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Morphophonemics of Modern Hebrew

Noam Chomsky

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This work is of singular importance as it contains the genesis of the author's work in the field of generative grammar which has had such a profound impact upon the study of linguistics. This reissue of a truly pioneering work will be of great interest to all those concerned with generative grammar and its origins, and with the progression of thought of one of the greatest minds of our time.

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Avram Noam Chomsky

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TABLE OF CONTENTS

0. Introduction

A grammar of a language must meet two distinct kinds of criteria of adequacy. On the one hand it must correctly describe the 'structure' of the language (i.e., it must isolate the linguistic units, and, in particular, must distinguish and characterize just those utterances which are considered 'grammatical' or 'possible' by the informant, including as a special subclass those of the analyzed corpus. On the other hand it must meet requirements of adequacy imposed by its special purposes (e.g., pedagogical, as a basis for comparative study, etc.), or, in the case of a linguistic grammar having no such special purposes, requirements of simplicity, economy, compactness, etc.[1] Thus the linguistic analysis of a language L can be described as the process of determining the set of 'grammatical' or 'significant' sentences of L (i.e., of determining the extension of the predicate 'grammatical in L'), or, in other words, it is the process of converting an open set of sentences--the linguist's incomplete and in general expandable corpus--into a closed[2] set--the set of grammatical sentences--and of characterizing this latter set in some interesting way. Accordingly we might distinguish and consider separately two aspects of the linguistic analysis of a language, a process of 'discovery' consisting of the application of the mixture of formal and experimental procedures constituting linguistic method, and a process of 'description' consisting of the construction of a grammar describing the sentences

which we know from step one to be grammatical, and framed in accordance with the criteria related to its special purposes.

Although the distinction between the processes of discovery and description is clear enough in the case of grammars with special purposes, it is perhaps less clear in the case of a linguistic grammar constructed solely in accordance with considerations of elegance, since the process of discovery itself can perhaps best be understood as the process of constructing a tentative grammar specifying the grammatical sentences by listing the linguistic elements and their permitted arrangements on various levels.[3] Furthermore it is clear that considerations of elegance are operative in the original process of discovery, i.e., that they have a distinct place in the framing of the procedures of linguistics themselves. Thus in setting up such linguistic elements as morphemes (a process of discovery) we must consider properties of the linguistic elements themselves (e.g., perhaps minimization of their number) and properties of the statements describing these elements and their relationships (e.g., perhaps minimization of their number),[4] and the same is true on other levels of linguistic analysis. This consideration amounts to the requirement that the predicate 'grammatical in L' (and in general, the procedures of linguistic analysis) be defined and analyzed in a metalanguage to the language in which grammars are written, and consequently in a

meta-metalanguage to the language L under analysis. Thus one of the considerations involved in setting up linguistic elements in a particular way, and consequently, in determining what are in fact the grammatical sentences, will be the total simplicity of the grammar in which these elements appear.

However it will still be useful to consider the processes of discovery and description separately. For the most reasonable way to approach the investigation and analysis of the notions of simplicity in terms of which 'grammatical in L' is defined (i.e., those notions of elegance that are relevant to the very formulation of the procedures of linguistics) seems to be to assume, for some language, that the grammatical sentences are fixed (i.e., that the process of discovery has been completed) and to determine the effect on grammar-formulation of explicit considerations of simplicity imposed on the grammatical statement.[5]

The outline of Modern Hebrew grammar given below is an example of the second step in linguistic analysis, artificially isolated. It is assumed that the sole purpose of the grammar is to generate a closed body of sentences, these having already been determined. Hence the grammar must be designed in such a way as to be the most efficient, economical, and elegant device generating just these sentences.

The grammar consists of the following parts:

1. A syntactic statement giving permitted arrangements of morphemes in sentences.

2. A morphemic constituency statement giving permitted arrangements of morphophonemes in morphemes.
3. A series of morphological and morphophonemic statements transforming any grammatical sequence of morphemes into a sequence of phonemes.
4. A phonemic statement (transforming phoneme sequences into phone sequences).[6]

The effect of the first two parts is to give the permitted sequences of morphemes by presenting sequences of 'morpheme names', some of them in morphophonemic spelling. The first part will only be sketched here, and the second[7] and the fourth will be entirely omitted. The third part will be given in detail. Beginning with a sequence of morphemes from parts one and two, each statement of the third part of the grammar specifies certain changes which must be undergone by any sequence of a certain shape. It will appear that an order is imposed on the statements, relative to certain criteria of simplicity. Thus the statements are ordered so as to present a maximally simple grammar. The actual demonstration of adequacy given below must be taken in a limited sense only. What is shown is that any single interchange of consecutive statements will necessitate changes which increase the complexity of the grammar.[8] Thus the simplicity of the system is at what might be called a 'relative maximum' with this ordering of

statements. It is not excluded that some complicated set of interchanges of the statements might give a simpler grammar, or in fact, that a total recasting in different terms might be more elegant. Thus this investigation is limited in that only one 'dimension' of simplicity is considered, viz., ordering. Actually a complete demonstration would have to show that the total simplicty is greatest with just the given ordering, segmentation, classification, etc.

For the formulation of any relatively precise notion of simplicity, it is necessary that the general structure of the grammar be more or less fixed, as well as the notations by means of which is constructed. We want the notion of simplicity to be broad enough to comprehend all those aspects of simplicity of grammar which enter into consideration when linguistic elements are set up. Thus we want the reduction of the number of elements and statements, any generalization, and, to generalize the notion of generalization itself, any similarity in the form of non-identical statements, to increase the total simplicity of the grammar. As a first approximation to the notion of simplicity, we will here consider shortness of grammar as a measure of simplicity, and will use such notations as will permit similar statements to be coalesced. To keep this notion of simplicity from reducing to an absurdity, the notations must be fixed in advance, and must be chosen to be neutral to any particular grammar, except with respect to the considerations they are chosen to

reflect.[9]

Given the fixed notation, the criteria of simplicity governing the ordering of statements are as follows: that the shorter grammar is the simpler, and that among equally short grammars, the simplest is that in which the average length of derivation of sentences is least.

1. Notation

The grammar, then, will be a set of transformation statements each of which transforms a given representation of a sentence into a more specific one.[10] If α, β, γ, with or without subscripts and primes, stand for any sequences (or zero, henceforth $\emptyset$) of the elements appearing in statements (e.g., sequences of phonemes, morphemes, phrases, etc., including brackets, dots, etc.), then the basic transformation statements of the grammar will be of the form:

(1) $\alpha \longrightarrow \beta$, where ...

where α and β contain no notational elements but are simply sequences of the elements set up to represent parts of sentences (phonemes, morphemes, etc.). This means that α is transformed by this statement into β, when conditions ... obtain.

If $\alpha=\alpha_1\beta_1\gamma$ and $\beta=\alpha_1\beta_1,\gamma$, we rewrite (1) as:

(2) $\beta_1 \longrightarrow \beta_1$, in environment $\alpha_1\_\_\_\gamma$, where ...

The notational devices which will actually be used should be introduced definitionally (by so-called 'contextual definitions') be describing a procedure to convert each expression using these notations into a sequence of simple expressions of the form (1) or (2) (which is reducible to (1)) where no notational elements appear. Two kinds of brackets--{},[]--and two kinds of parentheses--(), <>--will be employed as follows:

N1. A statement '... $\left\{\begin{matrix}\alpha_1\\ \alpha_2\\ \vdots\\ \alpha_n\end{matrix}\right\}$ ...' is an abbreviation for

(i) '... α_1 ...', (ii) '... α_2 ...', ..., ($\underline{n}$) '... $\alpha_{\underline{n}}$...', in that order. If two sets of brackets with a different number of rows appear, either can be expanded first. If two or more sets of brackets of this form with the same number of rows appear, then they are expanded simultaneously, the $\underline{k}^{th}$ row of the first concurring with the $\underline{k}^{th}$ row of the second. For example

$$'\alpha_1\left\{\begin{matrix}\alpha_2\\ \alpha_3\end{matrix}\right\}\alpha_4 \longrightarrow \beta_1\left\{\begin{matrix}\beta_2\\ \beta_3\end{matrix}\right\}, \text{ where } \ldots \left\{\begin{matrix}\gamma_1\\ \gamma_2\end{matrix}\right\} \ldots'$$

stands for

(i) '$\alpha_1\alpha_2\alpha_4 \longrightarrow \beta_1\beta_2$, where ... γ_1 ...'

(ii) '$\alpha_1\alpha_3\alpha_4 \longrightarrow \beta_1\beta_3$, where ... γ_2 ...'

in that order. To indicate how many rows a given set of brackets have, '---' is written where no element α occurs.

Thus '$\left\{\begin{matrix}\alpha_1 \\ --- \\ \alpha_2\end{matrix}\right\}$' has three rows.

N2. N1 holds in exactly the same form for [].

N3. A statement containing one or more elements in main parentheses () is an abbreviation for two statements, one in which all of the parenthesized elements appear, and one in which none of the parenthesized elements appear, in that order. For example

'$\alpha_1(\alpha_2)\alpha_3 \longrightarrow \beta_1\beta_2(\gamma_1(\gamma_2))$, where ...(---)...'

stands for

(i) '$\alpha_1\alpha_2\alpha_3 \longrightarrow \beta_1\beta_2\gamma_1(\gamma_2)$, where ...---...'

(ii) '$\alpha_1\alpha_3 \longrightarrow \beta_1\beta_2$, where .....'

with (i) preceding (ii), and (i) in turn standing for two statements by the same process of development.

N4. A statement containing one or more elements in parentheses <> is an abbreviation for the conjunction, in any order, of all statements with zero or more of the parenthesized elements omitted. For example

'$\alpha<\beta>\gamma \longrightarrow \alpha_1<\beta_1>$'

stands for

(i) '$\alpha\beta\gamma \longrightarrow \alpha_1\beta_1$'

(ii) '$\alpha\beta\gamma \longrightarrow \alpha_1$'

(iii) '$\alpha\gamma \longrightarrow \alpha_1\beta_1$'

(iv) '$\alpha\gamma \longrightarrow \alpha_1$'

taken in any order. Order does not happen to be important in the statements of the grammar in which <> is used. But it could be, and an order could be imposed. Note that the appearance of a single <> is just like that of a single () (except that order is imposed in the second case).

It remains to give the interpretation for the cases where several of these four notations co-occur in one statement. To do this we have to give an order of priority, stating which of co-occurring notations is to be expanded first, so as to have a unique interpretation for each statement. The order of development follows these two principles:

N5. No brackets or parentheses are expanded if enclosed within brackets or parentheses. I.e., at each step in the development of a sentence only main brackets or parentheses may be developed.

N6. If there is more than one set of main brackets or parentheses, they are developed in the order (i) {}, (ii) [], (iii) (), (iv) <>; i.e., in exactly the order in which they were introduced by N1-4.

This now gives us an explicit step by step procedure for converting each statement of the grammar into an ordered sequence of statements of form (1) or (2). Notice that the case of co-occurring brackets of the same kind with the same number of rows is analogous in interpretation to matrix multiplication, while co-occurring brackets of different kinds give essentially the Cartesian product.

One other point concerning co-occurrence of various notations needs clarification, namely, occurrence of brackets and parentheses within other brackets or parentheses.

N7. Each set of brackets or parentheses is treated as a single element when inside of a containing set. E.g., the main bracket in '$\left\{\begin{matrix}\left\{\begin{matrix}\alpha_1\\ \alpha_2\end{matrix}\right\}\beta\\ \left[\begin{matrix}\gamma_1\\ \gamma_2\\ \gamma_3\end{matrix}\right]\end{matrix}\right\}$' has two rows.

