theory that the simplest grammar will be the most adequate empirical representation.

It is hard to know what empirical extensions of phonological grammars it is reasonable to expect, other than the enumeration of the facts they were set up to describe. Chomsky has discussed the predictive adequacy of a particular set of phonological rules as one empirical criterion. That is, a set of rules can predict that certain non-occurring lexical items can occur more rarely than others because they are blocked by more morphophonemic rules. The empirical adequacy of these predictions can be tested against the intuitions of native speakers. Chomsky and Halle have argued that insofar as the general principles of distinctive feature phonology and simplicity motivate a particular synchronic analysis which predicts intuitively correct distinctions, both the general principle and the simplicity criterion receive empirical support.

Another source of empirical support for a synchronic phonological theory - albeit a weaker one than the above -

is the manner in which a synchronic analysis fits into an account of the history of the language. If a particular synchronic analysis provides for a coherent account of historical changes, then the general theory which leads to that analysis is supported over a general theory which does not provide for a coherent account of historical changes. Clearly this empirical criterion favors distinctive feature analysis over Bloomfield's, since in his analysis the theoretical segment /N/ has no particular place in the basic synchronic pattern and so cannot be integrated with the history of the language.

Consider the relation of the synchronic analysis of /N/ to the reconstructed Proto-Algonquin system set up by Bloomfield in a separate paper on the history of Algonquin languages.[11] The dental and palatal <u>non-nasal</u> system of Proto-Algonquin is:

(24)

t	c
θ	s

> Proto-Algonquian θ and l coincide in most languages. ... Menomini ... has /n/ coinciding with Proto-Algonquian /n/ but differing from the latter in morphologic treatment .... (Alg 6)

> Before i, ī, y, Proto-Algonquian t ⟶ c and θ ⟶ s .... This alternation distinguishes /n/ derived from Proto-Algonquian /θ/ in ... Menomini ... from /n/ derived from Proto-Algonquian /n/. (Alg 20)

Thus there are two historical sources for Menomini /n/, the original PA/n/ which does not mutate in general Algonquin , and PA/θ/ which does mutate. The following diachronic picture emerges:

(25) PA: θ l n

undergoes mutation: θ

Menomini phonetics: n

This parallels exactly the synchronic solution which we arrived at using distinctive feature analysis.

Thus with the use of natural classes and the goal of simplicity in the rules and lexicon we have synchronically derived the general solution corresponding almost exactly to the protolinguistic form and the historical changes. Distinctive feature analysis not only does not change Bloomfield's general observations, it follows them even more closely than his own phonological descriptions.

The Basic Four-Vowel System in Menomini.

The basic vocalic system of Algonquin is a quadrangle. For Menomini, however, Bloomfield sets up various other basic vowels and two semi-vowels:

(26) i u ī ū y w

e o ē ō

æ a ǣ ā

exceptional vowels: æ E ǣ

The most significant simplifications depend on the

prediction of the high vowels /i/, /ī/, and the semi-vowels /w/, /y/ from the other vowels /e, æ, o, a/. /i/ and /ī/ are assumed to be predictable from the assimilation of sequences of semi-vowels and vowels. This analysis is specifically rejected in M on the grounds that /i/ and /ī/ pattern like vowels even prior to semi-vowel assimilation; so in M the basic vowel system has six vowels and two semi-vowels.

The remainder of this part of the discussion of Menomini phonology is devoted to the reanalysis of the vowel system. Generative phonology provides several descriptive devices and motivations for a basic four vowel system in Menomini from which vowels and semi-vowels are derived. First I present the semi-vowel assimilation rules which produce /i̯/ and /u̯/ from semi-vowel-vowel sequences. Then I discuss the rules which predict /y/ and /w/ from basic /e/, /o/. Finally I discuss certain apparent exceptional forms to show that they have regular explanations.

Thus the following discussions shall prove that the basic vowels on the left are the underlying pattern for the segments on the right in the distinctive feature analysis in (27). Length is also a basic feature, although it is not represented below. (Long vowels have the same basic pattern.)

(27)

	e	æ	o	a
compact	-	+	-	+
grave	-	-	+	+
vocalic	+	+	+	+

	i	e	æ	u	o	a	y	w
diffuse	+	-	-	+	-	-	+	+
compact	-	-	+	-	-	+	-	-
grave	-	-	-	+	+	+	-	+
vocalic	+	+	+	+	+	+	-	-

Phonological rules

The Assimilation of Vowels and Semi-vowels.

Post-consonantal sequences of semi-vowels and vowels (except /a, ā/) are transformed into mid- and high-vowels. The rules that treat sequences of semi-vowels and vowels when morphonemes are adjoined, are summarized below.

1) After a consonant the first of two semi-vowels is dropped. (MM 16)

2) After consonant, y, w plus vowel other than a, ā are replaced by vowels. (MM 20)

(28) a) i) y ē ⟶ ē
ii) w ē ⟶ ō

b) i) y e ⟶ i
ii) w e ⟶ i

[all input sequences are post-consonantal]

c) i) y ǣ ⟶ ī
ii) w ǣ ⟶ ī

d) i) y æ ⟶ e
ii) w æ ⟶ o

e) i) y o ⟶ o
ii) w o ⟶ o

f) i) y ō ⟶ ō (no cases given)
w ō ⟶ ō

Examples (from MM 20 unless otherwise noted. The outputs are themselves intermediate forms.)

a) kōny+ēwe ⟶ kōnēwe
nētyānw+ēwe ⟶ nētyānōwew

b) kæsy+e+h ⟶ kæsih (M 4.29)
kyāsw+e+t ⟶ kyāsit (M 4.26)

c) pyāe-w ⟶ pīw
mænw+ǣnent ⟶ mænīnent

d) aqsæny+æns+ak ⟶ aqsænensak
sak+e+pw+ænt ⟶ sakepont

e) æskwāhtæmy+owāw ⟶ æskwāhtǣnowāw (M 4.29)
ǣhkw+ohnǣ+t ⟶ ǣhkohnǣt

Several modifications of these processes can be made. First, a general semi-vowel dropping rule can be isolated from the processes. It must be ordered to follow the mutations described in (28a - 28d). It incidently describes entirely the "assimilation" processes (28a,i), (28e) and (28f).

$$(29)\quad [-\text{cons}, -\text{voc}] \longrightarrow \emptyset \,/\, [-\text{voc}] \text{——} \begin{bmatrix} +\text{son} \\ -\text{grave} \\ -\text{comp} \end{bmatrix}$$

The combination of the mutation rules themselves is not so direct. If we classify the progressive and regressive assimilations according to the affected vowel, it is clear that there is an interaction between length and height. Short, low /æ/ and long, mid /ē/ assimilate the color of the previous semi-vowel, while long, low /ǣ/ and short, mid /e/ become high vowels. That is, processes (28a) and (28d) are related, as are (28b) and (28c). Distinctive feature analysis requires that the relations between the rules be reflected

in their formal statement. Thus the processes in (28a) and (28d) should be segregated in a rule separate from (28b) and (28c). In distinctive features the four rules are: (letters correspond to the labels in rule (28))

(28') (precedes rule (29))

a) ii) $\begin{bmatrix} - \text{ comp} \\ - \text{ grave} \\ + \text{ long} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ grave} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \\ + \text{ grave} \end{bmatrix} \_\_$

d) i) $\begin{bmatrix} + \text{ comp} \\ - \text{ grave} \\ - \text{ long} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ grave} \\ - \text{ comp} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \\ - \text{ grave} \end{bmatrix} \_\_$

ii) $\begin{bmatrix} + \text{ comp} \\ - \text{ grave} \\ - \text{ long} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ comp} \\ + \text{ grave} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \\ + \text{ grave} \end{bmatrix} \_\_$

---

b) $\begin{bmatrix} - \text{ comp} \\ - \text{ grave} \\ - \text{ long} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ diff} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \end{bmatrix} \_\_$

c) $\begin{bmatrix} + \text{ comp} \\ - \text{ grave} \\ + \text{ long} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ diff} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \end{bmatrix} \_\_$

(Note in (28'c) that the affected segments automatically become "-comp" as a consequence of becoming "+ diff". See footnotes 8, 15)

Above we saw that rules are combined according to the features they share. All the features on the right of the arrows are identical in rules (28'b) and (28'c), thus;

(30) $$\left[\begin{Bmatrix}-\text{comp}\\-\text{long}\\ \\+\text{comp}\\+\text{long}\end{Bmatrix}\right] \longrightarrow [+\text{diff}] \,/\, [-\text{voc}] \begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{son}\end{bmatrix} \begin{bmatrix}\\-\text{grave}\end{bmatrix}$$

Rule (30) is a correct combination of (28'b) and (28'c) but it is not a satisfactory representation of the fact that the vowel raising is a unified and general process. The same number of features in the process could be used to represent an intuitively much less general process, e.g. (31):

(31) $$\text{"æ} \longrightarrow \text{u"}$$
$$\begin{bmatrix}+\text{comp}\\-\text{long}\\-\text{grave}\end{bmatrix} \longrightarrow \begin{bmatrix}+\text{diff}\\ \\+\text{grave}\end{bmatrix}$$

That is, rule (30) fails to meet the goal of distinctive feature phonology of representing general processes with simple rules.

The complexity of rule (30) is due to the fact that it must apply to both /e/ and /ǣ/ to the exclusion of /æ/ and /ē/. Suppose that the processes in (29a, 29d) were preceded by an <u>exchange</u>[12] of short /e/ and short /æ/. There would then be two processes, a gravity assimilation of mid vowels following /Cw-/, (32a), and a raising of low vowels to high vowels (32b):

(32) (applies after /e/ and /æ/ are exchanged when they follow a consonant-semi-vowe l sequence)

(32)

a) $\begin{bmatrix} - \text{ comp} \\ - \text{ grave} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ grave} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \\ + \text{ grave} \end{bmatrix} —$

b) $\begin{bmatrix} - \text{ grave} \\ + \text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ diff} \end{bmatrix} / \begin{bmatrix} - \text{ voc} \end{bmatrix} \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \end{bmatrix} —$

That is, after /e/ - /æ/ exchange, non-compact, non-grave vowels assimilate gravity to the preceding semi-vowel, and non-grave, compact vowels become high.

This solution (in particular (32b)) satisfies the requirement of simplicity better than (30) but it is now necessary to include the exchange of /e/ and /æ/ as part of the system. Suppose that this were to be accomplished with two processes:

(33) a) $\begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ + \text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ comp} \end{bmatrix}$ ("æ ⟶ e")

b) $\begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ comp} \end{bmatrix}$ ("e ⟶ æ")

Unfortunately a system as in (33) cannot be used since rules (33a) and (33b) cannot apply in any order. Suppose (33a) preceded (33b): The output of the two rules would always be /æ/ since the /æ/ raised to /e/ by (33a) would subsequently be lowered to /æ/ by (33b) (along with basic /e/). Similarly, if (33b) preceded (33a) the unique output of the system would be /e/. An alternative is to introduce a new feature "$\pm$ x" which could differentiate those segments produced by the first rule from those to be affected by the second rule.[13]

(34) x) $\begin{bmatrix} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ x} \end{bmatrix}$

a) $\begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ + \text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ comp} \\ + \text{ x} \end{bmatrix}$

b) $\begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ - \text{ comp} \\ - \text{ x} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ comp} \end{bmatrix}$

Although the solution in (34) is adequate it is so complex that it would critically weaken the simplicity of the two-process solution proposed in (32). Furthermore rule (34x) is entirely arbitrary since there are <u>no</u> motivations in the choice of what feature "x" actually is. For these reasons the solutions in (34) must be rejected.

How, then can /e/ and /æ/ be exchanged so that (32) can apply correctly? The answer to this question requires the descriptive use of variables ranging over "+" or "-". Essentially, I shall propose that /e/ and /æ/ are exchanged by a "switching rule" (35) ordered before (32).

(35) $\begin{bmatrix} - \text{ grave} \\ - \text{ long} \\ \alpha \text{ comp} \end{bmatrix} \dashrightarrow \begin{bmatrix} \sim\alpha \text{ comp} \end{bmatrix}$

("α" has the value of "+" or "-"; "∼α" is "-" if "α" is "+", and is "+" if "α" is "-".)

<u>Phonological Variables</u>.

Before further discussion it is necessary to motivate briefly the general use of variables in phonological notation. Consider first the description of assimilation. Suppose

(as in English) that the voicing of the second segment in a final consonant cluster always agrees with the voicing of the first segment. This could be described by the following rules:

(36) a) $\begin{bmatrix} - \text{ voc} \\ + \text{ obstr.} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ voiced} \end{bmatrix} / \begin{bmatrix} + \text{ cons} \\ - \text{ voc} \end{bmatrix} \text{——} \#$

b) $\begin{bmatrix} - \text{ voc} \\ + \text{ obstr.} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{ voiced} \end{bmatrix} / \begin{bmatrix} + \text{ cons} \\ - \text{ voc} \\ + \text{ voiced} \end{bmatrix} \text{——} \#$

That is, all final consonantal segments preceded by consonants are unvoiced (36a), unless preceded by a voiced segment (36b). This solution fails to represent the unity of the notion "assimilation". (36a) and (36b) are distinct rules and as such they do not reflect adequately the claim that assimilation is a single, coherent phonological process. This would be represented, however, if phonological variables are included in the phonological theory. Using a variable "α" which can be either "+" or "-" (and must be one or the other in any given application of the rule) (36) becomes:

(37) $\begin{bmatrix} - \text{ voc} \\ + \text{ cons} \end{bmatrix} \longrightarrow \begin{bmatrix} \alpha \text{ voiced} \end{bmatrix} / \begin{bmatrix} + \text{ cons} \\ - \text{ voc} \\ \alpha \text{ voiced} \end{bmatrix} \text{——} \#$

Phonological variables are critically necessary in the description of dissimilation as a single phonological process. Suppose (as in Menomini, see below,) that a root initial non-consonantal sonorant becomes a semi-vowel after a vowel and

becomes a vowel after a semi-vowel, glide or consonant. This can be represented:

(38) a) $\begin{bmatrix} - \text{ cons} \\ + \text{ son} \end{bmatrix} \longrightarrow [-\text{ voc}] / [+\text{ voc}] \quad + \text{——}$

b) $\begin{bmatrix} - \text{ cons} \\ + \text{ son} \end{bmatrix} \longrightarrow [+\text{ voc}] / [-\text{ voc}] \quad + \text{——}$

Like (36) this solution fails completely to represent the concept of a <u>dissimilative process</u>. If the negative operator, "ɳ" is included in the notation, and "ɳ+" is "-" and "ɳ-" is "+", then (38) becomes:[14]

(39) $\begin{bmatrix} - \text{ cons} \\ + \text{ son} \end{bmatrix} \longrightarrow [\text{ɳ}\alpha \text{ voc}] / [\alpha \text{ voc}] \quad + \text{——}$

Often processes require phonological variables to express internal assimilations. For instance, in Menomini voicing is predictable from the feature "± sonorant":

(40) $[\alpha \text{ son}] \longrightarrow [\alpha \text{ voiced}]$

Internal dissimilation also occurs. In Menomini, short vowels are mapped onto phonetic segments in the following manner: (The feature "± grave" is not entered since it is the same phonemically and phonetically.)

(41) $a \longrightarrow \Lambda = \begin{bmatrix} - \text{ comp} \\ - \text{ diff} \\ - \text{ tense} \end{bmatrix}$

$æ \longrightarrow e = \begin{bmatrix} - \text{ comp} \\ - \text{ diff} \\ - \text{ tense} \end{bmatrix}$

$o \longrightarrow \text{ʊ} = \begin{bmatrix} - \text{ comp} \\ + \text{ diff} \\ - \text{ tense} \end{bmatrix}$

$$e \longrightarrow I = \begin{bmatrix} - \text{ comp} \\ + \text{ diff} \\ - \text{ tense} \end{bmatrix}$$

$$u \longrightarrow u = \begin{bmatrix} - \text{ comp} \\ + \text{ diff} \\ + \text{ tense} \end{bmatrix}$$

$$i \longrightarrow i = \begin{bmatrix} - \text{ comp} \\ + \text{ diff} \\ + \text{ tense} \end{bmatrix}$$

This can be represented:

$$(42) \quad \begin{bmatrix} - \text{ long} \\ \alpha \text{ comp} \\ \beta \text{ diff} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{ comp} \\ \neg\alpha \text{ diff} \\ \beta \text{ tense} \end{bmatrix}$$

(Notice that the same results can be stated in two rules (since all segments start out "-tense")

$$(a) \quad [+ \text{ diff}] \longrightarrow [+ \text{ tense}]$$

$$(b) \quad \begin{bmatrix} - \text{ long} \\ \alpha \text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} \neg\alpha \text{ diff} \\ - \text{ comp} \end{bmatrix}$$

Although this solution also contains internal dissimilation I did not present it since it involves (1) an ordering condition and (2) twice as many segments.)

Exchange Rules and Menomini Vowel Assimilation.

Return now to the problem posed in (33). How can /æ/ and /e/ be exchanged? (33a) and (33b) will not give the correct results, applied in any order, and solution (34) is complex and arbitrary. Using phonological variables, however, (33a) and (33b) can be combined into a single rule:

$$(43) \quad \begin{bmatrix} - \text{ long} \\ - \text{ grave} \\ \alpha \text{ comp} \end{bmatrix} \longrightarrow [\neg\alpha \text{ comp}] \Big/ [- \text{ voc}] \begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \end{bmatrix} \text{———}$$

Since (43) applies only once to change /æ / to /e/ and simultaneously /e/ to /æ / there is no difficulty with order of application. ((43) and (32) combine into (44).

(44) a) $[\alpha\ \text{comp}] \rightarrow [\sim\alpha\ \text{comp}] \ /\ [-\ \text{long}]$ (from (43))

b) $[-\ \text{comp}] \rightarrow [+\ \text{grave}] \ /\ [+\ \text{grave}]\ \_\_$ (from 32a)

c) $[+\ \text{comp}] \rightarrow [+\ \text{diff}] \ /\ \_\_$ (from 32b)

/ all in the environment $[-\ \text{voc}]\ \begin{bmatrix}-\ \text{voc}\\-\ \text{cons}\\+\ \text{son}\end{bmatrix}\ \begin{bmatrix}\_\_\\-\ \text{grave}\\+\ \text{voc}\end{bmatrix}$

(44) can be further simplified to: (The semi-vowel-dropping rule (29) is now included in 45d.) [15] (See the description of (53) for the interpretation of overlapping environments.)

(45) a) $[\sim\alpha\ \text{comp}] / [-\ \text{long}]$

b) $[\alpha\ \text{comp}] \rightarrow \{[\sim\alpha\ \text{grave}] / [+\ \text{grave}]\_\_\ ;\ [\alpha\ \text{diff}] / \_\_\}\ /\ [-\ \text{voc}]\begin{bmatrix}-\ \text{voc}\\-\ \text{cons}\end{bmatrix}\begin{bmatrix}\_\_\\-\text{grave}\\+\ \text{voc}\end{bmatrix}$

c)

d) $\begin{bmatrix}-\ \text{cons}\\-\ \text{voc}\end{bmatrix} \rightarrow \emptyset\ /\ [-\ \text{voc}]\_\_\begin{bmatrix}+\ \text{voc}\\-\ \text{comp}\end{bmatrix}$

Examples: (When not mentioned, rules (45b, c) apply vacuously.)

kōny+ēwe	
kōnēwe	(45d)
netyanw+ēwe	
netyanwōwe	(45b)
næ mæ nw+e+hsenǣ +m	
næ mæ nwæ hsenǣ m	(45a)
næ mæ nwihsenǣ m	(45c)
næ mæ nihsenǣ m	(45d)

pyǣ +w	
pyiw	(45c)
piw	(45d)
sak+e+pw+æ nt	
sakepwent	(45a)
sakepwont	(45b)
sakepont	(45d)

Initial /+o/ Assimilation and "Initial Change"

The phonological rules in (45) allow /i/ and /ī/ to be predicted from morphological combinations of vowels and

semi-vowels. In many cases /ī/ appears to be part of a root and not the result of combinations. For example /pīw/ in (45) is the result of the root /pyæ+/ and /+w/. Certain facts indicate that initial /+o/ is the result of the assimilation of /+wæ/ to /+o/:

(46) a) /e/ - does not appear in first syllable.
b) /i/ - does not appear in first syllable.
c) /wæ/ - does not appear in first syllable.
d) /o/ - does appear in first syllable.

If /i/ is always the result of the assimilation of /ye/ then (46a) explains (46b). Furthermore, if rule (45) were to be applied to semi-vowel-vowel sequences following morpheme boundary as well as following consonants, then (46c) and (46d) would be consistent: /wæ/ never appears initially because it is always transformed to /o/. Since semi-vowels can appear initially before long vowels, (45d) must be allowed to apply to initial semi-vowels only before short, non-compact vowels: (Note that the ordering of the "#" and "[-voc]" is free)

(47) $$\begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix} \longrightarrow \emptyset \Big/ \left\{ \begin{matrix} \langle \# \rangle \\ [-\text{voc}] \end{matrix} \right\} \text{——} \begin{bmatrix} +\text{voc} \\ -\text{comp} \\ \langle -\text{long} \rangle \end{bmatrix}$$

(Recall that "$\langle X \rangle$ # ... $\langle Y \rangle$" is interpreted, "if X ... then Y")

Similarly, rules (45a-c) must be allowed to apply

initially only to short vowels:

(48) a) $[\alpha\ \text{comp}] \;/\; [-\ \overline{\text{long}}]$

b) $[\alpha\ \text{comp}] \rightarrow \{[\alpha\ \text{grave}] \;/\; [+\ \text{grave}]\}$

c) $[\alpha\ \text{diff}] \;/\; \_\_\_$

$$\left\{\begin{matrix}[+\ \text{voc}] \\ \langle \# \rangle\end{matrix}\right\}\begin{bmatrix}-\ \text{voc} \\ -\ \text{cons} \\ +\ \text{son}\end{bmatrix}\begin{bmatrix}-\ \overline{\text{grave}} \\ \langle +\ \text{long} \rangle\end{bmatrix}$$

Certain phonological changes are the reflections of morphological processes. One of these provides further motivation for the analysis of initial /o/ as basic /wæ/. The first syllable of words undergoes various changes which are conditioned by the subordinate clause mode: These changes are called "Initial Change" (IC) by Bloomfield (M 4.74-9)

(49)

In the first syllable

a) a, æ $\rightarrow$ $\bar{æ}$
   o $\rightarrow$ $\bar{o}$ (when /o/ is not word initial)

b) initial o is replaced by $w\bar{æ}$

c) initial $y\bar{a}$ has a prefixed to it

d) after the initial consonant, the sequences $w\bar{a}$, $y\bar{a}$ have ay prefixed to them

e) all long vowels except those in a-d have /ay/ prefixed

Aside from rule (49b) this can be represented:

(49') a) $\emptyset \longrightarrow \begin{bmatrix} +\text{son} \\ -\text{voc} \\ -\text{cons} \\ -\text{grave} \end{bmatrix} / \# \left\{ \begin{matrix} [+\text{cons}] \_\_\_\_ [-\text{voc}] \\ [\ ]^1_o \_\_\_\_ [+\text{long}] \end{matrix} \right.$

b) $\begin{bmatrix} -\text{long} \\ \alpha\ \text{comp} \end{bmatrix} \longrightarrow \begin{bmatrix} +\text{long} \\ \alpha\ \text{grave} \end{bmatrix} / \# [-\text{voc}]^2_o \_\_\_\_$

c) $\emptyset \longrightarrow \begin{bmatrix} -\text{cons} \\ +\text{voc} \\ -\text{long} \\ +\text{grave} \\ +\text{comp} \end{bmatrix} / \# [-\text{voc}]^1_o \_\_\_\_ \begin{bmatrix} +\text{son} \\ -\text{voc} \\ -\text{grave} \end{bmatrix}$

Examples:

ahsamet	kwāhnet	pōset
āehsamet (b)	kywāhnet (a)	pyōset (a)
	kaywāhnet (c)	payōset (c)

If initial /o/ is repreaented as /wæ-/, then the above rule (49) will correctly produce the result noted in (49'b):

Without initial change	With initial change
wæ +sāmeqtaw	wæ +sāmeqtat
wesāmeqtaw - (48a)	wāe sāmeqtat - (49b)
wosāmeqtaw - (48c)	
osāmeqtaw - (47)	

Assimilation and Menomini Syllable Structure.

One further restriction on the application of the exchange rule (48a) allows the structure of Menomini basic syllables to be highly regular. If /i/ and /ī/ are derived from /C$\left\{ \begin{matrix} y \\ w \end{matrix} \right\}$e/ and /C$\left\{ \begin{matrix} y \\ w \end{matrix} \right\}$æ/, and both /i/ and /ī/ appear in some roots, then the possible consonant-semivowel-vowel sequences

are: (Notice that basic / C$\begin{Bmatrix} y \\ w \end{Bmatrix}\begin{Bmatrix} æ \\ \bar{e} \\ o \\ \bar{o} \end{Bmatrix}$ / would produce / C$\begin{Bmatrix} e \\ \bar{e} \\ o \\ \bar{o} \end{Bmatrix}$/ which are already basic vowels. Thus the only reason for such basic sequences could be to represent different sources for [e ē o ō]. At the moment I know of no motivation for this.)

(50) C$\begin{Bmatrix} y \\ w \end{Bmatrix}$ $\begin{Bmatrix} e \\ \bar{æ} \\ a \\ \bar{a} \end{Bmatrix}$ C ——

Not only are the possible vowels asymmetric, this restriction is different from initial semivowel-vowel sequences, (51):

(51) #(C)$\begin{Bmatrix} y \\ w \end{Bmatrix}\begin{Bmatrix} æ \\ \bar{æ} \\ a \\ \bar{a} \end{Bmatrix}$ C ——

If the exchange rule (48a) applies only to morphologically combined sequences and initially, then the syllabic composition would be quite uniform:

(52) a) C$\begin{Bmatrix} y \\ w \end{Bmatrix}\begin{Bmatrix} æ \\ \bar{æ} \\ a \\ \bar{a} \end{Bmatrix}$

b) #(C)$\begin{Bmatrix} y \\ w \end{Bmatrix}\begin{Bmatrix} æ \\ \bar{æ} \\ a \\ \bar{a} \end{Bmatrix}$

(48a) is restricted to morphological combinations or initial semi-vowel-vowel sequences, by the requirement that at least one morpheme boundary, "+", be present:

(53) a) b) c) $[\alpha\ \text{comp}] \rightarrow \begin{cases} [\alpha\ \text{comp}] \,/\, \langle\!+\!\rangle \_\_ [\overline{-\ \text{long}}]\ \langle\!+\!\rangle \\ [\alpha\ \text{grave}] \,/\, [+\ \text{grave}] \_\_ \\ [\alpha\ \text{diff}] \,/\, \_\_ \end{cases}$

all in the environment: $\left\{ \begin{matrix} \langle \# \rangle \\ [-\ \text{voc}] \end{matrix} \right\} \begin{bmatrix} -\ \text{voc} \\ -\ \text{cons} \\ +\ \text{son} \end{bmatrix} \begin{bmatrix} \overline{+\ \text{voc}} \\ -\ \text{grave} \\ \langle -\ \text{long} \rangle \end{bmatrix}$

("$\langle\!+\!\rangle$ x $\langle\!+\!\rangle$ ... $\langle\!+\!\rangle$ y $\langle\!+\!\rangle$" is interpreted "at least X or Y". By convention, the overall environment condition is to be superimposed on the individual environments: for example, "/ [+ x] [+ y] in the environment [+ p] [+ g] " is interpreted"/ $\begin{bmatrix} +\ \text{x} \\ +\ \text{p} \end{bmatrix} \begin{bmatrix} +\text{y} \\ +\text{g} \end{bmatrix}$." I use this notational convention here and below <u>only</u> to increase the comprehensibility of the written rules: unlike other notational conventions, I am using this purely for orthographic simplicity.)

<u>Example</u>:

sōnwæ yan+æ m	(M 6.36)
sōnwiyanæ m	(53c)
sōniyanæ m	(47)

If rule (53a) applies only across morpheme boundaries, basic /i/ inside a root is represented as /Cyæ/, while /i/ which is developed from morphological combinations is represented as / C $\langle\!+\!\rangle$ y $\langle\!+\!\rangle$ e/. The advantage of this alignment is that the basic vowels which can follow a semi-vowel after a consonant can be systematically restricted - <u>only compact vowels can occur</u>. (See (52a)) This allows statement of the

general restrictions on Menomini syllables, which will be useful in the prediction of semi-vowels from basic non-compact vowels:

(54) A syllable never ends in a semi-vowel preceding a consonant, and is either:

a) a non-vocalic segment followed by a vowel.

b) a non-vocalic segment followed by a semi-vowel followed by a compact vowel.

c) an initial non-vocalic segment, not /h/ or /q/, followed by a compact or long vowel.

d) an initial compact or long vowel.

- or -

$$\text{(a - b)}\quad \left[-\text{ voc}\right]\left\langle\begin{bmatrix}-\text{ voc}\\ -\text{ cons}\\ +\text{ son}\end{bmatrix}\right\rangle \qquad \left[\begin{matrix}+\text{ voc}\\ \langle+\text{ comp}\rangle\end{matrix}\right]$$

$$\text{(c - d)}\quad + \left[\begin{matrix}-\text{ voc}\\ \{+\text{ son}\\ +\text{ cons}\}\end{matrix}\right]_{o} \qquad \left[\begin{matrix}+\text{ voc}\\ \{+\text{ comp}\\ +\text{ long}\}\end{matrix}\right]$$

The Prediction of /u/ and /ū/.

There is only one source of /u/ and /ū/. First /ē/ and /ō/ are raised to /ī/ and /ū/ if a postconsonantal high vowel or semi-vowel follows anywhere in the word: (i.e. "X" below cannot contain a "#".)

$$(55)\quad \begin{bmatrix}+\text{ voc}\\ +\text{ long}\\ -\text{ comp}\end{bmatrix} \longrightarrow \left[+\text{ diff}\right] \Big/ \text{---}\ X\ \left[+\text{ cons}\right] \begin{bmatrix}-\text{ cons}\\ +\text{ son}\\ +\text{ diff}\end{bmatrix}$$

Examples:

mayēcekwaq ⟶ mayīcekwaq

kōnyak ⟶ kūnyak

In certain cases (initial syllable, preceding glottal stop), short /o/ is also raised to short /u/: (See below, (pp128ff.) the treatment of glottal stop, for an analysis of this process.)