N8. In accordance with customary practice, a set of brackets with a single row is used to give the membership of a class. Thus $\{\alpha_1, \alpha_2, \ldots, \alpha_{\underline{n}}\}$ is the class containing as members $\alpha_1, \alpha_2, \ldots, \alpha_{\underline{n}}$. A statement of the form '$\alpha=\{\alpha_1, \alpha_2, \ldots, \alpha_{\underline{n}}\}$' is interpretable in terms of (1) and (2). It can be taken as an abbreviation for '$\alpha\longrightarrow\alpha_1$ or $\alpha\longrightarrow\alpha_2$ or ... or $\alpha\longrightarrow\alpha_{\underline{n}}$'. We write '$\alpha_1\varepsilon\alpha$', '$\alpha_2\varepsilon\alpha$', etc., to indicate that α_1 is a member of α, α_2 is a member of α, etc. '$\alpha_{\underline{i}}$' will be taken to designate the $\underline{i}^{th}$ member of α considered to be ordered from left to right as given, i.e., $\alpha_{\underline{i}}$, and 'α' will be used as a variable ranging over members of the class α. If $\alpha_{\underline{i}}$ itself contains variables or brackets, then any explicit expanded expression produced by developing $\alpha_{\underline{i}}$ is taken to be a member of α. E.g., if

$$\alpha=\{\alpha_1, \alpha_2\left\{\begin{matrix}\alpha_3\\ \alpha_4(\alpha_5)\end{matrix}\right\}\}$$

then $\alpha_1\varepsilon\alpha$, $\alpha_2\alpha_3\varepsilon\alpha$, $\alpha_2\alpha_4\alpha_5\varepsilon\alpha$, $\alpha_2\alpha_4\varepsilon\alpha$.

As an example of the functioning of these rules of development consider the following case:

(i) $\left\{\begin{bmatrix}(\alpha_1)\alpha_2\\ \alpha_3\end{bmatrix}\right\}\longrightarrow(\gamma_1)\begin{bmatrix}\gamma_2\\ \gamma_3\end{bmatrix}$

The expansion is given step by step as follows, with the rule governing each step.

(ii) a: $\begin{bmatrix}(\alpha_1)\alpha_2\\ \alpha_3\end{bmatrix}\longrightarrow(\gamma_1)\begin{bmatrix}\gamma_2\\ \gamma_3\end{bmatrix}$

b: $\beta\longrightarrow(\gamma_1)\begin{bmatrix}\gamma_2\\ \gamma_3\end{bmatrix}$

} by N1, priority given to {} by N6.

(iii) a1: $(\alpha_1)\alpha_2\longrightarrow(\gamma_1)\gamma_2$

a2: $\alpha_3\longrightarrow(\gamma_1)\gamma_3$

} by N2, priority given by N6.

b1: $\beta\longrightarrow(\gamma_1)\gamma_2$

b2: $\beta\longrightarrow(\gamma_1)\gamma_3$

} by N2, priority given by N6.

(iv) a1a: $\alpha_1\alpha_2\longrightarrow\gamma_1\gamma_2$

a1b: $\alpha_2\longrightarrow\gamma_2$

} by N3.

a2a: $\alpha_3\longrightarrow\gamma_1\gamma_3$

a2b: $\alpha_3\longrightarrow\gamma_3$

} by N3.

b1a: $\beta\longrightarrow\gamma_1\gamma_2$

b1b: $\beta\longrightarrow\gamma_2$

} by N3.

b2a: $\beta\longrightarrow\gamma_1\gamma_3$

b2b: $\beta\longrightarrow\gamma_3$

} by N3.

The final set is given as (iv), in that order. The use

of five pairs of brackets and parentheses eliminates fourteen occurrences of α_1, β, ..., etc., which may themselves be long expressions.

2. Syntax

In accordance with the plan stated above, the syntactic statement will be skeletal and incomplete. It is intended merely as an indication of the framework into which the detailed morphological statement fits, and as a sketch of the general structure of the simple Hebrew sentence. Syntactic and morphological considerations may be interrelated in the process of grammar construction, since we are seeking the simplest total set of transformations. Thus if the morphology were presented independently of syntactic considerations, one might consider the various forms of plural and feminine suffixes to be parts of special vowel patterns, added to roots to make up stems. But this would hide the characteristic feature of these as long components, i.e., components of phrases or sentences rather than of words. Such a formulation would greatly complicate the syntactic statement. Consequently the syntactic statement must be detailed enough so that all further elaborations of it will be irrelevant to morphological considerations.

S1. Sentence $\longrightarrow$ Elementary sentence <Connective+Sentence>

S1 must be reapplied until 'Sentence' is eliminated.

S2. Connective={v, aval, o, ...} [{and, but, or,...}]

S3. Elementary Sentence $\longrightarrow NP^{LC_{\underline{i}}} \left\{ \begin{array}{c} <Lb_3\, LC_{\underline{i}}> \left\{ \begin{array}{c} PP \\ NP^{LC_{\underline{i}}} \end{array} \right\} \\ VP^{LC_{\underline{i}}} \end{array} \right\}$

$[\underline{i}=1,\ldots,4]$

The sentence is now represented in terms of phrases (NP=Noun Phrase, VP=Verb Phrase, PP=Prepositional Phrase, $LC_{\underline{i}}$ is the $\underline{i}^{th}$ member of the class of Long Components, Lb_3 is the third person pronoun in its free form).

S4. $VP^{LC_{\underline{i}}} \longrightarrow V_1 + LC_{\underline{i}} <V_2><V_2>\ldots<V_2> NP^{LC_{\underline{j}}}$ $[j=1,\ldots,4]$

S5. $PP \longrightarrow$ Preposition$+NP^{LC_{\underline{j}}}$ $[j=1,\ldots,4]$

Prepositions and their special forms before various kinds of NP's are left out of consideration below.

S6. $NP^{LC_{\underline{i}}} = \{ \left[\begin{array}{c} La_{\underline{k}} \\ Lb_{\underline{k}} \end{array} \right] LC_{\underline{i}},\ Z+LC_{\underline{i}},\ \left\{ \begin{array}{c} \emptyset \\ N_1+LC_{\underline{i}}+\underline{S} \end{array} \right\} \delta \left\{ \begin{array}{c} N_1+LC_{\underline{i}} \\ \left[\begin{array}{c} N_1+LC_{\underline{j}} \\ La_{\underline{k}}(LC_{\underline{n}}) \end{array} \right] \end{array} \right\}$

$<\delta N_2+LC_{\underline{q}}><\delta Z+LC_{\underline{q}}>\}$ [11]

where (i) $[\underline{j},\underline{n}=1,\ldots,4]$, $[k=1,2,3]$

(ii) $\underline{q} \longrightarrow \underline{i}$ $\left[\begin{array}{l} \text{or } \underline{j} \text{ in env. } LC_{\underline{j}}\ldots\_\_ \\ \text{---} \end{array} \right]$

'...' does not extend outside of the NP

(iii) $\delta \longrightarrow$ ha (or $\emptyset$ in env. $\_\_N_1$) [12]

and all δ's change simultaneously and identically since δ represents a long component.

(iv) $ha\underline{La}_{\underline{k}} \longrightarrow \underline{La}_{\underline{k}}$

(v) $N_1=\{N_{1a}, N_{1b}\}$

ha is the definite article, a long component in Hebrew. $\underline{La}_{\underline{k}}$ and $Lb_{\underline{k}}$ are forms of the personal pronoun, Z is a demonstrative, and $\underline{S}$ is a morpheme occurring automatically with the first N_1 of an N_1N_1 'compound noun'. This 'construct state' (Hebrew--'smixut') construction seems to be disappearing as a productive construction in colloquial speech[12] in favor of N_1 šel N_1 (šel=of). Since $\underline{j}$ is independent of $\underline{i}$, certain of the arrangements of LC's are purely internal matters of the Noun Phrase. Notice that when two LC patterns occur, the one falling on the first element of the phrase carries the LC of the sentence, just as with VP's (see S4).

S6'. $\emptyset \longrightarrow <N_1+LC_{\underline{m}_1}+S><N_1+LC_{\underline{m}_2}+S>\ldots$ in env. $\underline{S}$ __

$[\underline{m}_1, \underline{m}_2,\ldots=1,\ldots, 4]$

S7. $\left\{\begin{matrix}\underline{La}_{\underline{k}}\\ Lb_{\underline{k}}\end{matrix}\right\} LC_{\underline{i}}(V_1+LC_{\underline{i}}) \longrightarrow \left\{\begin{matrix}\emptyset\\ \underline{La}_{\underline{k}}+\underline{Lp}+LC_{\underline{i}}\end{matrix}\right\}(V_1+\underline{La}_{\underline{k}}+LC_{\underline{i}})$

$\left\{\begin{matrix}\text{except in env. } \underline{S}\#\_\_\\ ---\end{matrix}\right\}$

S8. Let '$\alpha_{\underline{i}}$' stand for '$N_{\underline{i}}+LC(S(\underline{La}_{\underline{k}}+LC))$' $[\underline{i}=1a, 1b, 2]$

Then let $M=\{\alpha_{1a}, \alpha_2\}$ $M^+=M\cup\{\alpha_{1b}\}$

$U=\{V_1+\underline{La}_{\underline{k}}+LC, V_2\}$ $U^+=U\cup\{\alpha_{2b}\}$

M and U are the major structural classes of words, the units within which the morphological transformations function. They correspond, as can be seen by their morpheme class constituents, to Noun and Verb, respectively.

$$S9. \quad + \longrightarrow \# \text{ in env. } \_\_ \begin{Bmatrix} M^+ \\ U \\ ZLC \\ La_k Lp LC \end{Bmatrix} \_\_ ^{13}$$

The units within #__# will be the words with which the morphology is concerned. M, M^+, U, and U^+ will be used throughout the morphological section to indicate within which class of words a rule holds.

$$S10. \quad \begin{Bmatrix} V_1 \\ V_2 \end{Bmatrix} \longrightarrow U_0 + R + VlP_2 \begin{Bmatrix} U_2 \ (La_3, \text{ in env. } \_\_ LC) \\ Ft + Lc \end{Bmatrix}$$

R and VlP are the major morpheme classes, roots and vowel patterns, respectively. Ft is the morpheme of the future tense, Lc is the infinitive morpheme, U_0 and U_2 are classes of verb affixes ($Ft \epsilon U_2$, see below, S15).

$$S11.^{14} \quad N_{1a} = \{ \begin{bmatrix} N_s \\ M_0 \\ h- \end{bmatrix} R \begin{Bmatrix} VlP \\ a--\acute{a} \end{Bmatrix} ((F)) \Big] (M_1) \}$$

$$N_{1b} = \{ \begin{bmatrix} U_0 \\ h- \end{bmatrix} R \begin{bmatrix} VlP_2 + m- \\ i--:\acute{e} + M_1 (F) \end{bmatrix} (M_1) \}$$

m- is the morpheme of present tense ($m- \epsilon U_2$, see S15). Thus present tense verbs can also be nouns. N_s is a class of nouns, mostly foreign borrowings, best construed as

not composed of roots and vowel patterns. They are not treated in the present study. N_2 is a subclass of N_1, essentially, adjectives. A much more explicit characterization of N_2 could be given, but is omitted here. M_0 is a set of noun prefixes. The forms h-... are formed from the corresponding verb forms. h-εU_0 (see S15) and the two vowel patterns given are the members of $V1P_2$ (see S20). F=Feminine.

S12. M_1 is any sequence or non-zero subsequence of morphemes of one of the following forms:

(i) aY_2

(ii) $on+aY_3$

(iii) $\begin{Bmatrix} on \\ an \end{Bmatrix} + \begin{Bmatrix} i(+u(F+i)) \\ u(F+i(+u)) \end{Bmatrix}$

where $M_1 \longrightarrow \begin{Bmatrix} u \text{ in env. } \left[\begin{smallmatrix} m- \\ i--:\acute{e} \end{smallmatrix} \right] \\ i... \text{ in env. } h-... \end{Bmatrix}$ —

and $V \longrightarrow V$: [V=Vowel]

The general meanings of these suffixes are roughly as follows: aY_2--dual; a:n and $a:Y_3$--agent, person connected with; o:n--thing connected with; u:--abstract noun formative; i:--adjectival formative. Thus most N's ending in i: are in N_2.

S13. LC={Ø, F, P, PF},

where $LC_i \longrightarrow \begin{Bmatrix} P, \text{ in env. } a:Y_2\_\_ \\ F \text{ or } PF \text{ in env. } u:\_\_, \text{ and} \\ u: \longrightarrow u:y \text{ in env. } \_\_ \ PF \end{Bmatrix}$

and if one $LC_i \longrightarrow \alpha$, then all

S13 (cont.). instances of $LC_{\underline{i}}$ in the sentence $\longrightarrow \alpha$.[15]

and $\underline{i} \longrightarrow \emptyset$, sometimes, in env. ___ $\underline{P}$.

$\underline{F}$ is the Feminine, $\underline{P}$ the plural long component.

S14. $Z \longrightarrow \left\{ \begin{array}{l} \underline{LpLa}_3 \text{ in env. ha\#\_\_, sometimes} \\ \left\{ \begin{array}{l} \text{zot} \quad " \quad " \quad \underline{\quad} \; \underline{F} \\ \text{eyle} \quad " \quad " \quad \underline{\quad} \; \underline{PF} \end{array} \right\} \text{and } \underline{F}, \; \underline{PF} \longrightarrow \emptyset \\ \text{ze} \end{array} \right\}$

S15. $M_0 = \{\emptyset, \underline{m1}\text{-}, \underline{m2}, \underline{T}\text{-}\}$

$U_0 = \{\emptyset, \underline{h}\text{-}, \underline{N}\text{-}, \underline{h}\text{-}\underline{N}\text{-}\}$

$U_2 = \{\emptyset, \underline{Ft}, \underline{m}\text{-}\}$

$\underline{m1}$-, $\underline{m2}$-, and $\underline{T}$- are noun prefixes, $\underline{N}$- and $\underline{h}$- are verb prefixes. $\underline{N}$-+Verb is generally passive, $\underline{h}$-+one type of verb stem (with V1P=a...á, see S20) is generally causative, $\underline{h}$-+the second type of verb stem (with V1P=i...:é) is generally reflexive. $\underline{Ft}$ signifies future tense, $\underline{m}$- signifies present tense.

S16. $\underline{La}_{\underline{k}} \longrightarrow \emptyset$ in env. $\underline{m}$-+___

$\underline{La}_{\underline{2}} \longrightarrow \underline{La}^{\underline{I}}_{\underline{2}}$, sometimes, in env. $\#_{\underline{n}}$...$\underline{Ft}$+___, where $\#_{\underline{n}}$ is the first # in the sentence, and ... contains no #. La^{I}_{2} will be the morpheme of the imperative, which varies freely with second person future in this position.

S17. $\emptyset \longrightarrow$ et in env. U#__NP [i.e., before the NP which is part of the VP, see S4],

when NP contains ha#, where et is a member of the class of prepositions [see S5].

Except for R and V1P, sentences are now completely specified in terms of morphemes. A few illustrations of the representation of a sentence in terms of morphemes by development of the syntactic statements may be helpful here. The number of the Syntactic Transformation applied is in brackets on the same line as the result of that transformation.

A. 1. Sentence

2. Elementary Sentence [S1]

3. $NP^{LC_2}+VP^{LC_2}$ [S3]

4. $NP^{LC_2}+V_1+LC_2+V_2$ [S4]

5. $\underline{La_2}+LC_2+V_1+LC_2+V_2$ [S6]

6. $V_1+\underline{La_2}+LC_2+V_2$ [S7]

7. $\#V_1+\underline{La_2}+LC_2\#\#V_2\#$ [S9]

8. $\underbrace{\#U_0+R+V1P_2+U_1+\underline{La_2}}+LC_2\#\#\underbrace{U_0+R+V1P_2+\underline{Ft}+\underline{Lc}\#}$ [S10]

9. $\qquad\qquad\quad "\qquad\quad +\underline{F}\#\#\qquad\quad "$ [S13]

10. $\#R+V1P_2+\underline{La_2}+\underline{F}\#\#\underline{h}-+\underline{R}+V1P_2+\underline{Ft}+\underline{Lc}$ [S15]

An example, filling in actual roots and vowel patterns, might be "racít lhitraxéc" ('you(F) wanted to get washed').

B. 1. Sentence

2. Elementary Sentence [S1]

3. $NP^{LC_4}+VP^{LC_4}$ [S3]

4. $NP^{LC_4}+V_1+LC_4+NP^{LC_1}$ [S4]

5. $N_1+LC_4+\underline{S}+ha+N_1+LC_1+ha+N_2+LC_4+V_1+LC_4+N_1$
$+LC_1+\underline{S}+ha+N_1+LC_3$ [S6]

6. $\#N_1+LC_4+\underline{S}\#ha\#N_1+LC_1\#ha\#N_2LC_4\#\#V_1\#LC_4$
$\#\#N_1+LC_1+\underline{S}\#ha\#N_1+LC_3\#$ [S9]

7. $\#N_1+LC_4+\underline{S}\#ha\#N_1+LC_1\#ha\#N_2LC_4\#\#U_0RV1P_2U_1$
$\underline{La_3}Lc_4\#\#N_1+LC_1+\underline{S}\#ha\#N_1+LC_3\#$ [S10]

8. $\#M_0RV1PM_1LC_4\underline{S}\#ha\#N_SLC_1\#ha\#M_0RV1PLC_4\#\#U_0$
$RV1P_2U_1\underline{La_3}LC_4\#\#M_0RV1PLC_1\#ha\#M_0RV1PLC_3\#$ [S11]

9. $\#M_0RV1P+i+LC_4\underline{S}\#ha\#N_SLC_1\#ha\#M_0RV1PLC_4\#\#U_0$
$RV1P_2U_1\underline{La_3}LC_4\#\#M_0RV1PLC_1\#ha\#M_0RV1PLC_3\#$ [S12]

10. $\#M_0RV1P+i+\underline{PFS}\#ha\#N_S\#ha\#M_0RV1P+\underline{PF}\#\#U_0RV1P_2$
$U_1\underline{La_3}\underline{PF}\#\#M_0RV1P\#ha\#M_0RV1P+\underline{P}\#$ [S13]

11. $\#\underline{T}-RV1Pi\underline{PFS}\#ha\#N_S\#ha\#RV1P\underline{PF}\#\#RV1P_2+\underline{m}-+\underline{La_3}$
$\underline{PF}\#\#RV1P\#ha\#RV1P\underline{P}\#$ [S15]

12. $\#\underline{T}-RV1Pi\underline{PFS}\#ha\#N_S\#ha\#RV1P\underline{PF}\#\#RV1P_2+\underline{m}-+\underline{La_3}$
$\underline{PF}\#et\#RV1P\#ha\#RV1P\underline{P}\#$ [S17]

An example of this, filling in roots and vowel patterns, might be "toxniot ha radyo ha rgilot mša'ammot et khal ha šom'im" ('The ordinary radio programs bore the listening audience').

Leading up to the analysis of roots and vowel patterns, we list several classes of morphophonemes, which will also be referred to later on.

If α and β are classes of elements, then $\alpha \cup \beta$ is the class containing as members the elements of α and the elements of β, i.e., it is the sum of α and β.

S18. Let $G=\{', {}^{6}, X, h\}$

$L=\{', t, n, y\}^{16}$

$G^{+}=G \cup \{r\}$

$L^{+}=L \cup \{1\}^{16}$

$C^{R}=G^{+} \cup L^{+} \cup \{B, P, K, d, k, g, v, s, z, š,$
$c, m, N, Y_1, Y_2, Y_3\}$

$C=C^{R} \cup \{M, b, p, f, x, :\}$

$V=\{V_0, \acute{V}_0, \overset{(}{\acute{V}}_0:\}$, where $V_0=\{i, e, a, o, u\}$

I.e., V is the class of vowels with or without accent (´) or :. To indicate that '´' or ':' explicitly do not occur, they are replaced by '˘' (giving 'V̆' and 'V˘', respectively). Thus only V_0 or $\acute{V}_0$ occur in env. $\_\breve{}$, and only V_0 and V_0: occur in env. $\underset{\smile}{\_}$. When written over either kind of bracket, then, just like the rest of the morphophonemic environment, '´' and '˘' hold for each element in the bracket (e.g., {´} or [´], etc.).

W=CUV

μ=the class of all morphemes (i.e., 'μ' is a variable ranging over morphemes.)

It will appear later that roots are discontinuous morphemes. They are analyzed as follows:

S19. $R \longrightarrow C_1^R C_2^R C_3^R$(:, sometimes, if $C_2=Y_2$)

Numerical subscripts on C will refer henceforth to position with respect to the root. Thus C_0 will be the consonant of a prefix, C_1 will be the first consonant of a root (or any consonant it is transformed into), etc.

There are various limitations on the distribution of elements of C^R in roots. I will not go into these here (see pp.3-4 above) except for stating that N occurs only as C_1, h rarely occurs as C_3, v is rare, and, when in R, $Y_{\underline{i}}$ occurs only as $C_{\underline{i}}$ (i=1, 2, 3) (only Y_2 occurs outside of R).

Several subsets of R may be listed here for later reference.

Ra={šYr, šYm, ...}, all of form CYC [see MR1]

Rb={kYm, šYB, ...}, " " " " [see MR1]

Rc={zYt, lYl, ...}, " " " " [see MR12]

Rd={šmr, KtB, 'sP, ...} If $C_1=Y_1$, RεRd [see MR2]

Re=R-Rd; i.e., all members of R except those in Rd [see MR24]

If C_1=y, then RεRe

If C_2=G, then RεRe (except, sometimes, when C_2=X, e.g., mXk, dXP)

If C_3=G, then RεRe (unless $C_1=Y_1$)

Re'={yšn, yr', ml', KBd, ...} [see MR1]

Re' is a subset of Re[17]

Re"={'mr, 'Bd, 'Kl, 'BY_3, 'PY_3}, all of the form 'CC. [see MR27]

Re" is a subset of Re

Rf={KnP, 'nP, XBr, ...} [see MR26]

Rg={mšl, Xkr, rkz, lcr, ...}, mostly with C_1=l,r,X. [see MR24]

Vowel patterns are single or bi-vocalic discontinuous sequences of elements in the range of V. The final vowel of each is accented. The discontinuity will be represented by '--', and the first and second vowels, respectively, or any vowel into which they are transformed, by V_1 and V_2. They are most conveniently treated as being each composed of two elements, of which at least one is a vowel, and the other a vowel or Ø. Thus vowel patterns can be taken as of the form 'α_1--β_2', essentially, where α_1, β_2=V or Ø.