(56)

$$\begin{bmatrix} +\text{voc} \\ -\text{long} \\ -\text{comp} \\ +\text{grave} \end{bmatrix} \longrightarrow [+\text{diff}] \;/\; [+\text{cons}] \text{—} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix} [+\text{cons}]\,[+\text{cons}] \begin{bmatrix} +\text{son} \\ +\text{diff} \end{bmatrix}$$

Example:

koqnatwaq ⟶ kuqnatwaq

Thus there is no need to represent /u/ or /ū/ as basic vowel segments. (See below, where (55) and (56) are combined.)

Some Exceptional Vowels.

I have shown that the six vowels /i, u, e, o, æ, a,/ and two semi-vowels are predictable from combinations of four basic vowels, /e, o, æ, a/ and the semi-vowels. There are in addition several exceptional vocalic segments. There are three basic vowels which underlie /e/, /ē/, which do not cause t-mutation nor do they act as /e/ in vowel assimilation and lengthening. The chart below summarizes the behavior of these exceptional segments, and the representation Bloomfield gave them in M and MM. The regular phonemic

vowel which the segment acts like in each phonological process is listed separately.

MM	M	In sv-v assimilation	does it cause t-mutation	if length changes	phonological output
"ϵ"	"æ"	æ	no	ē	e, ē
"∂"	"E"	æ	no	ǣ	e, ǣ
-	"ǣ"	ē	no	e	ē, e

Each of these segments does not pattern consistently like any of the four vowels /a, æ, e, o/. It is not clear how many instances of each exception actually occur. In every case there are several solutions available which leaves the four-vowel system intact.

"æ".

In MM Bloomfield sets up a special set of clusters "nC" and precedes them with "æ" ("ϵ" in MM). He then orders a set of rules:

(57) a) t-mutation (rule 20)

b) vowel assimilation (rule 53) (45 d)

c) "æ" ⟶ e / ____nC (MM 22)

d) n ⟶ h / ____ C

e) length assignment rules

That is, there are two types of phonetic [hC], those that derive from basic /nC/ and those from /hC/. All the cases of "æ" occur before /nC/ and are raised to /e/ following the processes of t-mutation and assimilation, so that the above solution is easily available. It involves, however, the construction of basic /-nC/ clusters since there is

no other motivation for them. This would considerably complicate the basic cluster system. (See (21))

It is not at all clear what prompted Bloomfield to develop this solution to the problem. Rule (57d) can affect only sequences set up as /-nC/ in the underlying structure. Rule (57c), also, is not required on any independent grounds.

"æ" is really an /e/ which assimilates like /æ/ and doesn't cause t-mutation. We could set up a special segment with these properties, and this is what Bloomfield did in M. But to do this with distinctive feature notation would greatly complicate the lexical entries for vocalic segments. If there are only four vowels, the system is:

(58)

	e	æ	o	a
compact	-	+	-	+
grave	-	-	+	+

Any additional vocalic segment would require at least one additional feature which would have to be marked "+" or "-" on at least three of the five vocalic segments. Since considerations of phonological complexity include the complexity of the lexicon itself, this solution must be rejected.

The alternative above,(57) is rejected on similar grounds, since it weakens the generalizations which can be used to simplify the lexical specification of clusters. (See rules (22), (23).) Suppose instead we introduce a rule ordered like

(57c) above, to precede the vowel length adjustment rules,

(59) æ ⟶ e /

and we specify that all segments are marked [- rule 59], except the few sequences of /ænC/in which "æ" occurs: (I can find only two - thus rule (59) might be classified as a 'minor rule' (c.f. Lakoff 1966). In this case all segments are automatically [- rule 59], unless otherwise stated.)

(60) [ ] ⟶ [- rule 59] / —

-ænS+
-æn+ ⟶ [+ rule 59] / —

⋮

At first this solution may appear to offer no advantage over simply introducing a new vocalic segment and feature to distinguish it: the assignment of that feature would be similar to the above interpretation(ω). The difference lies in the kind of empirical claim intrinsic to these solutions. If a new vocalic feature were to be used, how should we decide what feature to use? There are many available (e.g., "±diffuse", "± voiced", "± sharp") and it is arbitrary which is chosen since the segments are ultimately mapped onto one of the regular vowels.

It is exactly the arbitrariness of the decision which indicates that we should use a formalism which has no specific

phonological claims inherent to it. The solution I propose claims exactly what is correct and no more: Certain basic /æ/ which act as /æ/ for t-mutation and semi-vowel assimilation are then treated as /e/ in the length assignment system and thereafter.

"E"

"E" is a segment which acts as /æ/in the entire phonology but which emerges at the end of the phonology as /e/. Setting up a separate vocalic segment faces the same objections as those discussed for /æ/. There is a fairly large number of suffixes with initial /E/ (at least 20). Suppose we treated these suffixes as though they were entered lexically with an initial word boundary, "#", and that t-mutation is not allowed to apply across #, although the other rules are. Then the regular late rule,

$$(61)\quad \begin{bmatrix} +\text{voc} \\ -\text{long} \\ -\text{grave} \end{bmatrix} \longrightarrow [-\text{comp}] \;/\; \#\,[-\text{voc}]_0 \;\_\_$$

would apply correctly to raise these /æ/ to /e/ after the other phonological systems.

Notice that this solution has an attendant claim; namely, that /E/ is a phonologically systematic exception related to the 'size' of the juncture preceding a set of suffixes. Note also that (61) solves the problem of being an exception to t-mutation since the # blocks its application.

"ǣ",

Like "æ", this segment is extremely limited in occurrence, so that it is probably best to treat it as a rare /ē/ which is marked [- t-mutation] by exception.

Caveat.

The exact form of these proposals depends on the entire phonological system. Since I have not observed the whole system, nor all occurrences of these exceptional segments, they may have characteristics which would motivate different analyses. The point of this discussion has been to show that several descriptive devices are available which will treat these exceptions adequately and leave intact the basic four-vowel quadrangle.

The Prediction of Basic Semivowels from Vowels.

The preceding discussions have organized some of the restrictions on the composition of Menomini syllables and have shown that Menomini has only four basic vowels. The restrictions on syllables with apparent 'basic' semivowels in them are so great that it is possible to derive the semivowels themselves from basic /e/ and /o/. In this section I present a set of rules which uniquely assigns the feature "± voc" to segments marked "+son" and "-cons" in the lexicon.

In addition to the general syllable restrictions summarized above there are other restrictions on underlying phonemic forms relevant to the correct prediction of the feature "± voc": (These restrictions are stated in (62) with the assumption that basic semivowels are phonemic; the following discussions utilize these restrictions to predict the occurrence of /y,w/.)

(62) a) No basic diphthongs occur. A sequence of two sonorants is always composed of a semivowel followed by a vowel.

b) Semivowels do not occur between vowels and consonants, or after the glides /h,q/.

c) Semivowels occur finally (in roots) to the exclusion of /e,o/ except after semivowels.

d) /ye, yo, we, wo/ do not occur in post-consonantal positions within roots, since the assimilation rules would change these sequences to /e, o, o, o/ which can be entered as they stand.

These constraints are a rough statement of certain aspects of the vowel-semivowel-consonant sequences which can occur in the basic morpheme. They are not exhaustive, but they do allow for formulation of a set of rules to assign semivowels. Suppose that segments are entered only with the features "$\pm$ son", "$\pm$ cons". Then the forms with vowels and semivowels on the right would be represented as on the left, below in (63). (Capital letters are used to indicate segments marked "$\begin{bmatrix} - \text{ cons} \\ + \text{ son} \end{bmatrix}$" but not marked for vocalicness.)

(63)

+AnOĀĒht+OÆE+	+anwǣht+wæy+
+OEǢO+	+wyǣw+
+kOnE+ĒOE+O+	+kony+ewe+w+
+OĒskEO+A+EÆO+	+weskew+a+yæw+
+Ahk OO+Æk O+	+ahkow+ækw+
+OĒkEOAm+	+wekewam+
+Æn+kĀpOOE+O+	+æn+kapowe+w+
+kÆmEO+Ank+	+kæmew+ank+
+kAO+OÆpÆnÆO+	+kaw+wæpænæw+
+OĀOAn+	+wāwan+
+Æ skOĀh+ĀEmE+OÆ OĀO+	+æ skwāh+ǣmy+wæ wāw+
+AnÆm O+Æ OE+O+	+anæmw+æwe+w+
+kĒkOOAO+	+kekowaw+
+kÆ +ĒEAO+	+kæ +eyaw

Rules (64), (65) correctly assign "$\pm$ voc".

(64) a) $[+\text{ son}] \rightarrow [+\text{ voc}]$
b) $\rightarrow [-\text{ voc}] \; / \begin{bmatrix} \_\_ \\ + \text{ cons} \\ - \text{ son} \end{bmatrix}$

(64a),(64b) simply mark all basic sonorants "+ vocalic" and all basic consonants "-vocalic". Rule (65) then changes some sonorant, vocalic segments to non-vocalics.

(65) $$\begin{bmatrix} +\text{ voc} \\ -\text{ comp} \\ -\text{ long} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ voc} \\ +\text{ diff} \end{bmatrix} \Big/ \left([+\text{ voc}] \right) \_\_ \begin{cases} \text{(a)} & [+\text{ voc}] \\ \text{(b)} & + \end{cases}$$

The environment statement in (65) must utilize several substantive conventions which govern the interpretation of (disjunctive) optional segments (indicated by "( )"), and (conjunctive) rule schemata (indicated by "{ }"). To operate correctly on the forms in (63), rule (65) must be interpreted as standing for these four ordered rules:

(66) $$\begin{bmatrix} +\text{ voc} \\ -\text{ comp} \\ -\text{ long} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ voc} \\ +\text{ diff} \end{bmatrix} \Big/ \begin{cases} 1) & [+\text{ voc}] \_\_ [+\text{ voc}] \\ 2) & [+\text{ voc}] \_\_ + \\ 3) & \_\_ [+\text{ voc}] \\ 4) & \_\_ + \end{cases}$$

These sub-rules apply only within morphemes - i.e. to the lexical entries before word formation. Rules (1) and (2) apply disjunctively with rules (3) and (4). That is, if (1) or (2) applies in a particular derivation, then neither (3) nor (4) is allowed to apply. There is precedent for this interpretation of rules like (65) which have optional environments. Chomsky and Halle (SPE) have proposed that rules with optional environments, e.g. "X(Y)", universally first apply the longer environment, "XY". Only if that environment cannot apply, is the shorter environment, "X" tried.

A formal mechanism which automatically gives this result is to mark each segment "-rule N" once it has been affected by rule N. (As we saw above (in the section on exceptional vowels in Menomini) "$\pm$ Rule N" lexical features are required for all segments in any case.) Once a segment has been marked "-Rule N" by the longer form of an optional rule, "XY", then ipso facto it cannot be affected by the shorter part of that rule, "X".

Chomsky and Halle do not state whether the disjunctive application of optional rules ranges over the individual segments, or entire morphemes. If the answer were for a rule with an environment "X(Y)" that both "XY" and "X" cannot apply to the same morpheme, then solution (65) could not work in any case, since there are many examples in which two or more rules from (65) must apply to the same morpheme. (See the examples below.) So, let us assume that the disjunctive application of optional rules ranges over the individual segments, that is, if "XY" involves a segment, then that segment cannot be affected subsequently by environment "X" alone. This segmental disjunction convention can be stated:

(67) 1) A Rule "R_i" stated to include optional environments is interpreted as several subrules applying in the order of longest to shortest environment (By convention any segment, "[ ]" is counted as longer than "+") Each subrule is itself labled "R_i".

2) If a rule has an optional environment and a rule schema, the sub-rules are ordered

primarily by the optional environment (following 67-1). The sub-rules are secondarily ordered according the the schema. (A schema refers to an ordered series, e.g. " $\left\{\begin{matrix}[+\text{ voc}] \\ + \end{matrix}\right.$ ".)

3) A rule "R_i" is tried in its order and can apply to change a segment only if the segment is not marked "-rule R_i". Any segments mentioned in the environment as well as the segments affected by rule N in an application are marked "-Rule R_i" after its application.

Notice that conditions (67) allow more than one of the optional rules in "X(Y)" to apply within a morpheme, but "X" does not apply to any segments mentioned in the rule "XY".[16] Furthermore (67-2) guarantees that (65) is not interpreted as having (66-2) follow (66-3). The examples below illustrate the operation of rule (65) as interpreted by the 'segmental disjunction convention'. (The examples assume that (64) has applied. The marking "-Rule 65" due to convention (67-3) is indicated by underlining the segment.)

+ahkoo+
+ahkow+ (66-2)

+kone+
+kony+ (66-4)

+æ skoāhtæ me+
+æ skwāhtæ me+ (66-3)
+æ skwāhtæ my+ (66-4)

+kapooe+
+kapowe+ (66-1)

+ēeao+
+ēyao+ (66-1)
+ēyaw+ (66-2)

+oēskoo+
+oēskow+ (66-2)
+wēskow+ (66-3)

+æ oe+
+æ we+ (66-1)

+oēkeoam+
+oēkewam+ (66-1)
+wēkewam+ (66-3)

Consider now the implications of not using the conventions stated in (67). Suppose that (67-1) (try longer environments first) were not used, and (66-3) could precede (66-1):

+kapooe+		+oēkeoam+	
*+kapwwe+	(66-3)	*+wēkywam+	(66-3)

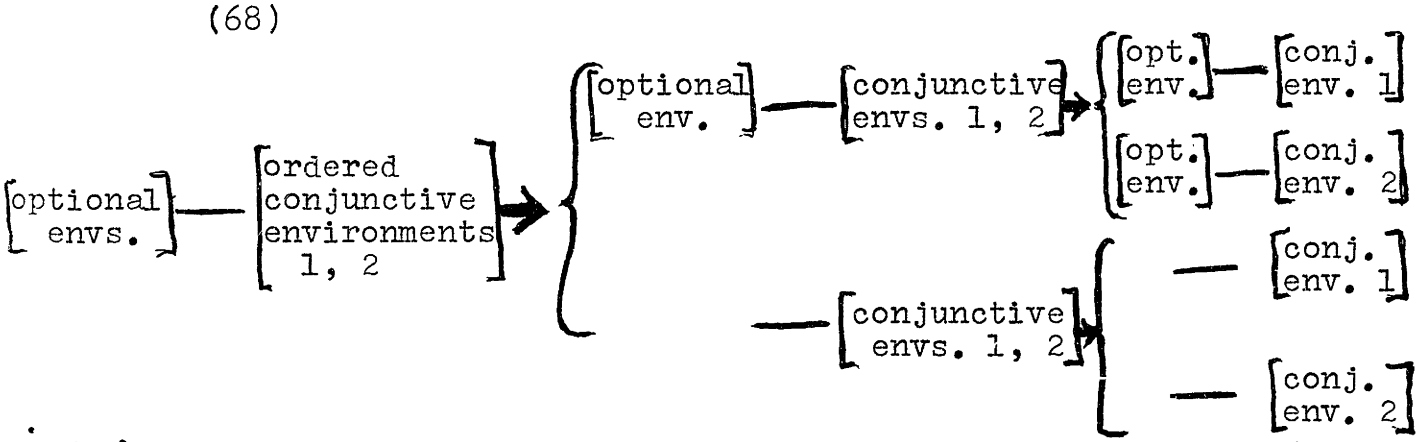
Incorrect results also occur if (4) could precede (2):

+oēskoo+		+ahkoo+	
+oēskwo+	(66-4)	*+ahkwo+	(66-4)
*+wēskwo+	(66-3)		

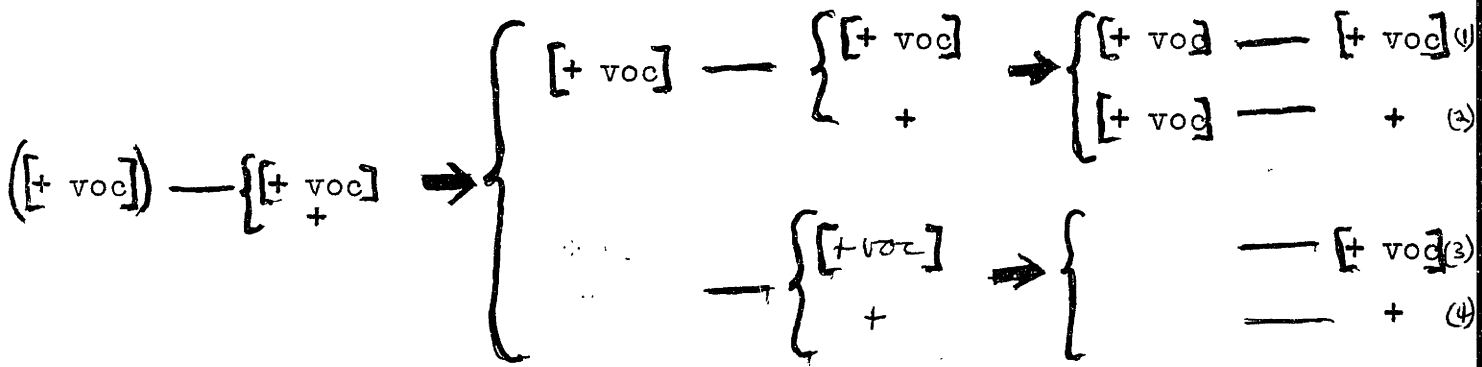
Thus the optional environment "([+ voc])" must be applied before trying the form of the rules without it.

(67-2) applies to (65) to expand the environments into sub-rules in the following order:

(68)



i.e.:



Suppose that (67-2) were not used, and the sub-rules were developed by first expanding the conjunctive environments. This would give the order:

$$\left([+\text{voc}]\right)\text{—}\left\{\begin{matrix}[+\text{voc}]\\ +\end{matrix}\right\}\rightarrow\left\{\begin{matrix}\left([+\text{voc}]\right)\text{—}[+\text{voc}]\rightarrow\left\{\begin{matrix}[+\text{voc}]\text{—}[+\text{voc}] & (66\text{-}1)\\ \text{—}[+\text{voc}] & (66\text{-}3)\end{matrix}\right.\\ \left([+\text{voc}]\right)\text{—}+\rightarrow\left\{\begin{matrix}[+\text{voc}]\text{—}+ & (66\text{-}2)\\ \text{—}+ & (66\text{-}4)\end{matrix}\right.\end{matrix}\right.$$

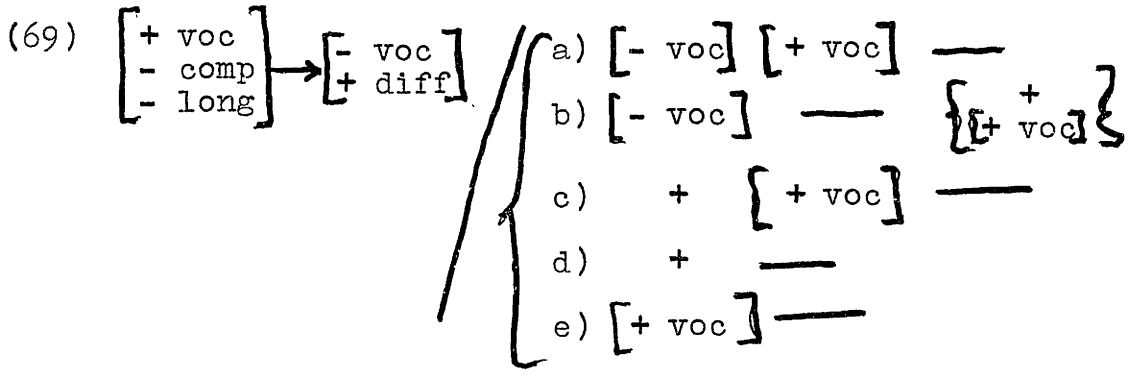
This is equivalent to the order 66-1, 66-3, 66-2, 66-4, which is the same as indicated by (67-2), except that (66-3) precedes (66-2). This ordering gives incorrect results, e.g:

+oēskoo+
*+wēskwo+ (66-3)

It is clear that the disjunction condition on optional environments cannot restrict entire morphemes to only one application by (65); many morphemes require more than one rule to apply, to different parts. (See examples, p.111). But suppose that there were no segmental disjunctive restriction and all expansions of (65) could apply; this too would lead to incorrect derivations:

+æ oe+		+kapooe+	
+æ we+	(66-1)	+kapowe+	(66-1)
*+æ wy+	(66-4)	*+kapowy+	(66-4)

Thus rule (65) critically exploits all of the conventions in (67). If the conventions were not available, the processes which assign $\left[\begin{matrix}-\text{voc}\\ +\text{diff}\end{matrix}\right]$ would be unnecessarily complex: ((69).)

(69) 

The complexity of (69) is itself the empirical motivation for the conventions.

This concludes the presentation of the rules which predict the feature "$\pm$ vocalic". To account correctly and simply for the phenomena it is necessary to assume that phonological rules with optional environments are interpreted as applying the environments in order of decreasing complexity. Optional environments are expanded before rule schemata. A further convention allows a shorter environment to apply to transform a segment only if that segment has played no role in any of the preceding longer environments. In certain cases this allows different optional environments to apply at different points within the same morpheme, but never to the same segment. The conventions of segmental disjunction of rules with optional expansions and primary expansion of optional environments must be proposed as a general formal universal if they are proposed at all. Thus, further empirical consequences of these conventions are necessary to motivate their unquestioned inclusion in phonological theory.

Some Apparent Exceptions to this Solution.

The only incorrect results from this system are morphemes with two initial semivowels (e.g. /+oeæ o+/ above). (p. 108) If these cases are in fact correctly included as regular Menomini forms, (65) can be modified to include (c), ordered before (a), (b):

(70) $\begin{bmatrix} +\text{ voc} \\ -\text{ comp} \\ -\text{ grave} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ voc} \\ +\text{ diff} \end{bmatrix}$ / (c) + ——— ([+ voc]) — { (a) [+ voc] ; (b) + }

These cases, however, seem to be set up for those instances where an initial /y/ does not cause n-mutation in a preceding morpheme (blocked by a /w / introduced initially), and a small number of instances which begin in phonetic $[\#\{y\ w\}\ \bar{\imath}\ -]$ which must be / + $\{y\ w\}$ $\{y\ w\}$ ǣ —— / in their underlying form. (See (45) above.) I think that these are also exceptional forms, so (70 c) may turn out to be unnecessary.

Solution (65) also assumes that there are no post-consonantal sequences of five vowels in which the middle three are all potential semivowels. For example, the sequence /+C æ oe æ — / would be correctly transformed to /+C æ wy e — / since both the /e/ and /o/ are intervocalic at the time of (66-1)'s application. But sequences like /+C æ oeo æ — / would be incorrectly transformed to */+C æ wyy æ —/ instead of /+C æ wewæ—/. I have found no such morphemes, but there do not seem to be any general

constraints which would rule them out.

There are some apparent exceptions to rule (65) in which morpheme-final, postconsonantal /e, o/ do not appear as /y, w/. In most instances, there are / — Ce+/ before /+æ C — /, which appear ultimately as /CeC/. (The second of two vowels across morpheme boundary drops: see rule (71).) The results would be the same as those if the forms were / — Cy_/; the semivowel-vowel assimilation rules would convert / — Cy+æ C — / to / — CeC — /. Any other exceptions to (70) would have to be lexically marked as such.

The Dropping and Merging of Vowels.

When two morphemes bring two vowels together, a short vowel drops to leave a long vowel, and the second of two short vowels drops:

(71) $\begin{bmatrix} +\text{ voc} \\ -\text{ long} \end{bmatrix} \longrightarrow \emptyset \;/\; \text{i)}\ [+\text{ voc}] + \_\_\_\_$

$/\ \text{ii)}\ \_\_\_\_ + [+\text{ voc}]$

If two long vowels come together they are separated by an introduced /y/.

There is a general exception to the rules governing adjacent vowels: if two long /ā/ are brought together, instead of infixing a /y/, one of the /a/ drops, i.e., "...ā)+ (ā.... ⟶ ....ā...." The set of rules below includes this phenomenon and correctly derives adjacent vowel sequences. If these rules apply after the semivowel assignment rules the morpheme boundary "+" does not need to be included specifically since rule (68-1) automatically includes it, and there are no vowel sequences after the semivowel assignment rules, except those across morpheme boundary.

(72) $[+\text{ voc}] \longrightarrow \emptyset \;/\; \begin{array}{ll} \text{i)} & [+\text{ voc}]\ \underline{[-\text{ long}]} \\ \text{ii)} & \underline{[-\text{ long}]} \\ \text{iii)} & \langle [+\text{ comp}, +\text{ grave}] \rangle \end{array} \Big\} \begin{bmatrix} +\text{ voc} \\ +\text{ long} \\ \langle +\text{ comp} \\ +\text{ grave} \rangle \end{bmatrix}$

(Recall that "$\langle X \rangle \ldots \langle Y \rangle$" is interpreted "if X...then Y".) (72-i,ii) are the same as in (71). (72 iii) expresses the special case in which /ā + ā/ is shortened to /ā-/. After these rules, y-insertion (73) can apply anywhere between vowels since the only sequences of vowels are those left by rule (72).

(73) (y insertion)

$$\emptyset \longrightarrow \begin{bmatrix} + \text{ son} \\ - \text{ voc} \\ - \text{ cons} \\ - \text{ grave} \end{bmatrix} \Big/ \begin{bmatrix} + \text{ voc} \end{bmatrix} + \text{——} \begin{bmatrix} + \text{ voc} \end{bmatrix}$$

Some saving can be made if y-insertion (73) is ordered adjacent to e-insertion, which inserts /e/ following nonvocalic segments (consonants and semivowels) and preceding consonantal segments. The two rules are: (features in parentheses indicate redundant markings; they are included to indicate the overlap of /y/- and /e/- insertion.)

(74) (y-insertion)

$$\emptyset \longrightarrow \begin{bmatrix} + \text{ son} \\ - \text{ voc} \\ - \text{ cons} \\ - \text{ grave} \\ (- \text{ comp}) \end{bmatrix} \Big/ \begin{bmatrix} + \text{ voc} \\ (- \text{ cons}) \end{bmatrix} + \text{——} \begin{bmatrix} + \text{ voc} \\ (- \text{ cons}) \end{bmatrix}$$

(75) (e-insertion)

$$\emptyset \longrightarrow \begin{bmatrix} (+ \text{ son}) \\ + \text{ voc} \\ - \text{ cons} \\ - \text{ grave} \\ - \text{ comp} \end{bmatrix} \Big/ \begin{bmatrix} + \text{ voc} \end{bmatrix} + \text{——} \begin{bmatrix} (- \text{ voc}) \\ + \text{ cons} \end{bmatrix}$$

(N.B. - all segments marked $\begin{bmatrix} - \text{ voc} \\ - \text{ cons} \\ + \text{ son} \end{bmatrix}$ are automatically "[+diffuse]".)

Using the conventions on the interpretation of "α" discussed, the above combine into one rule:[17]

(76)

$$\emptyset \longrightarrow \begin{bmatrix} +\text{ son} \\ \alpha\text{ voc} \\ -\text{ cons} \\ -\text{ grave} \\ -\text{ comp} \end{bmatrix} \Big/ \begin{bmatrix} \alpha\text{ voc} \\ \alpha\text{ cons} \end{bmatrix} + \_\_ \begin{bmatrix} \alpha\text{ voc} \\ \alpha\text{ cons} \end{bmatrix}$$

Examples: (From now on the examples assume that (64) applied to fill in the feature "+ vocalic".)

a s e ǣ + æ n + am	"he pushes it back"
a s y ǣ + æ n + am	semivowel assignment rules. (70)
a s y ǣ + n + am	(72i)
a s ī n a m	assimilation rules. (53, 49d)

a s e ǣ + ǣ n + æ m æ o	"he blows him back"
a s y ǣ + ǣ n + æ m æ w	semivowel assignment (70)
a s y ǣ + y ǣ n + æ m æ w	(76)
a s ī y ǣ n æ m æ w	assimilation rules.

+nakā+āpeǣ +nasoæ +æ o+	
+nakā+āpyǣ + naswæ +æ w+	(sv assignment, (70))
+nakā+āpyǣ +naswæ +w+	(72 i)
+nakā+pyǣ +naswæ +w+	(72 ii)
nakāpīnasow	assimilation rules

+pōn+m+	
+pōn+em+	(76)
pōnew	
+keāso+t+	
+kyāsw+t+	(sv assignment, (70))
+kyāsw+et+	(76)
+kyāsot+	assimilation rules

This completes the discussion of the basic constitution of Menomini words. The systems discussed are ordered as follows:

sv assignment (70)
adjacent vowel dropping (72)
e/y insertion (76)
t-mutation (20)
semivowel-vowel assimilation (53), (49d)

The motivations for this particular ordering are quite numerous. Here are some of them.

Semi-vowel assignment must precede adjacent-vowel dropping since the latter rule assumes that the feature "± vocalic" has been assigned to all segments. Furthermore, even if all vowels were marked "+ vocalic" by some other rule, adjacent-vowel-dropping could often apply incorrectly to delete an /o/ or /e/ which should eventually become /w/ or /y/.

Adjacent-vowel-dropping must precede both e-insertion and y-insertion so that they can be combined into one rule. If the order were the reverse, intermorphemic introduced /y/ would be inserted incorrectly between short vowels (one of which is ordinarily already deleted by adjacent-vowel dropping). e/y-insertion necessarily precedes t-mutation, since an inserted /e/ often causes mutation in the preceding /t/. Finally, t-mutation must precede semi-vowel-vowel assimilation so that there can be two kinds of phonetic /ī/, those which cause t-mutation (represented as basic /+yæ/), and those which do not (basic /+wē/).

Glottal Stop and Some Late Phonological Rules in Menomini.

After these rules have applied, Menomini forms are quite close to their final phonetic shape. Several processes remain, however, which apply only between word-boundaries: the adjustment of length and the raising of vowels. Involved in these is a systematic set of exceptions which contain glottal stop; this is discussed separately in the final section.