VlP_{1a}={V_0--Ø ($V_0 \neq e$), Ø--V_0:}

VlP_{1b}={u--:o, u--:a, a--:u, a--:a:, i--:a, i--:o,
i--:u, e:--e, e:--a, e:--o, e:--u, o:--a, a--i,
a--u, a--o(:), a--e(:)}

where $V_2 \longrightarrow \acute{V}_2$(:, when V_2=o, i)

VlP_2={a--á, i--:é}

$VlP=VlP_{1a} \cup VlP_{1b} \cup VlP_2$[18]

There are also many four-consonant roots (and even some with five consonants). This class is not treated in the present study, but could conveniently be introduced at this point. Four-consonant roots might be considered to arise through replacement of : in VlP's of the form V_1--:V_2 by a member of C^R. If a rule were given at this point for the introduction of this fourth consonant in this way, almost all such roots could be accommodated with almost no change in the subsequent statements of the grammar.

Various restrictions on distribution within M and U can be stated now. In U,

$$VlP_2 \neq \begin{Bmatrix} i\text{--}:\acute{e} \\ a\text{--}\acute{a} \end{Bmatrix} \text{ in env. } \# \begin{Bmatrix} \text{---} \\ \underline{h}\text{-} \end{Bmatrix} \underline{N}\text{-}R\_\_ \ \underline{Ft} \begin{bmatrix} \underline{La}_2^1 \\ \underline{Lc} \end{bmatrix}$$

The non-zero members of M_0 occur only with VlP's of the form $\begin{Bmatrix} Ø \\ a \end{Bmatrix}$--V. m1- predominates with V_2=a, m2- predominates with V_2=e, o. As an alternative treatment, we could dispense with m2- and define two new classes of roots. This change would involve only slight changes at various points. Actually, a detailed statement should be given here of the actual distribution of roots among vowel patterns. The

form of this statement might have some effect on the rest of the grammar. Thus the system of eight verbal conjugations is considered in this treatment to be derived from the two V1P's and two prefixes, each V1P occurring alone, with each prefix, and with both prefixes at once. Alternatively, this subsystem could be constructed from two V1P's and three prefixes, each V1P occurring alone and with each prefix. One of the considerations in rejecting the latter formulation (though not the only one) involves the statement (not given in this grammar) concerning the distribution of roots through conjugations, which is greatly simplified with the two prefix system. The simplification of this statement is important because it makes clear the active-passive relationship between conjugations. Further statements on restriction of distribution will not be given, but could be adjoined here.

At this point detailed statements of morphemic alternation would also be given in a complete grammar. This is simply a matter of added detail and would not affect the formulation of the following statements. We might mention the complex alternation of some roots of the form CYC:, which sometimes become $C_1C_3C_3$, sometimes $C_1Y_2C_3$, sometimes $NC_1C_3(:)$. These forms are rare, and details of the situation will be omitted. Another alternation characteristic of several roots is the alternation YcC∿NcC, the latter appearing in env. __ Ft, or when $U_0 \neq \emptyset$.

3. Further Notational Statement

The statements of the grammar are in general of form (1) and (2) (p. 6), but occasionally with certain minor and generally self-explanatory deviations.

N9. If a statement is of the form

$$\alpha \longrightarrow \beta\gamma_1 \text{ in env. } \alpha_1 \_\_ \alpha_2, \text{ and } \gamma_1 \longrightarrow \gamma_2 \text{ where } \ldots$$

then the γ_1 referred to in the second half is that γ_1 introduced by the first part, and not some other γ_1 in the form under consideration (e.g., M10, 11, 12). Furthermore, the second part of a statement does not apply unless the transformation indicated in the first part actually takes place.

N10. Statements of the form

$$\alpha \longrightarrow [\beta \longrightarrow \gamma]$$

are abbreviations for

$$\alpha \longrightarrow \emptyset \text{ and } \beta \longrightarrow \gamma$$

i.e., they assert that α is transformed into the change of β to γ.

N11. Statements MR24, MR27, MR30, and MR32, under the heading 'Intrusion of $V_{\underline{k}}$' are to be interpreted as follows. A substatement

$$\alpha \_\_ \beta$$

is an abbreviation for

$$\alpha\beta \longrightarrow \alpha V_{\underline{k}} \beta \text{ (i.e., '}\emptyset \longrightarrow V_{\underline{k}} \text{ in env. } \alpha\_\_\beta\text{')}$$

and a statement

$$\alpha \underset{\gamma}{\_\_\_} \beta$$

is an abbreviation for

$$\alpha\gamma\beta \longrightarrow \alpha V_{\underline{k}} \beta \text{ (i.e., '}\gamma \longrightarrow V_{\underline{k}} \text{ in env. } \alpha\_\_\beta\text{')}.$$

N12. Dots '...' are used to indicate sequences (perhaps Ø) where the particular shape occurring is inconsequential, or to indicate the relative position of two elements, in which case the element for which the dots stand is placed above them in square brackets. Thus

$$\alpha \longrightarrow \overset{[\beta]}{\vdots}\gamma \text{ in env. } \_\_\beta$$

stands for

$$\alpha\beta \longrightarrow \beta\gamma \text{ (see MR7, MR22)}.$$

N13. No statement holds of a context including #, unless this is explicitly stated. Thus statements hold only within words.

N14. Juncture (non-phonemic) between morphemes is written '+'. It is often omitted from statements. Thus any statement holding of '$\alpha\beta$' holds also of '$\alpha+\beta$' (although the converse is not true), and '+' can be freely dropped at the end of the process of conversion to phonemes.

N15. If a statement is of form (2), where β_1=V, β_1'=Ø, and γ=CCα_2, then it does not apply. I.e., 'V$\longrightarrow$ Ø'

does not apply in env. __CC. (Notice that :εC).

N16. u⟶ u:, and similarly when u is introduced below.

N17. When any V_0 appears unmarked by ´, ˘, :, or ˘ in a specification of relevant environment (i.e., in α_1 or γ of a statement of form (2)), then the statement also holds when V_0 is replaced by any corresponding V_0, i.e., by $\acute{V}_0$, V_0:, or $\acute{V}_0$:.

4. Morphology and Morphophonemics

The sentences of the language are now represented in terms of morphemes, some given in morphophonemic spelling. The following set of grammatical statements is designed to convert any sequence of morphemes from section 2 into a sequence of phonemes.

Below each statement several examples are given of its operation. The references are to section 6, where a set of sample morphological derivations is given.

MR1.

In U^+, $\acute{a}_2 \longrightarrow$ { (1) [ó / i]:(ó); (2) [í / ú]:; (3) é; (4) } in env. # { [N- / n-]CYC...__ { (+La$_1$,2, sometimes, and o:--- u[19]; Ft, Rε[Ra / Rb] }; --- ; [N-...__ Ft, and $a_1 \longrightarrow a_1$: ; ...__ [{La$_k$ / m-}, RεRe'[20] ; m-, and $a_1 \longrightarrow$ o:] $C_2 \neq Y_2$ } }

E.g.

(1) $\underline{N}$-+KYn+a_1--$\acute{a}_2$ ⟶ $\underline{N}$-+KYn+a_1--$\acute{o}_2$; ultimately, "naxón"

$\underline{h}$-+BYn+a--á+$\underline{La}_1$ ⟶ $\underline{h}$-+BYn+a--í:ó+$\underline{La}_1$; ultimately, "havinóti".

Also 6A4, 8.

(2) šYr+a--á+$\underline{Ft}$+$\underline{La}_2$ ⟶ šYr+a--í+$\underline{Ft}$+$\underline{La}_2$; ultimately, "tašír"

kYm+a--á+$\underline{Ft}$+$\underline{La}_2$ ⟶ kYm+a--ú+$\underline{Ft}$+$\underline{La}_2$; ultimately, "takúm".

(3) $\underline{N}$-+KtB+a--á+$\underline{Ft}$+$\underline{La}_2$ ⟶ $\underline{N}$-+KtB+a:--é+$\underline{Ft}$+$\underline{La}_2$; ultimately, "tikatév".

Also 6A11.

(4) yr'+a--á+$\underline{La}_2$ ⟶ yr'+a--é+$\underline{La}_2$; ultimately, "yaré(y)ta"

yšn+a--á+$\underline{m}$- ⟶ yšn+a--é+$\underline{m}$-; ultimately, "yašén"

KtB+a--á+$\underline{m}$- ⟶ KtB+o:--é+$\underline{m}$-; ultimately, "kotév";

but kYm+a--á+$\underline{m}$- ⟶/ kYm+o:--é+$\underline{m}$-; but ultimately, "kám".

MR2. $\acute{a}_2 \longrightarrow \left\{\begin{array}{ll}(1) & \check{a} \\ (2) & \acute{i}: \\ (3) & \left\{\begin{array}{l}a: \\ e\end{array}\right\} \\ (4) & \acute{a}: \\ (5) & \acute{o}\end{array}\right\}$ in env. $\left\{\begin{array}{l} Y_3\ldots:\_\_:, \text{ sometimes} \\ \left[\begin{array}{l}U^+ \\ M\end{array}\right]\underline{h}\text{-}+C_1\cdots\left[\left\{\begin{array}{c}\overline{\quad\quad} \\ C_3+(\underline{P})\underline{F}^{21} \\ \underline{\quad\quad}\end{array}\right\}\right] \\ \_\_\underline{m}\text{-} \\ \_\_\underline{Ft}\left\{\begin{array}{l}\underline{La}_{\underline{K}}^{(I)},\ R\in Rd \\ \underline{Ln} \\ \underline{Lc}\end{array}\right\}\end{array}\right\}$

E.g.

(1) BnY+a--:á:⟶ BnY+a:--:ă:; ultimately, "bana'í";

but zKY+a--:á:⟶ zKY+a--:á:; but is ultimately "zakáy" (see MR14).

(2) h-+Psk+a--á⟶ h-+Psk+a--Í:; ultimately, "hifsík".

(3) h-+kdm+a--á⟶ h-+kdm+a--é; ultimately, "hekdém".

Also 6B5.

(4) 6A2, 6A14.

(5) 6A1, 6A3, 6A5, 6A9, 6A10;

smX+a--á+Ft+Lc⟶ smX+a--ó+Ft+Lc; ultimately, "lismóax".

MR3.

$$C_1C_2C_3\left\{\begin{matrix}:\\--\end{matrix}\right\}+Q_1\text{--}(:)Q_2\left[\begin{matrix}:\\--\end{matrix}\right]\longrightarrow C_1Q_1C_2(:)Q_2C_3\left\{\begin{matrix}:\\---\end{matrix}\right\}\left[\begin{matrix}:\\---\end{matrix}\right]$$

and ::⟶ : where $Q_{\underline{i}}=V_{\underline{i}}$ or Ø ($\underline{i}$=1,2)

E.g. each example in 6.

MR4.

$$\underline{Lc}\longrightarrow 1\left\{\begin{matrix}+\left[\begin{matrix}o\\---\end{matrix}\right]\ t \text{ in env. } \left[\begin{matrix}Y_3+\\ \#Y_1a\end{matrix}\right]\ \ldots\_\_\\ \\ - - - -\end{matrix}\right\}$$

E.g. 6A12, 6A9, 6A11.

MR5.

$\underline{La}_{\underline{2}}^{I}\longrightarrow 1^{I}$; a special case, henceforth, of 1. I.e., all statements applying to 1 (from MR4) hold as well of 1^{I}.

E.g. 6A10.

MR6.

$$\underline{N}\longrightarrow \left\{ \begin{array}{l} \left\{\begin{array}{c} i\longrightarrow \\ \text{---} \end{array}\right\} u \text{ in env.} \left\{\begin{array}{c} \# \\ \underline{h}- \end{array}\right\} \_\_ C \left\{\begin{array}{l} i, \text{ and } é\longrightarrow á \\ a, \text{ and } u\longrightarrow o \text{ sometimes,} \\ \quad \text{when } C_2 \neq Y_2 \text{ and } C_1 \neq N \text{ or } Y_1 \end{array}\right\} \\ \\ (h)N \text{ in env. } \_\_ \ldots (+1) \end{array}\right\}$$

E.g.