Length Adjustment.

A superficially complex set of processes adjusts the vowel length of syllables. These processes are outlined by Bloomfield as in (77).

(77) a) "In monosyllabics, short vowels are replaced by long." os ⟶ ōs

b) "If the first two vowels of a word are short the second is replaced by a long vowel."

mæ hk+am+w ⟶ mæ hkām

but

pōn+am+w ⟶ pōnam

c) "Anywhere after a long vowel after a closed syllable a long in an open syllable (a syllable not ending in a cluster) is replaced by a short vowel."

kēhk+ām-æ w ⟶ kēhkamæ w

but

kēhkāht-am ⟶ kēhkāhtam

(78) a) "If the even syllable after the next preceding long vowel...is open and has a long vowel, this long vowel is replaced by a short."

mamææ nawææ nehtamow+ææ +w → mamææ nawæ nehtamowæw

but

mēn+ææ w ⟶ mēnææ w

b) "If the even syllable is closed and contains a short vowel, this vowel is replaced by a long vowel."

māmat+æ hkā+æ w → māmatææ hkaw (the last ā causes the "+æ..." to drop, by rule (72)) (and is shortened by (77 c))

but

pyææ t+æ hkā+æ w → pĭtæ hkaw

The ordering restrictions on these rules limit the extent to which the environments and processes can be combined. Rule (77a) can, of course, be ordered anywhere in the length-adjustment system since no other rules affect monosyllabic words. The most efficient ordering is to combine 77a and 77b:

(79) $[+\text{voc}] \longrightarrow [+\text{long}]$

a) $/\#\ [-\text{voc}]_0^2\ \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\ [-\text{voc}]\_\__1$ (77b)

b) $/\#\ [-\text{voc}]_0^2 \text{ ——} [-\text{voc}]_1\ \#$ (77a)

Rules (79a), (79b) may be collapsed according to convention (61), since rule (79a) contains (79b) and they never both apply to the same word. If a form has two initial short vowels then rule (80) must apply in its long form to lengthen the second vowel (recall that the longest environment of optional rules applies first). By applying, the first short vowel is marked "-rule 80", so the short form of rule (80) cannot affect it after the second vowel is lengthened.

(80) $[+\text{voc}] \longrightarrow [+\text{long}] /\#\ [-\text{voc}]_0^2 \left(\begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right)[\text{voc}]_1\ \_\_$

The Importance of 'Vacuous' Application of Rules.

The only instance in which the longer environment cannot apply is if there is no second vowel, i.e., if the

word is a monosyllable. The case in which the first vowel is short and the second vowel is long is important. Rule (80) correctly has no effect on such forms, since the longer environment applies vacuously to the second vowel - it is already long. But the vacuous application is necessary even though it has no effect on the second vowel so that the first (short) vowel is marked "-rule (80)"; if the first vowel were not marked "-rule (80)" the short environment would apply incorrectly to lengthen the first vowel. Thus in this case we see that a rule must apply, even if it has no overt effect on the segment.

As they are stated in (77) (78), the other rules cannot be dealt with so simply. The environments of rules (78a) and (78b) can be combined together, but rule (77b) must precede these rules since long vowels are produced in (77b) which are referred to in (78a) and (78b). For instance, the final /-āw/ is unaffected in example (a) below, but in (b) it is shortened due to the long vowel produced by rule (77b). (Notice that /-aw / is an 'open syllable', since it does not end in a cluster.)

(a)	næ kan+ā+w	"he is left" (4.49)
	næ kān+ā+w	(77b) (or 80 , long environment)
	næ kānāw	output
(b)	kæ +næ kan+ā+w	"thou leavest him"
	kæ +nææ kan+ā+w	(77b)
	kæ nææ kan+a+w	(78a)
	kæ nææ kanaw	output

Rule (77b) must also precede (77c) as stated. Rule (77b) lengthens certain vowels before clusters which then allow rule (77c) to shorten the vowel in the next syllable.

næ+koqn+ā+w	"I fear him"
næ+kōqn+ā+w	(77b)
næ+kōqn+a+w	(77c)
næ kōqnaw	output

Finally, (77c) must also precede rules (78a) and (78b) since those rules are sensitive to some short vowels produced by rule (77c).

kēhkā-m-ǣ+w	"he berates him"
kēhkamǣ w	(77c)
kēhkamæ w	(78a)

The complexity and variety of these rules can be reduced. Suppose that we analyzed the phenomena as consisting of only two processes, one which shortens and one which lengthens vowels. They could be ordered: (Not in distinctive feature phonology notation for clarity.)

(81) a) [ ] → [- long]

i) before a single consonant and after a cluster (76c)

ii) before a single consonant, and an even number of consecutive short-vowel syllables after a long vowel (78a)

iii) before a single consonant, and an even number of consecutive short-vowel syllables starting from the beginning of the word. (Odd number from first syllable.) (77b and 78a)

b) [ ] → [+ long]

i) before two consonants, and an even number of consecutive short-vowel syllables after a long vowel (78b)

ii) before two consonants, and an even number of consecutive short-vowel syllables from the beginning of the word (77b and 78b)

iii) in the second syllable of a word, after a short syllable (77b)

iv) in a monosyllabic word (77a)

These rules can be combined: (81 aii) and (81 bi) are related, as are (81 aiii) and (81 bii). In fact they are identical statements except that in the shortening rules (81 aii, iii) (and 81 ai), the affected vowel is before a single consonant, while in the lengthening rules (81 bi, ii) the affected vowel precedes a cluster.[18]

(82) a) [ ] → [- long]

b) [ ] → [+ long]

i) after a cluster

ii) an even number of consecutive short vowel syllables (1) after a long vowel, or (2) after the beginning of a word

iii) in the second short syllable of a word; or the first short syllable if there is no second syllable (rule 80)

for (a), i, ii apply only before a single non-vocalic segment, iii never applies.

for (b), ii only before a cluster, iii everywhere, i never applies.

The essential feature of this solution is that certain processes which depend on the presence of a long vowel, ((77 c) and (d)) can be made to apply even though no long vowel is there, because it is predictable that one will be by rule (77 b) (the long form of 80 or (82 biii).) Thus rule (82 ai) requires that a long vowel be present somewhere preceding in the word. Rule (82 biii) guarantees that every polysyllabic word at least has a long vowel in the second syllable. Since words do not have initial cluster, the only problem is the possibility of inappropriate application of (82 ai) to the second syllable of a word with initial short vowel.

This, however, is correctly handled by these rules. Consider first the underlying form ahkōk (M4.30). (82 ai) changes this to ahkok. But rule (82 biii) lengthens the second vowel to produce the correct output ahkōk.

The other processes which can apply before lengthening even though it ordinarily depends on a long vowel are (82aii), (82bii). Suppose that in a basic form the first two vowels are short. In this analysis the rules apply from the beginning of the word. Consider the basic form kæ næ kanāw. In this analysis rule (82aii) applies to shorten the /a/ since the /-ā-/ is the fourth vowel from the beginning (i.e., the /ā/ is two vowels from a vowel which will be predictably lengthened by (82bii)). Subsequently, the second /æ/ is lengthened by rule (82biii).

Examples:

kēhkāmæw
kēhkamæw (82 ai)

os
ōs (82 biii)(short environment)

mæhkam
mæhkām (82 biii) (long env.)

māmatæhkāw
māmetæhkaw (82 ai)
māmatǣhkaw (82 bii)

mamǣ nawǣ nehtamowǣw
mamǣ nawæ nehtamowæw
mamæ nawæ nehtamowæw
mamǣ nawæ nehtamowæw

82 { aii (from long vowel) / aii (from beginning) / biii (long env.) } (may be interpreted as applying simultaneously)

kæ næ kanāw
kæ næ kanaw
kæ nǣ kanaw

82 { aii / biii (long env.) }

næ kognāw
næ koqnaw
næ kōqnaw

82 { aii / biii (long env.) }

The Analysis of Glottal Stop.

Glottal stop in Menomini is enmeshed in a large number of systematic exceptions. In this section I show that these exceptions are resolved if word initial sequences /#(C)Vq-/ are treated as though they are /#(C)V̄q V-/.

The arguments for this conclusion come from analysis of vowel length, raising, and stress, and the phonetic interpretation of glottal clusters. In each of these distinct phonological phenomena the assumption that certain initial glottal sequences are actually /V̄qV/ regularizes these forms so that the general rules apply without exception. Thus I am following the technique used by Bloomfield of modifying the lexical structure of exceptional forms so that general phonological rules operate without change.

Length Adjustment and Glottal Stop.

Above I presented the analysis of vowel length alternations. Consider rule (82biii), which guarantees that the second syllable of a word is long if the first syllable is not. The only exceptions to this process are words with the initial sequence /#(C)VqCV—/. Although the other rules apply regularly to these sequences the rule (82biii) does not apply. For example:

næ næ qnāw	basic form (MM 31)
næ næ qnaw	82ai
næ nǣ qnaw	82biii
næ nǣ qnaw	output

BUT (if the -V̆q- sequence is in the first syllable)

næ qnāw	basic form
næ qnaw	82 ai
næ qnaw	output (82 biii should apply to yield *hæquāw)

To account for the fact that words with initial short vowel-glottal stop sequences are not affected by rule (82 biii) complicates rule (82 biii):

$$(83)\ [\ ] \rightarrow [+\text{long}] / \# \ [-\text{voc}] \_ \ [\begin{matrix}+\text{voc}\\-\text{long}\end{matrix}] \left[\begin{matrix} -\text{voc} \\ \left\{ \begin{matrix} [\begin{matrix}+\text{cont}\\-\text{son}\end{matrix}] \\ [\begin{matrix}+\text{cons}\\+\text{son}\end{matrix}] \end{matrix} \right\} \end{matrix} \right] \_$$

(N.B. Note that (83) also excludes sequences of /VqV/. This is acceptable since /q/ never precedes a vowel.)

The above solution inherently claims that the exceptional treatment of glottal words is a peculiar feature of the length-adjustment rules, and is <u>not</u> a property peculiar to the glottal words themselves. There is an alternative approach to this. Suppose we assume that the original statement of the length adjustment system (82) is correct and that <u>glottal words themselves</u> have properties which block the application of (82 biii).

The other length adjustment rules appear to apply regularly to glottal words, e.g.,

aq͡senæ nahkwāq	
aq͡senæ nahkwaq	82 aii

koq:tahkwāq (MM .33)
koq:tahkwaq §2 aii
koq:tāhkwaq §2 bii

The descriptive problem is thus to set up forms with initial short syllables ending in glottal stop which automatically block (80 biii) but allow the other length rules. There are many ways in which glottal words could be temporarily altered to have this effect. One is to change sequences of /#(C)VqC-/ into /#(C)V̄qVC-/ by rule (84a) before the length adjustment rules and then reduce them back to /#(C)VqC/ by rule (84b). (The feature analysis of /q/ is "$\begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix}$")

(84) a) i) $\emptyset \rightarrow \begin{bmatrix} +\text{voc} \\ -\text{long} \end{bmatrix} / \left\{ \#\begin{bmatrix} -\text{voc} \end{bmatrix}_0^2 \left\{ \begin{bmatrix} +\text{voc} \\ -\text{long} \end{bmatrix} \right\} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix} \left\{ \begin{bmatrix} \text{—} \end{bmatrix} \right\}$

ii) $\begin{bmatrix} +\text{voc} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{long} \end{bmatrix}$

b) i) $\begin{bmatrix} +\text{voc} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{long} \\ \emptyset \end{bmatrix} / \#\begin{bmatrix} -\text{voc} \end{bmatrix}_0^2 \text{—} \left\{ \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix} \right\} \left\{ \begin{bmatrix} +\text{voc} \\ \text{—} \end{bmatrix} \right\}$

ii) $\begin{bmatrix} +\text{voc} \end{bmatrix}$

The applications of (84 a) and (84 b) are uniquely determined so that they cannot interfere with any other phonological rules. (84 a) applies only to 'glottal words',

(words with initial -V̆qC- syllables), and since /q/ never precedes a vowel elsewhere, (84 bi) and (84 bii) are uniquely restricted to those forms produced by (84 a). The effect of this solution is to claim that the reason the second vowel of a glottal word is not lengthened by (82 biii) is that the first vowel is already long (due to 84 aii). (Thus the second vowel is shortened before a single consonant, not by rule (82 ai) as it appears superficially, but actually by (82 aii).)

Examples:

(the rule order is 84 a, 82, 84b) ("v" indicates an unspecified vowel introduced by (84 a i))

næ qnaw	
næ qvnaw	84 a i
nǣ q vnaw	84 aii
næ qvnaw	82 aii (82 biii can't apply)
næ qvnaw	84 bi
næ qnaw	84 bii
aqsenæ nahkwaq	
aqvsenæ nahkwāq	84 a i
āqvsenæ nahkwāq	84 aiii
āqvsenæ nahkwaq	82 ai
āqvsenæ nāhkwaq	82 bii
aqvsenæ nahkwaq	84 bi
aqsenæ nahkwaq	84 bii
koqtahkwāq	
koqvtahkwāq	84 ai
koqvtahkwāq	84 aii
kōqvtahkwaq	82 ai
kōqvtāhkwaq	82 bii
koqvtāhkwaq	84 bi
koqtāhkwaq	84 bii

Although this analysis allows the glottal words to be handled as exceptions, the rules add a complexity of 8 features above

the analysis which states the exception as part of rule (82biii). Below I show that glottal words are exceptions to several other phonological phenomena in Menomini and that the solution outlined in (84) also resolves these. This indicates that the forms, not the rules, are exceptional, and this conclusion is supported by the fact that the analysis using rule (84) is simpler than any others, if the complexity of the whole grammar is considered.

Vowel Raising.

In the first chapter I discussed some of the theoretical implications of the rule which raises /e/ to /i/ in all environments. In addition to this rule, there is a general process which raises all long mid-vowels if a post-nonsyllabic high vowel (or semi-vowel) follows in the sentence. (See rule 18 in Ch. 1 and rule (55) in this Chapter.)

> "Whenever the high vowels i, ī, u, ū, or the semi-vowels or y, w after a non-syllabic occur later in the word, the vowel ē is raised to ī and the vowel ō to ū." (M.4.66, MM 35)

We can express this:

(85) $$\begin{bmatrix} +\text{long} \\ +\text{voc} \\ -\text{comp} \end{bmatrix} \longrightarrow [+\text{diff}] / \_ [\,]_0 \quad [-\text{voc}] \quad \begin{bmatrix} -\text{cons} \\ +\text{diff} \end{bmatrix}$$

An addition to this rule is that "$\overset{v}{o}$ in the first syllable of a glottal word is raised to $\overset{v}{u}$;" for instance, koqnatwaq ⟶ kuqnatwaq. Rule (85) must be modified. (Since /e/ does

not occur in initial syllables, the environment of (86) does not need to exclude it specifically.)

(86) $$\begin{bmatrix} - \text{ comp} \\ + \text{ voc} \end{bmatrix} \rightarrow [+ \text{ diff}]$$

$$/ \text{ i) } [+ \overline{\text{long}}][\ ]_0 [- \text{ voc}] \begin{bmatrix} - \text{ cons} \\ + \text{ diff} \end{bmatrix}$$

$$/ \text{ ii) } \# [- \text{ voc}]_0 [\text{—}] \begin{bmatrix} - \text{ voc} \\ - \text{ son} \\ - \text{ cons} \\ - \text{ comp} \end{bmatrix}$$

Of course, if the initial /o/ in a glottal word were actually a long vowel, then rule (86) could apply without <u>any</u> additional complication. This is the case if we use the analysis of glottal words outlined in (84). Rule (84 aii) lengthens the vowel preceding the /q/ of glottal words.

If the raising rule (85) follows (84 a), syllable initial /o/ in glottal words is lengthened to /ō/ by (84 aii) and <u>then</u> raised to /ū/ (by (85)). (84 bi) follows to shorten the /ū/ to /u/.

koqnatwāq	input
kōqVnatwāq	84 ai, 84 aii
kūqVnatwāq	85
kuqnatwāq	84 bi, 84 bii

Thus the use of the analysis in (84) allows the raising rule to be simply stated.

<u>Glottal Words, Stress, and Phonetics.</u>

<u>Neutralization</u>. As part of the phonetic rules, Bloomfield writes:

> "Initial short vowels are often spoken with tongue position indifferent as to height and distinct only as to front or back." (M 1.17)

That is:

$$(87) \quad [+\text{ voc}] \rightarrow \begin{bmatrix} - \text{ diff} \\ - \text{ compact} \end{bmatrix} / \; \# \; [-\text{ voc}]_0 \; \_\_$$

This occurs except in glottal words, in which initial short vowels maintain their gravity distinctions. To account for these exceptions we would have to change rule (87):

$$(88) \quad [+\text{ voc}] \rightarrow \begin{bmatrix} - \text{ diff} \\ - \text{ comp} \end{bmatrix} / \; \# \; [-\text{ voc}]_0 \; \_\_ \; \left\{ \begin{bmatrix} + \text{ cons} \end{bmatrix} \begin{bmatrix} - \text{ cons} \\ + \text{ cont} \end{bmatrix} \begin{bmatrix} + \text{ son} \end{bmatrix} \right.$$

This complexity (4 additional features) is avoided, of course, under the assumption that the first syllables of glottal words are long at this point in the derivation. This will be the case if (87) follows (84 a) and precedes (84b).

Stress.

The above height neutralization rule (87) may be related to stress. It is always the case that initial short vowels are unstressed. The same exception appears here, namely that the first vowel of glottal words is stressed much more than any other short vowel is ever stressed.

If we interpret this observation as meaning that these vowels have primary stress (since short vowels otherwise receive secondary stress at most) then this would surely be an exception to the general stress rules. (See rules 10 and 11 in Ch. 2.)

This complicated difficulty (at least 4 additional features) is resolved if the initial sequence of a glottal word is #(C)V̄qVC rather than #(C)VqC. In the former case the first vowel is regularly stressed primary and the vowel following the consonant is then subject to secondary stress (if the other conditions are met).

aqsæ nyak	input
ā́qVsæ nyak	84ai, 84aii
ā́qV̀sæ nyak	primary stress - Rule 10b, Ch.1
ā̀qV̀sæ nyak	secondary stress-Rule 11, "
àqsæ nyak	84bi, 84bii

Quite clearly, the glottal-vowel-dropping rule (84b) must also be ordered after the stress rules.

The Exceptional Terminal Clusters /qc/, /qs/.

In particles and some exceptional nouns the clusters /-qc /-qs / occur regularly. These constitute exceptions to the rule (see Ch. 2) discussed above, which applies to leave only one non-vocalic in word-final position:

$$(89)\ [\ ]_1^2 \longrightarrow \emptyset \ \Big/ \begin{matrix} / \\ / \end{matrix}\Big\}_1 [-\text{voc}]_1 \Big\{_1 \begin{matrix} [\frac{+\text{voc}}{\ }]\# \\ [\frac{\ }{-\text{voc}}]\# \end{matrix}$$

There are several exceptions to this rule, notably with the terminal clusters /-qs/ and /-qc/.

nouns	particles
nekiqs	ceyāqs (17.4)
namǣqs	kiaqc (17.4)

There are only a few noun exceptions, but there are many particles. However, it is not the case that rule (89) does not apply to particles in general. For instance,

> "Particles are formed from roots by the additions of a zero suffix which demands mutation of final N and t, and could well be set up as +et" E.G., (17.4)

nouns	particles
wēt-	wec
æn	es

Thus these particles are postulated as having the structure: ((noun) +e). Rule (89) operates regularly to drop the final /e/ after t-mutation. Rule (89) also operates to leave only one final non-syllabic in the following kinds of forms: (M 17.4, 17.2)

root	particle
āsetæ	āset
kakīcp-	kakīc
pēhk-	pēh
nekotw-	nekot

Thus the exceptions ending in /-qc/, /-qs/ are unique to those combinations and not a general property of all particles. Then each instance of this is an exception to rule (89) which must complicate the markings on the lexical items themselves. The number of such noun exceptions is small (Bloomfield lists only two) but there are many such particles. This could be described in a phonological system in which each lexical item is marked for those rules which (irregularly) do not apply to it. (It is assumed that a rule applies unless there is a

marking to the contrary (See Halle and Chomsky-SPE).) In a system like this we could treat the above exceptions by the following rule:

(90) namæ qs
nekiqs
(_____ q {c s}) particle } → [rule (89)]

The complexity of this rule is quite high (at least 8 features and 3 segments excluding the noun exceptions) but something like it is necessary to account for the exceptions to (89).

Suppose, instead, that a vowel introduction rule like (84ai) inserts a vowel into the position following glottal stops in the final clusters of the basic form of particles:

(91) $\emptyset \rightarrow \begin{bmatrix} +\text{voc} \\ -\text{long} \end{bmatrix} / \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix}$ _____ +e) particle

If this precedes rule (89) then that rule can apply regularly. Particles originally with final glottal clusters at that point in the derivation now have a final single syllabic. For instance, the above rule takes the particle form cayaq ϴ + e and transforms it to ceyaq Vϴ + e; this is changed to ceyaq Vs+e by t-mutation. Rule (89) applies to drop the final /e/: ceyaq Vs. Finally, the glottal-vowel dropping rule (84bii) drops any vowel following a glottal stop to produce the correct output for the particle, ceyaqs. Note that (84bi) does not shorten the final vowel of such

particles, since it applies only to pre-glottal vowels in the first syllable. Monosyllabic particles have short vowels in general, so (84 bi) does not produce incorrect results here, as well.

In this way we can explain the exceptions to rule (89) with relative ease. The vowel-introduction rule (91) above can be combined with the earlier vowel-introduction rule (84 ai). (N.B. Those particles (there are a few) which do not follow this rule will, of course, have to be marked as exceptions.)

The Exact Form of this Solution.

The above considerations overwhelmingly require the adoption of the vowel introduction-deletion solution (84) to the exceptional phonological development of glottal words. Essentially this is a claim that the rules are general and that glottal words have exceptional shape, rather than a claim that the particular rules have exceptional forms of application.

It is important at this point to notice that a solution equivalent to the introduction of a vowel into glottal clusters, (by 84 ai), is to assume that the vowel is lexically present in the underlying forms, and deleted in all but a few cases (initial syllables, final particle clusters). I have no direct evidence for this except for the peculiar

distributional properties of glottal stop; it is the only non-vocalic segment which never appears before a vowel in basic forms. However, since no phonological properties of the introduced post-glottal vowel, except the vocalic quality itself, play any phonological role and because the vowel is completely predictable where it is needed, there is no reason to assume that it occurs in the lexical forms.

FOOTNOTES - CHAPTER 2

1. "Menomini Morphophonemics" in Problemes de la Phonologie Synchronique, TCLP, 1939, pp. 105-135.

Eastern Ojibwe. Ann Arbor, Michigan: University of Michigan Press, 1956.

The Menomini Language. New Haven, Connecticut: Yale University Press, 1962.

- Note. Throughout this chapter double quotation marks indicate a direct quotation from Bloomfield or other writers. Single quotation marks indicate terms not used by Bloomfield, but used in current linguistic discussions. The forms of phonological notation in general are taken from Bloomfield, although other conventions are used when in my own discussions. For example vowel length is indicated either by a bar above the vowel, or a colon following the vowel. Phonetic sequences are represented with parentheses "( )" while morphophonemic and intermediate forms are indicated by slashes "/ /."

2. In doing this Bloomfield was not only following Pānini's grammar of Sanskrit. The notion that grammatical components are ordered appears in the Prague School grammars. See Vachek (ed.), Prague School Reader, pp. 33-59.

3. See his Language (1933) for an elaboration of this distinction.

4. See below for demonstrations that Bloomfield's underlying lexical forms were in fact abstract and that he was aware of this. His general presentation of morphology is, of course, quite taxonomic since he was not concerned with the generation of allowable morphological combinations.

5. Of course the notation used and the basic assumptions made can determine which theory turns out to be the "simplest." So in the last analysis, the particular choice of a given description is not somehow mysteriously "forced" by the actual facts but also requires prior decisions as to what is important in the described phenomena.

6. Such empirical claims assume general conventions for mapping a grammar onto speech behavior. See Chomsky and Halle, 1967, for general discussion; Bever, Fodor, and Weksel, 1965, for discussions of the empirical basis of linguistics.

7. Further examples of this kind of claim are found in Troubetzkoy, TCLP, Vol. 5, pp. 88-115.

8. In actual output of the phonological rules the second vowel is shortened to give na:hnæ w (See Chapter 3).

9. For instance, see Eastern Ojibwe and Hockett's "Potawatomi phonology," IJAL, 1948.

10. See Bloomfield's Language (1933) for his notion of phonological features. It is possible that Bloomfield intended the morphophonemic-phonetic mappings which were left inexplicit to be accounted for on a universal basis. See M 21.4 - 1.45 for examples of the phonetic statements.

11. Harris, Z. Methods of Structural Linguistics. Chicago, Illinois: University of Chicago Press, 1951. Appendix to section 14.32.

12. See T. Bever, A note on Bloomfield's "Menomini morphophonemics." Unpublished, 1962.

FOOTNOTES - CHAPTER 3

1. At the moment, very little is known about the details of this mapping.

2. In Menomini, any sequence of at least two non-sonorants must be a cluster. In the notation used in generative phonology, $[X]_n^m$ indicates "at least n adjacent segments of type X and not more than m." Rules of the form

$$[\alpha F_i] \rightarrow [\beta F_j] \;\; / [\gamma F_p] \_\_ [\delta F_q]$$

are interpreted: "any segment with the feature specification "α" for feature F_i is rewritten as a segment with feature specification "β" for F_j, and no other feature changes, in the environment following a segment specified "γ" for feature F_p and preceding a segment specified "δ" for feature F_q. $F_{i, j, p, q}$ are drawn from the set of distinctive features. α, β, γ, δ must be "+" or "-".

3. There is one example which would appear to indicate that /e/ is also inserted before /+h-/: myānōw+h → myānoweh (M 4.4). I think that this must be treated as an exceptional form since it is a general rule that no morpheme begins with a glide /h/ or /q/. See rule (8), below.

4. Notice that if multiple application of rules were allowed, the above system could be simplified to: $[\ ] \rightarrow \emptyset \;\; / [-\text{ voc}] \_\_$ which in many ways better captures the intuition that it is the final "open" syllable which is deleted.

5. In MM the orthography is the reverse of this: "n" is the mutating /n/, and "N" is the /n/ which does not mutate to /ʃ/.

6. Phonetically /p, t, k/ are unvoiced lenes: /m, n/ are as in English. /c/ is a post-dental affricate and /s/ is a continuant sibilant at the abstract level. A late phonetic rule softens /ʃ/ and /c/ to a point midway between [s] and [s̆], and [c] and [c̆]. See MM fn. 1, and M Ch. 1, on pronunciation.

7. Note the relation of "natural class" to the Prague School archiphoneme; a "natural class" that is neutralized in certain positions in the phonology of a language would be represented by the Prague School as a particular archiphoneme. Of course, in general, the simplest generative grammar should be the one that makes maximal use of these natural classes, since they claim implicitly that they are relevant classifications of phonemes for all languages.

8. It is the probable universality of rule 15 which gives this argument its real force. The redundancies among the features could be utilized in many other ways. The problem of how to build universal constraints into phonological theory (except by listing them) has not been solved.

The ordering of putatively universal redundancy rules like (15) poses a complex paradox. Surely (15) must apply early in the phonology so that later rules can apply to segments marked "± continuant" and "± strident". At the same time (15) must apply <u>after</u> rule (17) so that /Θ/ which becomes "+ nasal" by rule (17) can then automatically become "- continuant". This kind of problem indicates that universal redundancy rules are not <u>ordered</u> within a grammar, but normally apply at any point in a derivation where an appropriate segment is produced by other rules. See Chomsky and Halle, SPE (1967).

9. /qm/, /st/ occur rarely in foreign or derived forms (M 1.3). In MM, Bloomfield sets up combinations of /nC/ followed by consonants, but this is to handle an exceptional vowel and is, in fact, incorrect.

10. Of course the conclusion that phonetic $[{}^{"q}_{h\}}\ n"]$ is morphophonemic $/{}^{q}_{h\}}\ \Theta/$ assumes that morphophonemic ${}^{q}_{h\}}\ n + e$ in Bloomfield's analysis always appears as phonetic $[{}^{q}_{h\}}\ s + e]$. That is, that /q, h/ never occur before true, non-mutating /n/. I have found no counter-examples to this assumption.

11. Bloomfield, "Algonquin sketch" in Hoijer, <u>Linguistic Structures of Native America</u>. Bloomington, Indiana: University of Indiana Press, 1956.

12. I am indebted to Professor G.H. Matthews, who suggested the exchange solution to this problem and who was instrumental in the early development of variables in phonological notions.

13. Notice that if distinctive features are not used, the solution in (34) is equivalent to the introduction and deletion of a new segment "X"

1) e → X

2) æ → e

3) X → æ

14. The negative operator "n" is necessary if "α" are used for assimilation, since without "n" the difference between "[+ acute]" and "[- grave]" would be substantive, a process like palatalization ([ ] → [+ flat]) would be stated as <u>assimilative</u> to "[+ grave]" vowels; but as dissimilative to "[+ acute]" vowels. Notice also that the statement of dissimilation in a single rule like (3q) requires that features be binary. If features had three values, "+", "-" and "o", how could we interpret the segment "nαvoc"?

15. There is a slightly different solution which I include here for the reader's consideration.

$$\begin{bmatrix} \alpha\,\text{comp} \\ \alpha\,\text{long} \end{bmatrix} \rightarrow [+\,\text{diff}] \;/\; \left\{ \begin{array}{l} [-\,\text{diff}] \rightarrow [+\,\text{grave}] \;/\; [+\,\text{grave}]\,\_\_ \\ \begin{bmatrix} -\,\text{cons} \\ -\,\text{voc} \end{bmatrix} \rightarrow \emptyset \;/\; [-\,\text{voc}]\,\_\_\,\begin{bmatrix} +\,\text{voc} \\ -\,\text{comp} \end{bmatrix} \end{array} \right\} \;/\; [-\,\text{voc}]\,\begin{bmatrix} -\,\text{cons} \\ -\,\text{voc} \end{bmatrix}\,[-\,\overline{\text{grave}}]$$

At first glance this solution does not appear to be more complex than (45). However, some considerations below show that (45) is the simpler solution for the phonology as a whole. The crux of the matter is the restriction

of (45a) to sequences brought together by adjacent morphemes. If this is done, morpheme internal semi-vowel-vowel sequences can be simplified. There is no simple way to develop the same effect with the rules suggested in this footnote.