$\underline{N}$-+kiB:él+$\underline{m}$-$\longrightarrow$ kuB:ál+$\underline{m}$-; ultimately, "mkubál"

$\underline{N}$-+KatáB$\longrightarrow$ N+KatáB; ultimately, "nixtáv".

Also 6A14, 6A11.

MR7.

$$\underline{Lp}\longrightarrow \left\{ \begin{array}{l} \left\{\begin{array}{c} e \\ i \\ u \end{array}\right\} \\ \\ \left\{\begin{array}{l} [\underline{La}_2](e) \\ \ldots \\ n(ax)[\underline{La}_1] \\ \quad \ldots \end{array}\right\} \end{array}\right\} \text{in env.} \left\{ \begin{array}{l} \underline{La}_3 \text{---} \left\{\begin{array}{c} \underline{P} \\ \underline{F} \\ \text{---} \end{array}\right\} \\ \\ \left\{\begin{array}{c} \underline{La}_2 \\ \underline{La}_1 \end{array}\right\} \_\_ (+\underline{P}) \end{array}\right\}$$

E.g. 6A7, 6A3, 6A5.

MR8.

$$\left\{\begin{array}{c} \underline{m}- \\ \\ \underline{Ft} \end{array}\right\} \longrightarrow \text{prefixation to } U^+ \text{ of} \left\{ \begin{array}{c} m \\ \\ \left[\begin{array}{c} 1 \\ \underline{La}_k \end{array}\right] \end{array}\right\}$$

E.g. 6A2, 6A14; 6A6, 6A10, 6A11, 6A12; 6A1, 6A3, 6A5, 6A6.

MR9.

$$V_1 \longrightarrow \left\{\begin{array}{c} \emptyset \\ a \end{array}\right\} \text{in env. } \mu \ldots \_\_ \quad (V_1 = a, i)$$

E.g. almost every example in 6A, 6B.

MR10.

(1) $\underline{La}_1 \longrightarrow \left\{ \begin{array}{l} \text{n in env. } \_\_\ldots \underline{P} \\ \text{' in env. } \_\_\ldots C_1 \\ \left[\begin{smallmatrix} t \\ -- \end{smallmatrix}\right] \text{ i in env. } \left[\begin{smallmatrix} U \\ -- \end{smallmatrix}\right] \end{array} \right\}$

(2) $\underline{La}_2 \longrightarrow$ ta, and

a$\longrightarrow$ Ø in env. $\_\_\mu$

t$\longrightarrow$ (e)x in env. $\underline{S}$ $\_\_$(a) (sometimes, but not in env. $\underline{P}..\_\_$)

(3) $\underline{La}_3 \longrightarrow$ h, and

$$h \longrightarrow \left\{ \begin{array}{l} \text{y in env. } \_\_\ldots C_1 \\ \text{Ø in env. U, } C_3(:)\_\_ \\ e\left\{\begin{smallmatrix} y \\ -- \end{smallmatrix}\right\}h\left\{\begin{smallmatrix} u \\ -- \end{smallmatrix}\right\} \text{ in env. } Y_3+\underline{S}+\_\_\left\{\begin{smallmatrix} \# \\ \underline{F} \end{smallmatrix}\right\} \\ \text{o in env. } \underline{S}+\_\_\# \end{array} \right\}$$

E.g. almost every example in 6.

MR11.

$\left\{\begin{smallmatrix} \underline{P} \\ \underline{F} \end{smallmatrix}\right\} \longrightarrow$ Ø in env. $\#\left[\begin{smallmatrix} ' \\ n \end{smallmatrix}\right]+\ldots\_\_$

E.g.,

'+šamór+$\underline{F}\longrightarrow$ '+šamór; ultimately, "ešmór"

n+KatóB+$\underline{P}\longrightarrow$ n+KatóB; ultimately, "nixtóv.

MR12.

$$Ø \longrightarrow \left\{\begin{smallmatrix} : \\ --- \end{smallmatrix}\right\} a \left\{\begin{smallmatrix} --- \\ (Y_3) \end{smallmatrix}\right\} \text{ in env. } C_2\_\_C_3 \left\{ \begin{array}{l} \text{o:n\#, } V_1=\acute{\text{i}}\text{, sometimes} \\ \underline{P} \text{ (}\underline{F}\text{, sometimes)} \end{array} \right\}$$

where R$\not=$Rc

and if $\left[\begin{smallmatrix} C_1=G \\ C_3=Y_3 \end{smallmatrix}\right]$, V_1=ó, then $V_1 \longrightarrow V_1:\left[\begin{smallmatrix} --- \\ \text{sometimes} \end{smallmatrix}\right]$

and $Y_2 \longrightarrow$ y, sometimes

and $aY_3C_3 \longrightarrow C_3a:Y_3$, sometimes

E.g.,

zíKro:n⟶ zíK:aron; ultimately, "zikarón";

but

kílšo:n⟶ (ultimately) "kilšón".

Also 6B3, 6B1;

kúPs+PF⟶ kúPsay$_3$PF; ultimately, "kufsa'ót".

6B2, 6B7;

ʿónš+P⟶ ʿó:naš+P; ultimately, "'onaším"

kóšY$_3$+P⟶ kó:šaY$_3$+P (or kóšaY$_3$+P); ultimately,
"košiím" ("kša'ím").

Otherwise these last two would be "'anaším", "kša'ím", always.

táYš+P⟶ táyaš+P; ultimately, "tyaším";

but

BáYt+P⟶BáYat+P; ultimately, "batím".

MR12'.

$$P \longrightarrow (i)W(A, \text{ in env. } M^{+}, \text{ except in env.} \begin{Bmatrix} Y_2 \\ S\ldots \end{Bmatrix} \_\_)$$

$$\text{and } W \longrightarrow \begin{bmatrix} u \text{ in env.} \left[C_3^n <:> \right] \_\_ \\ m \end{bmatrix}$$

E.g. 6B1, 6B2, 6B3, 6B7, 6B8. Excluded: 6B6, 6B4, 6B5. 6A1, 6A4, 6A6, 6A7.

MR13. $\underline{F} \longrightarrow$ { (1) $\underline{F}$+A in env. m+$\alpha C_1 \ldots$__ { $C_3=Y_3$, and $\alpha \neq \{\underline{h}\text{-}V, \underline{N}\}$; $V_1=\emptyset$, $\alpha=\{\underline{h}\text{-}, \underline{N}, \emptyset\}$, $C_2=Y_2$ } exc. in env. [$\underline{S}\ldots$__ ; u__ ; [t+CC :]oC_3+__]

(2) $\underline{F}$+A, sometimes, in env. { M{ [{m{1,2}a--e}...+__+$\underline{S}$; oC_3+__^{22}] ; [m{1,2}+CCaC+__] ; [C{a,i}C:{a,e}C+__] ; [CCi:C+__ ; __+i] ; [m{$\underline{h}$-VC_1..., Y_3}__] } exc. in env. [$\underline{S}\ldots$__ ; u__ ; [t+CC :]oC_3+__]

(3) $\underline{F}$+A elsewhere in M

(4) {+im+(A)⟶ o: a Ø}t in env. M^+, { A__(A) ; __A(#, and t⟶ Ø) except in env. $\underline{S}\ldots$__ }

(5) +m+⟶ +n+ in env. m__

(6) {y+⟶ t+ ; i} in env. #{y+ ; {1^I, t+}}...C_3(u){(sometimes, and) ; (and i⟶Ø, and sometimes)}(+u⟶ #na)^{23}

(7)

(8) a in env. {h, C_3}__

(9) Ø in env. $\underline{S}\ldots$__

E.g.,

(1) m+rocéY_3+$\underline{F}$⟶ m+rocéY_3+$\underline{F}$A; ultimately, "rocá", etc. The exception $\alpha \neq \ldots$ is given to allow for the possibility (which may not be a real one) of forms like

"nivné(y)t", "mufné(y)t", alongside of "nivná", "mufná".

m+h-+Psí:k+F ⟶ m+h-+Psí:k+FA; ultimately, "mafsiká"

m+N+KYó:n+F⟶ m+N+KYó:n+FA; ultimately, "nxoná"; 6A2.

m+Y_1šén+F⟶ m+Y_1šén+FA; ultimately, "yšená".

(2) m_1+šté:l+F+S⟶ m_1+šté:l+FAS; ultimately, "maštelát",

but

m_1+Plág+F+S⟶ (ultimately) "mifléget";

similarly "xaveratí" (from XaBé:r+F+S+La_1) but "šxentí" (from šaKé:n+F+S+La_1); "mxoná" (from m_1+KYón+F, F⟶ FA) but "maxlóket" (from m_1+Xló:k+F); "mištará" (from m_1+štár+F, F⟶ FA), but "magévet" (from m_1+NgáB+F); "kabalá" (from kaB:á:l+F, F⟶ FA), but "šaxéfet" (from šaX:á:P+F);[24] "tipšá" (from tiP:eš+F, F⟶FA), but "pikáxat" (from Pik:éX +F); "šmirá" (from šmí:r+F, F⟶FA), but "gvéret" (from gBí:r+F);[24] "hadragatí" (from h-+drá:g+F+i, F⟶ FA), but "hakartí" as in "tat-hakartí" (from h-+NKá:r+F+i); "muxaná" (from m+h-+KYá:n+F, F⟶FA), but 6A14.

(3) Yáld+F⟶ Yáld+FA; ultimately, "yaldá"; 6B4, 6B5. Exceptions are 6B4, 6B6, 6B7; "soxnút" (from m+so:Kén+u+F, F⟶/ FA); "tizmóret" (from t+zmó:r+F, F⟶/ FA), "bikóret" (from Bik:ó:r+F, F⟶/ FA).

(4) 6B1, 6B3, 6B8; 6A2, 6B4, 6B5; 6A14, exception, 6B4, 6B6, 6B7.

(5) 6B4, 6A7.

(6) y+KtóB+u+F⟶ t+KtóB#na (ultimately, "tixtóvna")

or remains y+KtóB+u+F (ultimately, "yixtvú");

y+KtóB+F$_\longrightarrow$ t+KtóB; ultimately, "tixtóv".

(7) 1^{I}+KtóB+u+F$\longrightarrow$ 1^{I}+KtóB#na (ultimately, "któvna")

or $\longrightarrow$ 1^{I}+KtóB+u (ultimately, "kitvú")

1^{I}+KtóB+F$\longrightarrow$ 1^{I}+KtóB+i; ultimately, "kitví";

6A6.

(8) 6B7;

KatáB+F$\longrightarrow$ KatáB+a; ultimately, "katvá".

(9) 6B6.