A solution in which /e/ and /æ/are lexically reversed is not viable here since the phonological need for the exchange arises only when C-SV-V combinations are produced by morphemic combination. When the morphemes occur in other contexts, then the /e/ and /æ/ must not be exchanged. Also the /e/ which participates in these alterations (to be changed to /æ/)is often the introduced epenthetic vowel, which is /e/ elsewhere, not /æ/.

Note that in all these rules it is true by convention that if a segment is made "[+ comp]" it is automatically made "[- diff]", and if it is made "[+ diff]" it is automatically made "[- comp]".

16. The feature "- rule R_i" can be lexical as well as introduced by the application of rule R_i itself. That is, some exceptional morphemes are marked lexically that particular rules do not apply; these morphemic features affect every segment in the morpheme.

17. Notice that if SV-assignment rules applied after e/y insertion as well as before, the feature "α voc" would not have to be specified in (75). This is the

only clear motivation for a phonological cycle (see SPE Ch. 2) in Menomini which I can find, and it is not compelling. Rule (70) has been discussed as applying to single morphemes, only. Because of environment (70 c) and (70 b) the rules could not apply to any morpheme due to the nature of an adjacent morpheme.

18. In distinctive feature notation (80) appears as

$$[+\text{voc}] \rightarrow [-\text{long}]$$

i) $[-\text{son}]_2 \text{ -- } [-\text{voc}]^1$

ii) $\#\left([-\text{voc}]_0 \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right)_{ODD} [-\text{voc}]_0 \text{ -- } [-\text{voc}]^1$

iii) $[+\text{long}]\left([-\text{voc}]_0 \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right)_{ODD} [-\text{voc}]_0 \text{ -- } [-\text{voc}]^1$

(80 a)

$$\rightarrow [+\text{long}]$$

iv) $\#\left([-\text{voc}]_0 \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right)_{ODD} [-\text{voc}]_0 \text{ -- } [-\text{voc}]_2$

v) $[+\text{long}]\left([-\text{voc}]_0 \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right)_{ODD} [-\text{voc}]_0 \text{ -- } [-\text{voc}]_2$

vi) $\left([-\text{voc}]_0 \begin{bmatrix}+\text{voc}\\-\text{long}\end{bmatrix}\right) [-\text{voc}]_0 \text{ ---}$

This can be simplified first by collapsing (ii) with (iii) and (iv) with (v)

(80 b)

$$[+\text{ voc}] \rightarrow [-\text{ long}] \;/\; \text{i)}\ [-\text{ son}]_2 \text{ — } [-\text{ voc}]^1$$

(ii-iii) $$/\ \begin{matrix}\#\\ [+\text{ long}]\end{matrix}\Big\}\Big([-\text{ voc}]_0 \begin{bmatrix}+\text{ voc}\\ -\text{ long}\end{bmatrix}\Big)_{ODD} \quad [-\text{ voc}]_0 \text{ — } [-\text{voc}]^1$$

$$\rightarrow [+\text{ long}]$$

(iv-v) $$\begin{matrix}\#\\ [+\text{ long}]\end{matrix}\Big\}\Big([-\text{ voc}]_0 \begin{bmatrix}+\text{ voc}\\ -\text{ long}\end{bmatrix}\Big)_{ODD} [-\text{ voc}]_0 \text{ — } [-\text{ voc}]_2$$

(vi) $$\#\Big([-\text{ voc}]_0 \begin{bmatrix}+\text{ voc}\\ -\text{ long}\end{bmatrix}\Big) \quad [-\text{ voc}]_0 \text{ —}$$

Rules (ii-iii) and (iv-v) can be further combined.

(80 c)

$$[+\text{ voc}] \rightarrow [-\text{ long}] \;/\; \text{i)}\ [-\text{ son}]_2 \text{ — } [-\text{ voc}]^1$$

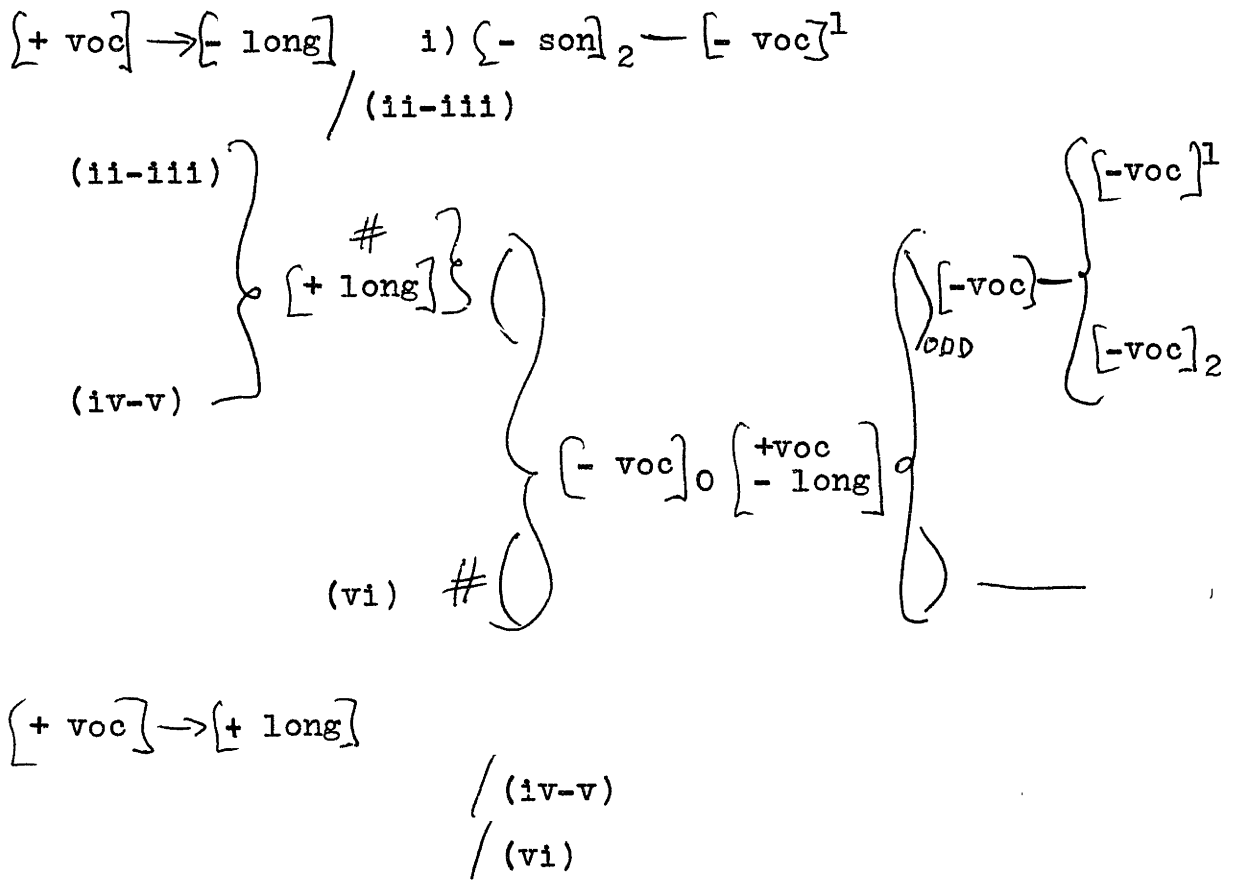
(ii-iii)
(iv-v) $$\begin{matrix}\#\\ [+\text{ long}]\end{matrix}\Big\}\Big([-\text{ voc}]_0 \begin{bmatrix}+\text{ voc}\\ -\text{ long}\end{bmatrix}\Big)_{ODD} [-\text{ voc}]_0 \text{ —} \begin{cases}-\text{voc}^{\,1}\\ -\text{ voc}_{\,2}\end{cases}$$

$$[+\text{ voc}] \rightarrow [+\text{ long}] \quad (\text{env. iv-v}) \quad (\text{vi})$$

(vi) $$\#\Big([-\text{ voc}]_0 \begin{bmatrix}+\text{ voc}\\ -\text{ long}\end{bmatrix}\Big) [-\text{ voc}]_0 \text{ —}$$

This can be further combined to

(80 d)



"Numbered parentheses, $\begin{Bmatrix} X \\ Y \end{Bmatrix}_1 \ldots \begin{Bmatrix} P \\ Q \end{Bmatrix}_1$, indicate two sequences "X - P" and "Y - Q".) (80d) is opaque to immediate interpretation. I include it to show that the solution in (80c) is in fact simple, and a simplification over Bloomfield's solution.

The numerical concept of "ODD" must be included within the phonological theory to account for processes which alternate syllables (or other segments). It is clear that

rules like (ii-iii) and (iv-v) cannot apply the longer versions of the rule first and then the shorter, as indicated in convention (6). If this convention for disjunctive rules were to apply to alternating rules, only the segments at the end of the alternation would be affected. All preceding segments could not be affected by the shorter environments since the longer application would block the shorter.

Thus alternation rules must apply simultaneously to all segments within a morpheme. This is automatically accounted for if alternation rules can directly use the environment statements 'odd' and 'even', rather than recreating the concept with optional environments.

BIBLIOGRAPHY

Bever, T.G. "The significance of Bloomfield's menomini studies." Quarterly Progress Report of R.L.E. No. 68, Jan. 15, 1963.

Bever, T.G., Fodor, J.A., and Weksel, W. Is linguistics empirical? Psychological Review, Vol. 72, 493-500, December, 1965.

Bloomfield, L. The Study of Language. New York: Holt, Rhinehart and Winston, 1914.

Bloomfield, L. Language. New York: Holt, Rhinehart and Winston, 1933.

Bloomfield, L. "Menomini morphophonemics," Problemes de la Phonologie Synchronique, pp. 105-115. Travaux du Cercle Linguistique de Prague, 1939.

Bloomfield, L. Eastern Ojibwe. Ann Arbor, Michigan: University of Michigan Press, 1956.

Bloomfield, L. "Algonquin sketch" in Hoijer (ed.) Linguistic Structures of Native America. Bloomington, Indiana: University of Indiana Press, 1956.

Bloomfield, L. The Menomini Language. New Haven, Connecticut: Yale University Press, 1962.

Chomsky, N.A. Problems in Linguistic Theory. The Hague: Moulton and Co., 1965.

Chomsky, N.A., and Halle, M. Sound Patterns of English. New York: Harper and Row, 1967, in press.

De Saussure, F. Cours de Linguistique Generale. Paris: Payot, 1916.

Harris, Z. Methods of Structural Linguistics. Chicago, Illinois: University of Chicago Press, 1951.

Lakoff, G. "English Lexical Structure" Harvard Computation Lab. Report NSF 16, 1966.

APPENDIX

Summary of Major Rules Discussed (In their final form) and Their Order of Application

Syllable Structure ((54), page 100)

A syllable never ends in a semi-vowel preceding a consonant, and is either:

a) a non-vocalic segment followed by a vowel.

b) a non-vocalic segment followed by a semi-vowel followed by a compact vowel.

c) an initial non-vocalic segment, not /h/ or /q/, followed by a compact or long vowel.

d) an initial compact or long vowel.

- or -

(a - b) $[-\text{voc}]\ \left\langle \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{son} \end{bmatrix} \right\rangle \left[\begin{matrix} +\text{voc} \\ \langle +\text{comp} \rangle \end{matrix} \right]$

(c - d) $+ \left[\begin{matrix} -\text{voc} \\ \{ +\text{son} \\ +\text{cons} \} \end{matrix} \right]_0 \left[\begin{matrix} +\text{voc} \\ \{ +\text{comp} \\ +\text{long} \} \end{matrix} \right]$

Clusters ((23), page 80)

$$[-\text{voc}] \begin{cases} \rightarrow [+\text{cons}, -\text{nasal}] \,/\, \leftarrow\!\!\!\times [-\text{voc}] \leftarrow\!\!\!\times \text{(i.e. "before or after } [-\text{voc}]\text{")} \\ \rightarrow [+\text{grave}, -\text{strident}, -\text{continuant}] \,/\, [+\text{cons}]\ \text{——} \\ \rightarrow [+\text{strident}, -\text{grave}] \,/\, [+\text{cons}\ \text{——}]\ [+\text{cons}] \end{cases}$$

No Initial Clusters ((2), page 71)

$$[\ ] \rightarrow \begin{bmatrix} +\text{ son} \\ -\text{ cons} \end{bmatrix} \ / \ + \ \_\_ \ [-\text{ son}]$$

Initial Segments ((8), page 74)

$$[-\text{ son}] \longrightarrow [+\text{ cons}] \ / \ + \ \_\_$$

Voicing Assimilation ((40), page 93)

$$[\alpha\ \text{son}] \longrightarrow [\alpha\ \text{voiced}]$$

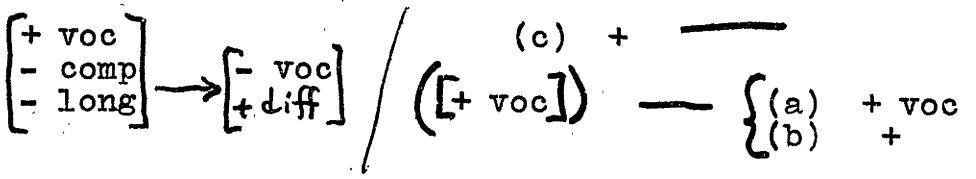
Initial change ((49 a-c), page 97)

(a) $$\emptyset \longrightarrow \begin{bmatrix} +\text{ son} \\ -\text{ voc} \\ -\text{ cons} \\ -\text{ grave} \end{bmatrix} \ / \ \# \begin{Bmatrix} [+\text{ cons}] \ \_\_ \ [-\text{ voc}] \\ [\ ]_0^1 \ \_\_ \ [+\text{ long}] \end{Bmatrix}$$

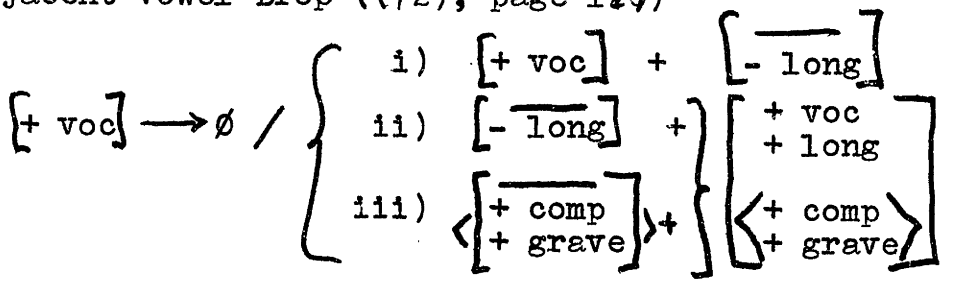
(b) $$\begin{bmatrix} -\text{ long} \\ \alpha\text{ comp} \end{bmatrix} \longrightarrow \begin{bmatrix} +\text{ long} \\ \neg\alpha\text{ grave} \end{bmatrix} / \ \#[-\text{ voc}]_0^2 \ \_\_$$

(c) $$\emptyset \longrightarrow \begin{bmatrix} +\text{ cons} \\ +\text{ voc} \\ -\text{ long} \\ +\text{ grave} \\ +\text{ comp} \end{bmatrix} \ / \ \#[-\text{ voc}]_0^1 \ \_\_ \ \begin{bmatrix} +\text{ son} \\ -\text{ voc} \\ -\text{ grave} \end{bmatrix}$$

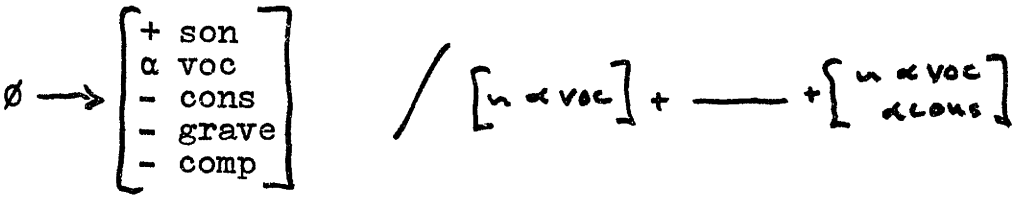
Semi-Vowel Assignment ((70), page 115)



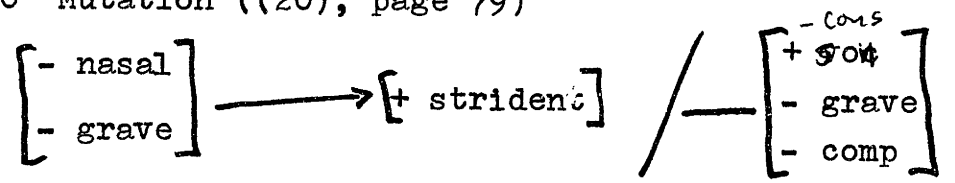
Adjacent Vowel Drop ((72), page 117)



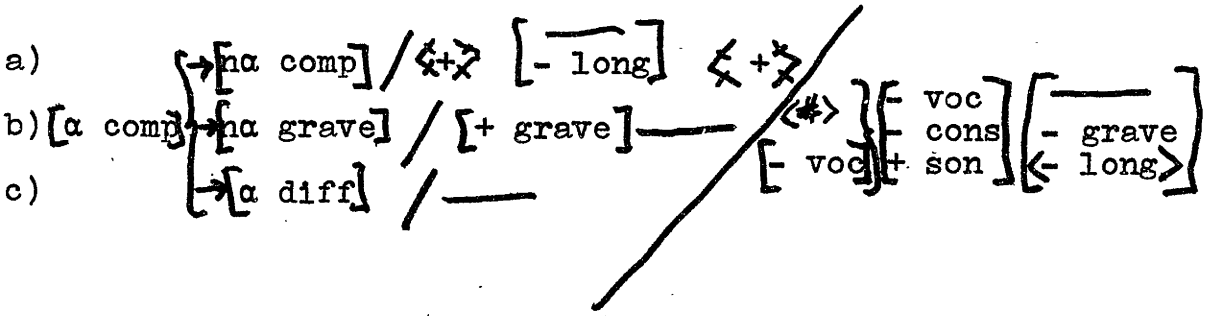
e/y Insertion ((75), page 119)



t/θ Mutation ((20), page 79)



Semivowel - Vowel Assimilation ((53a - c), page 99)



Semivowel Drop ((45 d), page 94)

$$\begin{bmatrix} -\text{ cons} \\ -\text{ voc} \end{bmatrix} \longrightarrow \emptyset \quad / \quad [-\text{ voc}] \text{ —— } \begin{bmatrix} +\text{ voc} \\ -\text{ comp} \end{bmatrix}$$

Glottal Word Reinterpretation ((84a), page 130)

i) $\emptyset \longrightarrow \begin{bmatrix} +\text{ voc} \\ -\text{ long} \end{bmatrix}$

ii) $[\ ] \longrightarrow [+\text{ long}]$

$$[-\text{voc}]_0^2 \left\{ \begin{bmatrix} +\text{ voc} \\ -\text{ long} \end{bmatrix} \right\}_1 \begin{bmatrix} -\text{ voc} \\ -\text{ cons} \\ -\text{ son} \\ -\text{ cont} \end{bmatrix} \left\{ \text{ —— } \right.$$

$$\left. \begin{bmatrix} \text{ —— } \\ -\text{ long} \end{bmatrix} \right\}_1$$

Particles with Final Glottal Clusters ((91), page 134)

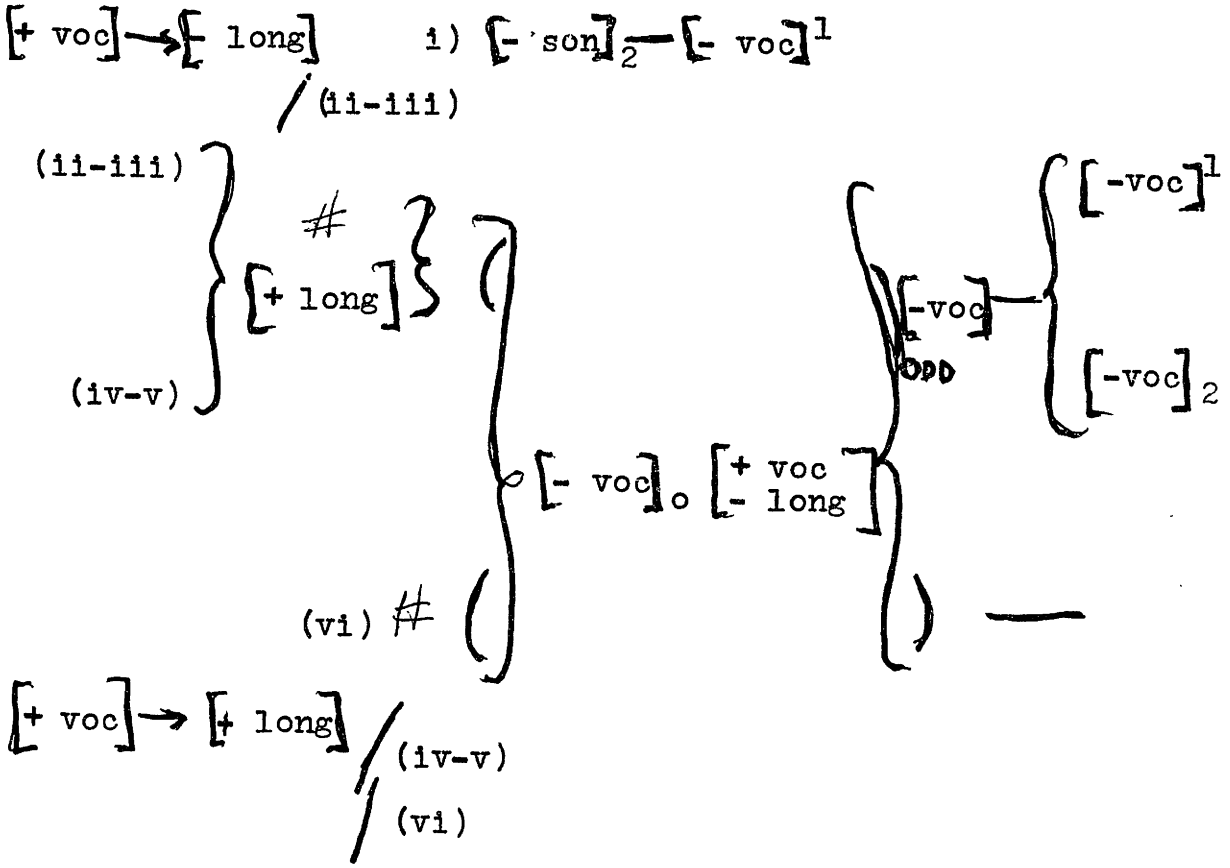
$$\emptyset \longrightarrow \begin{bmatrix} +\text{ voc} \\ -\text{ long} \end{bmatrix} / \begin{bmatrix} -\text{ voc} \\ -\text{ cons} \\ -\text{ son} \\ -\text{ cont} \end{bmatrix} \text{ —— } + e \ )_{\text{particle}}$$

Final Segment Adjustment ((89), page 137)

$$[\ ]_1^2 \longrightarrow \emptyset \ \begin{matrix} (a)/ \\ (b)/ \end{matrix} \Big\}_1 [-\text{ voc}]_1 \qquad \left\{ \begin{bmatrix} +\overline{\text{ voc}} \end{bmatrix} \right\}_1 \#$$

$$\left. \begin{bmatrix} -\overline{\text{ voc}} \end{bmatrix} \right\}$$

Length Adjustment ((82), footnote 18)



Initial Vowel Raising ((55), page 100)

$$\begin{bmatrix} +\text{long} \\ +\text{voc} \\ -\text{comp} \end{bmatrix} \rightarrow [+\text{diff}] \;/\; \text{—} [\,]_0 \quad [-\text{voc}] \begin{bmatrix} +\text{son} \\ -\text{cons} \\ +\text{diff} \end{bmatrix}$$

Glottal Word Adjustment ((84b), page 130)

i) $[+\text{voc}] \rightarrow [-\text{long}] \;/\; \#[-\text{voc}]_0^2 \text{ —}$

ii) $\rightarrow \emptyset \;/$

$$\left\{ \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{son} \\ -\text{cont} \end{bmatrix} \left\{ \begin{matrix} [+\text{voc}] \\ [\text{—} \; +\text{voc}] \end{matrix} \right. \right.$$

æ- Raising ((61), page 105)

$$\begin{bmatrix} -\text{long} \\ -\text{grave} \end{bmatrix} \longrightarrow [-\text{comp}] \;/\; \#[-\text{voc}]_0 \text{ —}$$

æ - Raising ((7), page 73)

$$æ \longrightarrow e \;/\; \begin{bmatrix} + \text{voc} \\ + \text{long} \end{bmatrix} \quad [\,- \text{voc}\,]_1 \;\text{——}\; [+ \text{cons}]$$

Vowel Phonetic Interpretation ((42), page 93)

$$\begin{bmatrix} - \text{long} \\ \alpha \text{ comp} \\ \beta \text{ diff} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{comp} \\ n\alpha \text{ diff} \\ \beta \text{ tense} \end{bmatrix}$$

THOMAS G. BEVER

Born December 9, 1939, Boston, Mass. Married, one child.

EDUCATION

Harvard College, Cambridge, Mass. 1957-61; A.B., 1961
Massachusetts Institute of Technology, Cambridge 1961-66; Ph.D., 1967

AWARDS AND DEGREES

Phi Beta Kappa - Harvard, 1961
"Magna Cum Laude with highest honors in Linguistics and Psychology" (A.B. Harvard, 1961)
National Institutes of Health Predoctoral Fellow 1962-64
Ph.D. in Linguistics, M.I.T. (Thesis defended May, 1966)
Elected to Harvard Society of Fellows (Harvard, 1964-67)

PROFESSIONAL ASSOCIATIONS

Linguistic Society of America
Animal Behavior Society

EMPLOYMENT

Teaching

Teaching Assistant, Psychology Section, M.I.T., 1963-64. Duties: One-half of the lectures in undergraduate and graduate psycholinguistics courses (introduction to linguistics).

Lecturer, Psychology Department, M.I.T., 1964-1965. Duties: All lectures in (1) undergraduate course, (2) graduate course, and (3) graduate seminar in the psychology of language.

Lecturer, Psychology Department, M.I.T., 1965-66. Duties: Teach graduate seminar in the psychology of language.

Assistant Professor, Rockefeller University, July 1967 -

Research

Project Assistant, NIH project, "Development from vocal to verbal behavior in children." (NIMH M-4300) 1959-61. Duties: Design and construction of integrated tape and file data collection and apparatus. Acoustic and linguistic analysis of infant vocalization.

Research Assistant, Research Laboratory of Electronics, M.I.T., 1961-62. Duties: X-ray and spectographic analysis of speech.

Research Associate, MITRE Corporation, Bedford, Mass., Summer, 1963. Duties: Syntactic and semantic analysis of English.

Thomas G. Bever

Research (continued)

Research Associate, Psychology Department, M.I.T., 1964-present. Duties: Research in linguistics and the psychology of language.

Visiting Associate, Department of Psychology, University of Geneva, Summer, 1966.

PUBLICATIONS

Books:

1. Menomini Phonology (forthcoming, M.I.T. Press).

2. The Structure and Psychology of Language. Editor of a set of new articles on linguistic theory and psychology. Holt, Rhinehart and Winston (in press). With W. Weksel.

3. The Perception and Memory of Language (in preparation). With J. Fodor, M. Garrett, and J. Mehler.

Articles:

1. A.B. thesis topic: Neurological and Vocal Development in the First Year. (1961)

2. Ph.D. thesis topic: The Phonology of the Menomini Indians and Leonard Bloomfield. (1966)

3. Bloomfield's "Menomini Morphophonemics." Quart. Progr. Rep., Research Laboratory of Electronics, Winter, 1963.

4. (a) The Formal Justification and Descriptive Role of Variables in Phonology

   (b) The Description of the Indo-European E/O Ablaut. With T. Langendoen.

   (c) The E/O Ablaut in Old English. Q.P.R., R.L.E., Summer, 1963.

5. The development of vocalization in infants." In: The Acquisition of Language (SSRC Conf. on First Language Learning, 1961), Ursula Bellugi and R.W. Brown, eds. Child Development Monographs, 1964. With M. Bullowa and L. Jones.

6. The psychological reality of linguistic segments." J. verbal Learning and verbal behavior.,(Nov. 1965), 4, 414-420. With J.A. Fodor.

7. On the acquisition of syntax." Psychol. Rev., (Dec. 1965), 72, 467-482. With J.A. Fodor and W. Weksel.

8. Is linguistics empirical?" Psychol. Rev., (Dec. 1965), 72, 493-500. With J.A. Fodor and W. Weksel.

Thomas G. Bever

Articles: (continued)

9. "Reading without listening." Project Literacy Reports, Dec. 1965. With T.G. Bower.

10. "The active use of grammar in speech perception." Perception and Psychophysics, (Jan. 1966), Vol. 1, 30-32. With J.A. Fodor and M. Garrett.

11. "Underlying structures in discourse." In: Proceedings of the Congress on Computer-Related Semantic Analysis, Los Vegas, Dec. 1965. With J. Ross.

12. "Associations to language and S-R theory." In: S-R Theory and Language Behaviour, R. Dixon and T. Horton, Eds. Prentice Hall (in press).

13. "A formal limitation of associationism." In: S-R Theory and Language Behaviour, R. Dixon and T. Horton, Eds. Prentice Hall (in press). With J.A. Fodor and M. Garrett.

14. "The behavioral segmentation of sentences." To appear in The Structure and Psychology of Language, T.G. Bever and W. Weksel, Eds. Holt, Rhinehart and Winston (in press). With M. Garrett.

15. "In Search of Ambiguity." Perception and Psychophysics (May 1967) With D.G. Mackay.

16. "What We Look at When We Read." Perception and Psychophysics (May 1967) With J. Mehler and P. Carey.