MR14. In M,

$$Y_3 \longrightarrow \left\{\begin{array}{l} (1)\ \left\{\begin{array}{c}(Y_3)\\ \\ --\end{array}\right\}(\acute{i})_{\text{env}}\left\{\begin{array}{c}C^{R}_{j<:>}\\ \\ :C_2\end{array}\right\}(\breve{a})\_\_\left\{\begin{array}{l}<\bar{S}>\#,\ \text{and}\\ \text{when } j=2,\left\{\begin{array}{c}\acute{a}\\ i\end{array}\right\}\longrightarrow \acute{e}\ \text{or}\\ V,\ \text{and a}\longrightarrow\end{array}\right\}\emptyset \\ \\ (2)\ '\ \text{in env.}\left\{\begin{array}{c}\breve{a}\\ \\ \mu+\ldots C_2\acute{a}\end{array}\right\}\_\_V\left\{\begin{array}{c}---\\ \\ \text{sometimes}\end{array}\right\} \\ \\ (3)\ y\ \text{in env. C}\_\_ \end{array}\right.$$

E.g.,

(1) ^{6}Yí:t:+o:n+a:Y_3#$\longrightarrow$ ^{6}Yí:t:+o:n+a:Y_3i; ultimately, "'itona'í"

Ban:ă:Y_3#$\longrightarrow$ Ban:a:Y_3í; ultimately, "bana'í"

láXY_3#$\longrightarrow$ léXi#; ultimately, "léxi"

kó:šaY$_3$+im+A$\longrightarrow$ kó:ší+im+A; ultimately, "košiím".

(2) Ban:a:Y_3í$\longrightarrow$ Ban:a:'í; ultimately, "bana'í" (similarly, ^{6}Yí:t:o:na:Y_3í, from (1))

kúPsaY_3+o:tA--- kuPsa'ó:tA; ultimately, "kufsa'ot"

kóšaY_3imA$\longrightarrow$ kóša'imA; ultimately, "kša'ím"

h-+rcá:Y_3+a+A⟶h-+rcá:'+aA; ultimately, "harca'á";

but

h-+Plá:Y_3+aA⟶ (ultimately) "haflayá".

(3) h-+Plá:Y_3+aA⟶ h-+Plá:y+aA; ultimately, "haflayá"

racú:Y_3⟶ racú:y; ultimately, "racúy"

hav:á:Y_3⟶ hav:á:y; ultimately, "haváy"

ʿónY$_3$+So⟶ ʿóny+So; ultimately, "'onyó".

MR15.

$$(1)\ (2)\ \left[\begin{array}{l} VY_3 \longrightarrow \emptyset \text{ in env. } M^+ \\ \left\{\begin{matrix}B\\P\\K\end{matrix}\right\} \longrightarrow \left\{\begin{matrix}b\\p\\k\end{matrix}\right\}^{25} \text{ in env. } C\acute{V}C_2 \end{array}\right] \_\_\alpha,\ \alpha \neq \left\{\begin{array}{l} u \text{ in env. } \#C_1 \ldots \_\_ \\ (\underline{S})\# \end{array}\right\}$$

E.g.,

(1) sadáY$_3$+o:tA⟶ sad+o:tA; ultimately, "sadót";

6B3; 6B8;

racáY$_3$+onA⟶ rac+o:nA; ultimately, "racón".

(2) málK+aA⟶ málk+aA; ultimately, "malká".

Exceptions are zaKáY$_3$+ut, ultimately, "zxút" (not "zaxút"); ml+XnáY$_3$#, ultimately, "maxané"; malK+út, ultimately, "malxút"; málK#, ultimately, "mélex".

MR16.

$$m \longrightarrow \emptyset \text{ in env. } \_\_ \left\{\begin{matrix} N+ \\ C_1o \\ C_1Y_2 \end{matrix}\right\} \text{ and } N \longrightarrow n \text{ in env. } \_\_\ldots Y_3\#$$

E.g.,

m+N+r'áY$_3$#⟶ n+r'áY$_3$; ultimately, "nir'é

m+Ko:téB⟶ KotéB; ultimately, "kotév"

6A2.

MR17.

$$m\begin{Bmatrix}1\\2\end{Bmatrix} \dashrightarrow \begin{Bmatrix}m\\M\end{Bmatrix}$$

E.g., 6B8;

m2+sKórt⟶ M+sKórt; ultimately, "maskóret".

MR18.

$$\underline{h} \longrightarrow \begin{Bmatrix}h\\ \\ \emptyset\end{Bmatrix}(t) \text{ in env.} \begin{Bmatrix}\begin{bmatrix}\#\\1\end{bmatrix}\text{—}\begin{bmatrix}u\\--\end{bmatrix}\\ \text{—}\cdots\end{Bmatrix} C_1(a)$$

$$\text{and } tC_{\underline{j}} \longrightarrow C_{\underline{j}}t,\ C_{\underline{j}}=\begin{Bmatrix}N\\s\\š\\c\\z\end{Bmatrix},\ \text{and } zt \longrightarrow zd$$

E.g., 6A13; 6A4, 6A8, 6B5; 6A14.

h-+N+zam:én⟶ t+N+zam:én⟶ Ntzam:én⟶ Nztam:én⟶
Nzdam:én; ultimately, "nizdamén".

MR19.

$$\emptyset \longrightarrow a \text{ in env. } \#(1)C_{\underline{k}}\text{—}C_1C_2\alpha$$

$$\text{where}\begin{Bmatrix}\alpha=\begin{Bmatrix}i, u, \text{ and } C_{\underline{k}}\neq (\text{or} =)\ h\\ e, \text{ and } C_{\underline{k}}=t\\ a, \text{ and } C_{\underline{k}}=h\\ o, \text{ and } C_2=Y_2\end{Bmatrix}\\ C_{\underline{k}}=M\end{Bmatrix}$$

E.g.,

l+h+Psí:k⟶ lhaPsí:k; ultimately, "lhafsík"

t+Klí:t⟶ taKlí:t; ultimately, "taxlít"

t+KY$_2$u:m⟶taKY$_2$u:m; ultimately, "takúm"

t+rB+utA⟶ tarB+utA; ultimately, "tarbút"

t+šBéc⟶ tašBéc; ultimately, "tašbéc;

6B5;

m+kY$_2$ó:m⟶ makY$_2$ó:m; ultimately, "makóm"

N+KYón⟶NaKYó:n; ultimately, "naxón"

M+sKórt⟶MasKórt; ultimately, "maskóret".

MR20.

$$\begin{bmatrix}(i)m\\ \emptyset\end{bmatrix}\longrightarrow e\left\{\begin{Bmatrix}Y_2\\ y\end{Bmatrix}\right\}\text{in env.}\left\{\begin{bmatrix}--\\ +o:\underline{t}\end{bmatrix}\right\}\_\_(A)\underline{S}\left\{W\left\{\begin{Bmatrix}\#, \text{ and } e\longrightarrow a\\ a\\ W\end{Bmatrix}\right\}\right\}\begin{bmatrix}\#\\ nu\end{bmatrix}$$

E.g., 6B6, 6B8; 6B7;

Bí^{6}y+o:t+A+$\underline{S}$+xm⟶ Bí^{6}yo:t+eyA$\underline{S}$xm; ultimately,

"ba'ayoteyxém";

6B2;

síPr+$\underline{S}$+nu⟶ síPr+ey+$\underline{S}$+nu; ultimately, "sifréynu".

MR21.

$$\emptyset\longrightarrow A\text{ in env.}\begin{bmatrix}(1)\ \alpha\left\{\begin{Bmatrix}\underline{S}(\ldots W_{\underline{i}})\_\_((CV))\#, \alpha\neq VY_2<A>, (W_{\underline{i}}\neq u)\\ \_\_\ \underline{S}W, \alpha=ey\end{Bmatrix}\right\}\\ (2)\quad M_1\_\_\end{bmatrix}$$

E.g.,

(1) m+Xn+$\underline{S}$+eha⟶ m+Xn+$\underline{S}$+eAha; ultimately, "maxanéha"(?);

6B4, 6B5; 6B2; excluded: 6B8,

síPr+ey+$\underline{S}$+nu⟶/ síPrey$\underline{S}$nu$\underline{A}$.

síPrey$\underline{S}$nu⟶síPreyA$\underline{S}$nu; ultimately, "sifréynu".

(2) Y$_1$árX+o:n⟶ Y$_1$árX+o:n+A; ultimately, "yarxón":

6B6.

MR22.

$$Y_2 \longrightarrow \left[\begin{array}{l} (1)\ V_1 \longrightarrow o{:}C_3 \overset{\text{in}}{\underset{\text{env.}}{}} U^+,\ V_1\text{—}{:}\left\{\begin{array}{l}\ldots C_3{:}\\ \text{sometimes}\end{array}\right\}\text{and } C{:}\longrightarrow C \\ (2)\ y\left\{\begin{array}{l}- - -\\ ([\alpha_i]{:}i)\end{array}\right\}\text{in env.}\left\{\begin{array}{l}\text{—}{:}\\ a\text{—}\alpha_j C(\#)\end{array}\right\} \\ (3)\ \emptyset,\ \text{and } a{<}{:}{>}\alpha_j\left\{\begin{array}{c}[o\\ i]\\ V_i\end{array}\right\}\longrightarrow\left\{\begin{array}{c}a[v\\ y]\\ V_i\end{array}\right\}\alpha_j \end{array}\right],$$

$$\alpha_j = \emptyset{<}A{>}{<}\underline{S}{>}$$

E.g.,

(1) 6A13;

ht+kaY$_2$:ém+ut⟶ ht+ko:mém+ut; ultimately,

"hitkommút".

(2) ht+kaY$_2$:ém⟶ ht+kay:ém; ultimately, "hitkayém"

BáY$_2$t#⟶ Báyit#; ultimately, "báyit";

6B6;

záY$_2$t+imA⟶ záyt+imA; ultimately, "zeytím".

(3) 6A2, 6A4, 6A8, 6B7;

síPar+aY$_2$+A$\underline{S}$+o⟶ síPar+av+A$\underline{S}$; ultimately,

"sfaráv";

6B8; 6A14, 6B6.

MR23.

$$V_{\underline{i}} \longrightarrow \emptyset \text{ in env.} \left\{\begin{array}{ll} (1) & \left\{\begin{array}{c}\smile\\ \cdot\\ \text{—}\end{array}\right\}..V_{\underline{j}}..\left\{\begin{array}{c}V_{\underline{k}}\\ \underline{S}\end{array}\right\} \\ (2) & C{+}a{:}n{+} \end{array}\right\}\ldots A\left\{\begin{array}{c}\underline{i}=1,2;\ V_{\underline{i}}=V_O \\ V_{\underline{i}}=a(:)\end{array}\right\}$$

E.g.,

(1) daBár+imA⟶ dBár+imA; ultimately, "dvarím";

6B2,

daBár+ey+A+S+A⟶ dBár+ey+A+S+A⟶ dBr+ey+A+S+A;
ultimately, "divréy";

6B4, 6B7.

(2) Bay:áš+a:n⟶Bay:š+a:n; ultimately, "bayšán".

MR24. Intrusion of e

(1) $\overset{C}{\underset{(\bar{V})}{\ }}$ '__$C_{\underline{k}}$, $\underline{k}\neq 3$, V=í:,é (only sometimes when in env. L'__)[26]

(2) In U^{+} $\begin{Bmatrix} \dot{h} \\ N \\ L \end{Bmatrix}$ G__C_2 $\begin{Bmatrix} \text{where } \bar{G}\neq\text{'}, \ C_3\neq Y_3, \text{ sometimes} \\ \text{where } C_1C_2C_3\varepsilon Re \end{Bmatrix}$[27]

(3) $\underset{\bar{Y}_1}{L'\_\_}C\acute{\bar{o}}C$

(4) m__CC(a)C, where CCCεRg

(5) #$G_{\underline{i}}$__ $\underset{<\acute{i}>}{C_{\underline{j}}}$(__)$C_{\underline{k}}$ (where $\underline{j}$=1, $C_{\underline{j}}$=G)[27]

unless: $G_{\underline{i}}$=h in U^{+} [28]

$\underline{k}=\begin{bmatrix} 2 \\ 1 \end{bmatrix}$, $C_{\underline{j}}=\begin{bmatrix} G \\ N \end{bmatrix}$, sometimes[26]

(6) $\begin{Bmatrix} 1^{I}+\dot{h} \\ t \end{Bmatrix}aC_1$<C>$\underset{i:}{\acute{\ }}$C#$\begin{Bmatrix} -- \\ na \end{Bmatrix}$sometimes

E.g.,

(1) 6A8,

mo:cé't⟶mo:cé'et; ultimately, "mocé(y)t";

6A6; 6A12; but sometimes y+'róz⟶ ye'eróz, but is ultimately "ya'aróz".

(2) h+^{6}dí:P⟶ he^{6}edí:P; ultimately, "he'edíf"

N+^{6}záB⟶ Ne^{6}ezáB; ultimately, "ne'ezáv";

excluded is N+^{6}sáY$_3$; ultimately, "na'asá" or "ne'esá"(?);

t+XKám⟶ teXKám; ultimately, "texkám".

(3) 6A5, 6A9, 6A10.

(4) m+rKáz⟶ merKáz; ultimately, "merkáz".

(5) '+^{6}sóY$_3$⟶ 'e^{6}esóY$_3$; ultimately, "'e'esé", sometimes (ultimately "'a'asé" if (5) does not operate);

6B3; '+šmór⟶ 'ešmór; excluded are h+sPí:k, ht+mas:ér+u:tA, etc., also '+^{6}sóY$_3$ sometimes (as above), and '+N+Y$_1$a:dé^{6}, ultimately "'ivadá'", sometimes, instead of "'evadá'".

(6) l^{I}+hakí:m⟶ l^{I}+hakém; ultimately, "hakém"

taPsí:k#na⟶ taPsék#na; ultimately, "tafsékna".

These are essentially literary forms.

MR25.

$$(V)Y_3 \longrightarrow \left\{ \begin{array}{l} (1)\ \begin{Bmatrix} \acute{i} \\ ey \end{Bmatrix} \text{in env.} \begin{Bmatrix} \#C_1 \cdots \\ \_\_ \end{Bmatrix} \_\_ \begin{bmatrix} t \\ n \end{bmatrix} \\ (2)\ t \text{ in env. U, } \_\_a\# \\ (3)\ \emptyset \text{ in env. } \_\_W \\ (4)\ \acute{a} \text{ in env. U,} \#C_j \cdots \_\_, \text{ where } C_j = \begin{Bmatrix} N \\ h \end{Bmatrix},\ j=0, \\ \qquad\qquad\qquad\qquad\qquad \text{or where } j=1 \\ (5)\ \acute{e} \end{array} \right\}$$

E.g.,

(1) racáY$_3$+ti⟶ rací+ti

Xik:éY$_3$+ti⟶ Xik:í+ti; ultimately, "xikíti"

hšví:Y$_3$+nu⟶ hšvéy+nu; ultimately, "hišvé(y)nu".

(2) racáY$_3$+a⟶ ract+a; ultimately, "ractá".

(3) 6A12;

zKY$_3$u:yo:tA⟶ zKu:yo:tA; ultimately, "zxuyót".

(4) hrcí:Y$_3$⟶ hrcá; ultimately, "hircá"

racáY$_3$⟶ racá.

(5) mXzáY$_3$⟶ mXzé; ultimately, "maxazé"

yrcóY$_3$⟶ yrcé; ultimately, "yircé".

MR26.

$$\emptyset \longrightarrow \left\{\begin{matrix}a\\i\end{matrix}\right\} \text{in env. } \#\left\{\begin{matrix}---\\(1)\end{matrix}\right\}C\_\_CC\left\{\begin{matrix}CCC\varepsilon Rf\\\text{and } iy\longrightarrow i\end{matrix}\right\}$$

E.g.,

KnP+eyASA⟶ KanP+eyASA; ultimately, "kanféy".

6A1, 6A3, 6A11, 6A13, 6B4, 6B8;

t+yšán⟶ tiyšán⟶ tišán.

MR27. Intrusion of o

(1) óG__C^{27}

(2) $\underset{u:}{(\check{})}\left\{\begin{matrix}C_3C^{22}\\G^+:,\ \text{sometimes}\end{matrix}\right\}$

(3) $\underset{e'e}{L\_\_\_}\ C_2$, where RεRe"

(4) $\overline{\overline{VY_1}}$

E.g.,

(1) cóhr+a:yAim⟶ cóhora:yAim; ultimately, "cohoráyim".

(2) Xú:k:⟶ Xók:; ultimately, "xók"

yaXú:g:u⟶ yaXóg:u; ultimately, "yaxógu"

mPu:ráš⟶ mPoráš; ultimately, "mforáš"

But

mY$_1$u:':áš⟶ (ultimately) "myu'áš".

(3) 6A6.

(4) $yaY_1r\acute{i}:d \longrightarrow yor\acute{i}:d$; ultimately, "$yor\acute{i}d$".

MR28.

$$\overset{<\acute{\ }>}{V_0} \longrightarrow \emptyset \quad \text{in env.} \begin{cases} (1) \begin{bmatrix} U^+ \end{bmatrix} \\ (2) \begin{bmatrix} M, \ WC_{\underline{i}}C_{\underline{j}} \end{bmatrix} \end{cases} \_\_C_3 \begin{bmatrix} SW \\ V \end{bmatrix} \left\{ \begin{bmatrix} - \ - \ - \ - \end{bmatrix}, \begin{bmatrix} V_0=e, \begin{cases} C_{\underline{i}}=N \\ C_{\underline{j}}=: \end{cases} \end{bmatrix}, \begin{bmatrix} - \ - \ - \ - \\ \text{elsewhere,} \\ \text{rarely} \end{bmatrix} \right\}$$

E.g.,

(1) 6A1, 6A7, 6A8;

$Kot\acute{e}B+imA \longrightarrow KotB+imA$; ultimately, "$kotv\acute{i}m$"

$histo:v\acute{e}v+u:tA \longrightarrow histo:vvu:tA$; ultimately, "$histovv\acute{u}t$".

(2) $miNk\acute{e}l+S+oA \longrightarrow miNkl+SoA$; ultimately, "$makl\acute{o}$"

$tiP:\acute{e}\check{s}+u:tA \longrightarrow tiP:\check{s}+u:tA$; ultimately, "$tip\check{s}\acute{u}t$"

$mizB\acute{e}X+o:tA \longrightarrow mizBX+o:tA$; ultimately, "$mizbx\acute{o}t$"

but

$makl\acute{e}t+imA \longrightarrow$ (ultimately) "$makletim$".

MR29.

$$Y_1 \longrightarrow \begin{cases} v \text{ in env.} \begin{cases} \overset{t}{N}\_\_, \text{ sometimes} \end{cases} \\ y \end{cases}$$

E.g.,

$hitY_1aK:\acute{e}X \longrightarrow hitvaK:\acute{e}X$; ultimately, "$hitvak\acute{e}ax$"

but

$hitY_1a\check{s}:\acute{e}B \longrightarrow hitya\check{s}:\acute{e}B$; ultimately, "$hitya\check{s}\acute{e}v$".

6A11, 6B6.

MR30. Intrusion of a

(1) $W_{\underline{i}} \longrightarrow G<:>(SA)\#$, $W_{\underline{i}} \neq a$, $G \neq '$

$$\text{and}\left\{\begin{array}{l} W_{\underline{i}} \longrightarrow \emptyset \ \underset{\text{env.}}{\text{in}} \left\{\begin{array}{l} \text{L'eC} \\ \text{NCaC} \\ \left[\begin{array}{l}\#\\ \text{M}\end{array}\right]\text{CC} \end{array}\right\}\_\_\left\{\begin{array}{l} - - - - \\ - - - - \\ \left[\begin{array}{l} - - - - \\ \text{sometimes,esp.} \\ \text{in env.}\_\_..\text{SA} \end{array}\right] \end{array}\right\} \text{where } W_{\underline{i}}=e,o \\ \\ ah \longrightarrow \left\{\begin{array}{l} h \\ --- \end{array}\right\}a\left\{\begin{array}{l} \text{in env. V} \\ - - - - \end{array}\right\}\_\_\# \end{array}\right.$$

(2) $m\underset{i}{\_\_}\left\{\begin{array}{l} NC_2 \\ X(\_)C_2..., \text{ where ... does not contain } C_3 \text{ (but does not hold sometimes in env. } \_\_...S) \end{array}\right\}$

(3) $\#G\_\_C$

(4) $1+\underset{e}{\_\_} C_2$

(5) In U, $\underset{V_2}{\acute{\ }}C_3\left[\begin{array}{l}t\\ n\end{array}\right]$

$$\left\{\begin{array}{l} \overline{<\acute{\ }>} \\ V_{\underline{j}} \\ W \end{array}\right\}...G\left\{\begin{array}{l} --- \\ \\ <:> \end{array}\right\}...\_\_C_{\underline{k}}{}^{27}, \text{ where ... contains no W, } V_{\underline{j}}=i,\ e_2 \text{ } G=C_3 \text{ only in } M^+ \text{ or } 1+...\_\_{}^{29}$$

E.g.,

(1) noBéX⟶ no:BéaX; ultimately, "novéax"

likro^6⟶ likróa^6; ultimately, "likróa'".

But

naBaX↛ naBáaX

likro'↛ likróa'; but is ultimately, "likró'".

6A10; 6A11;

sBé^{6}SA (as in "svá' racón")⟶ sBéa^{6}S̲A⟶ sBá^{6}S̲A; ultimately, "svá'"

mixBéaXS̲A⟶ mizBéaXS̲A⟶ mizBáXS̲A; ultimately, "mizbáx", sometimes.

gaBóh⟶ gaBóah⟶ gaBóha; ultimately, "gavóha"

góBh⟶ góBah⟶ góBa; ultimately, "góva"

gBóhS̲A⟶ gBóah⟶ gBáh⟶ gBá; ultimately, "gvá" (as in "gvá komá").

(2) miNBát⟶ maNBát; ultimately, "mabát"

miXzé⟶ maXazé; ultimately, "maxazé";

6B8.

(3) 6A4; 6A5; 6A8;

XBér+imA⟶ XaBér+imA; ultimately, "xaverím".

(4) 6A9, 6A10.

(5) 6A4, 6A13.

(6) 6B4;

PíXd⟶ PáXad; ultimately, "páxad"

'o:réX+t⟶ 'o:ráXat; ultimately, "'oráxat"

ladé^{6}+t⟶ ladá^{6}at; ultimately, "ladá'at";

6A7, 6A14;

róXB⟶ róXaB; ultimately, "róxav".

But

karáta^{6} ~~⟶~~ karáata^{6}; but is ultimately "karáta'".

MR31.

S̲(A)⟶ Ø (in env. __#)

E.g., 6B2, 6B4, 6B5, 6B6, 6B7, 6B8.

MR32. Intrusion of e

(1) $\frac{(\acute{})}{i(:)}\left\{\begin{matrix} C_3: \\ G^+:, \text{ sometimes} \\ NG^+,\ G^+=C_1 \end{matrix}\right\}$[30]

(2) $\left\{\begin{matrix} C_{\underline{j}}\langle A\rangle\_\_ \\ \overline{V_{\underline{k}}}CV \end{matrix}\right\} C \left\{\begin{matrix} \langle A\rangle \\ \text{---} \end{matrix}\right\} \#,\ C_{\underline{j}} \neq :;\ V_{\underline{k}}=i\langle:\rangle,a$

(3) $\frac{\quad}{a\langle:\rangle}\ yC,\ C\neq:$[31]

(4) $\left\{\begin{matrix} C\_\_ \\ \acute{}e \end{matrix}\right.$

(5) $\left.\begin{matrix} \text{In } U^+,\ \#\left\{\begin{matrix} h \\ m \end{matrix}\right\}\underset{\alpha}{\_\_}C_1V,\ \alpha=i,a\left\{\begin{matrix} \text{except in env.}\_\_\ldots\acute{o} \\ \text{or, sometimes, } \alpha=\emptyset \end{matrix}\right\} \text{and } e\longrightarrow \\ \underline{\quad}W, \text{ in certain dialects}[32] \end{matrix}\right\}$

(6) $\overline{ey}$

$\left\{\begin{matrix} ey \\ \acute{e}y \\ \acute{e} \end{matrix}\right\}$

E.g.,

(1) kí:c:⟶ kéc:; ultimately, "kéc"

higí:n:⟶ higén:; ultimately, "hegén"

'iX:aru⟶ 'eX:aru; ultimately, "'exarú";

but

riX:amu⟶ (ultimately) "rixamú"

yiN^{6}asé⟶ yeN^{6}asé; ultimately, "ye'asé".

(2) yáld⟶ yáled⟶ yéled

KotéBt⟶ KotéBet; ultimately, "kotévet";

6A9; 6B4;

gBí:rt⟶ gBí:ret⟶ gBéret; ultimately, "gvéret".

But

Pí:l↛ Pí:el.

(3) BáytiA⟶ BeytiA; ultimately, "be(y)tí";

but

Bay:ša:nA↛ Bey:ša:nA; but is ultimately "bayšán".

(4) moc'et⟶ moceyt; ultimately, "moce(y)t;

6A8.

(5) 6A4, 6A8. But

haBí:nóti⟶ (ultimately) "havinóti"

(also hití:B⟶ heytí:B; ultimately, "he(y)tív".)

mBí:nimA⟶ meyBi:nimA; ultimately, "me(y)vinim",

sometimes.

(6) Béyt⟶ Bét; ultimately, "bét".

MR33.

$$\left\{\begin{matrix} 1^{I}(V) \\ \underline{F} \end{matrix}\right\} \longrightarrow \emptyset$$

E.g., 6A10;

lakáXtF⟶ lakáXt; ultimately, "lakáxt";

6A7, 6A13.

MR34.

$$\begin{bmatrix} B \\ P \\ K \end{bmatrix} \longrightarrow \left\{ \begin{bmatrix} b \\ p \\ k \end{bmatrix} \text{ in env.} \left\{ \begin{matrix} \_\_:W \\ \left\{ \begin{matrix} \# \\ \left\{ \begin{matrix} V \\ N \end{matrix} \right\} C_j \end{matrix} \right\} \_\_ \end{matrix} \right\} \; j=0,1;\; C_j \neq y \right.$$

$$\left. \begin{bmatrix} v \\ f \\ x \end{bmatrix} \right\}$$

E.g.,

kiB:é́l⟶ kib:é́l; ultimately, "kibé́l"

BaXú́:r⟶ baXú́:r; ultimately, "baxú́r"

hitBar:é́r⟶ hitbar:é́r; ultimately, "hitbarér";

6A3, 6B5.

yiNtBar:é́r⟶ yiNtbar:é́r; ultimately, "yitbarér".

Many examples in section 6.

MR35.

$$\left\{\begin{matrix}- - - \\ (\acute{}) \\ V_j \ldots\end{matrix}\right\} A \longrightarrow \left\{\begin{matrix}\emptyset \text{ in env. } \_\_\ldots A \\ \\ V, \text{ where } \ldots \text{ contains no } V\end{matrix}\right\}$$

E.g., many examples in 6B; 6A2.

MR36.

h⟶ Ø in env. C_j__, $c_j \neq y$,:

E.g., 6B5;

sífrhá⟶ sífrá.

But

sífreyhém⟶ sífreyém

'o:hév⟶ o:év.

MR37.

V́⟶ V̆ in env. __...V́

E.g., 6A2, 6B2, 6B5, 6B6.

MR38.

$$\left\{\begin{matrix}\breve{o} \\ e \\ a, \text{ sometimes}\end{matrix}\right\} \longrightarrow \left\{\begin{matrix}\breve{u} \\ i\end{matrix}\right\} \text{ in env. } \_\_ <:> C:W,\ C \neq G^{+}$$

E.g.,

xok:ím⟶ xuk:ím; ultimately, "xukím"

kec:ím⟶ kic:ím; ultimately, "kicím"

ma:s:ím⟶ mis:ím; ultimately, "misím",

but

ra:b:ím⟶ rib:ím; but is ultimately "rabím".

But

mfo:':ár⟶ mfu'ár; but is ultimately "mfo'ár".

MR39.

#⟶ + in env. __na#

E.g., 6A6.

MR40.

$$N \longrightarrow \begin{cases} \emptyset \text{ in env. } C_{\underline{j}}V\_\_C_{\underline{k}}, \text{ where } C_{\underline{j}} \neq l, \text{ and where,} \\ \qquad\qquad \text{if } \underline{k}=2, \text{ then } C_{\underline{k}} \neq G \\ n \end{cases}$$

E.g., 6A3, 6A11. But

liNpól⟶ linpól

hiNXíl⟶ hinXíl; ultimately, "hinxíl".

MR41.

X⟶ x

E.g., 6A14, 6B3, 6B8.

MR42.

6⟶ '

E.g., 6A7, 6A11, 6A10, 6B4, 6B5.

MR43.

M$\longrightarrow$ m

E.g.,

Maskóret$\longrightarrow$ maskóret.

MR44.

W:$\longrightarrow$ W

E.g., 6A2, 6A11, 6A13, 6A14, 6B1, 6B3, 6B5, 6B8.

MR45. If there is no $\acute{V}$ in env. $\#_1 \ldots \_\_ \ldots \#_2$, then

$\breve{V}_{\underline{k}} \longrightarrow \acute{V}_{\underline{k}}$, where $V_{\underline{k}}$ is the V nearest $\#_2$.

E.g., 6A1, 6A3, 6A5, 6A7, 6A10, 6A11, 6A12.

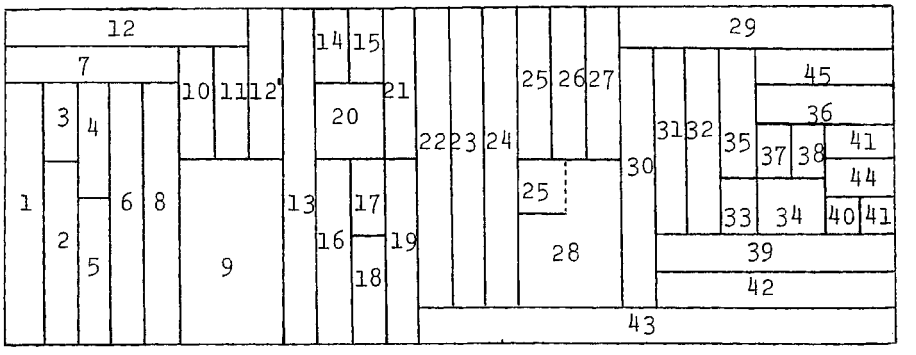
This completes the morphological and morphophonemic section. Running once through the whole set of transformation statements given above, both syntactic and morphological, gives one sentences in phonemic representation.[33] Running through the whole set in all possible ways, assuming the gaps cited to be filled in, would give all possible sentences. A phonemic statement giving allophones of phonemes (and describing automatic intrusions, e.g., intrusion of schwa in env. CC__C, etc.) would complete the grammar.

5. Justification

The fundamental question about any grammar, aside from that of its adequacy in describing the facts, is the question: why is it constructed in the particular way it is. As

stated in the introduction, we will attempt to give a limited answer to this question for the morphological statement just presented by demonstrating that the statements are partially ordered by criteria of simplicity. The necessary ordering of the statements of the morphology is given by the following chart. In this chart, a line drawn from left to right, not crossing horizontal lines, determines a necessary order (left to right) among the elements in the boxes through which it passes. These elements are the numbers of the morphological statements given in the preceding section. Any two elements through which such a line passes have an order defined for them. For each statement, it can be seen at a glance which statement it must precede, and which it must follow.

Within the statements themselves, substatements are ordered, in general. Indeed, even within a bracket, each line generally must precede each succeeding line. No proof of this will be given for parts of numbered statements, but this could easily be done in a manner similar to that exhibited below for the main statements.



The ordering indicated by the broken line (MR25<MR28) is that given by the application of criterion 2 (p. 52) as a subsidiary criterion.

To justify the ordering given by the chart (in a limited sense--see p. 4), then, it is necessary to justify the construction of each vertical line segment in the chart. One way to do this will be to show that if the statements separated by this line segment were applied in reverse order, the wrong form would result. In such cases the justification of the ordering MR$\underline{m}$<MR$\underline{n}$ will be given in the following form:

MR$\underline{m}$<MR$\underline{n}$, otherwise $\alpha \xrightarrow{n} \alpha' \longrightarrow {}^{*}\alpha''$ [α''']

This means: MR$\underline{m}$ precedes MR$\underline{n}$, otherwise some sequence α will be transformed by MR$\underline{n}$ (before MR$\underline{m}$ is applied) into a sequence α', ultimately resulting in α'', which is incorrect, the correct form being α'''.

Alternatively, we may justify the ordering MR$\underline{m}$<MR$\underline{n}$ by showing that, were they to be interchanged, they would have to be complexly rephrased to generate the same forms. The justification of the ordering MR$\underline{m}$<MR$\underline{n}$ will in this case be of the following form:

MR$\underline{m}$<MR$\underline{n}$, otherwise α'/α in MR$\underline{m}$ (or in MR$\underline{n}$)

meaning that MR$\underline{m}$ precedes MR$\underline{n}$, otherwise MR$\underline{m}$ (or MR$\underline{n}$) would have to be rephrased with α' replacing α, α' being less simple.

The criteria for justification of ordering are as

given at the conclusion of section 0: simplicity is increased by

1. reduction of the number of symbols in a statement (paired brackets, etc., counting as one symbol);
2. reduction of the length of derivations,

with the second requirement subsidiary. Actually it applies only once, and then in a trivial fashion. I mention it only to indicate explicitly that this consideration, taken as subsidiary, will not materially increase the ordering restrictions.

Once the criteria are accepted, it is necessary to apply them rigorously. Thus some of the justifications are based on trivial considerations. A higher order justification, demonstrating the ordering imposed on statements two, three, etc., removed, while it would be more complicated to present, would show many less trivial restrictions. That is, if the reason for MR$\underline{m}$<MR$\underline{n}$ is apparently trivial, it is almost always the case that the reason for MR$\underline{m}$<MR$\underline{n}$+$\underline{k}$, and form MR$\underline{m}$-$\underline{j}$<MR$\underline{n}$ (where $\underline{j}$, $\underline{k}$ are small integers, generally 1) is not trivial.

For justification of the first form, when it is not directly stated, it is implied and can be shown that if there is an effective possible reformulation, it is more complex.

MR1<MR2, otherwise

$$\underline{h}\text{-+BYn+a--}\acute{a}\text{+}\underline{La_1} \xrightarrow{MR2} \underline{h}\text{-+BYn+a--}\acute{i}\text{:+}\underline{La_1} \longrightarrow * \text{ always,}$$

"hevánti" ["hevánti" or "havinóti"].

MR1<MR3, otherwise

$(\overset{[C3\acute{o}]}{\ldots\ldots})/(\acute{o})$ in MR1.

MR3<MR4, otherwise

$\#Y_1\ldots+a/Y_1a$ in MR4.

MR2<MR5, otherwise

$1,\ 1\neq 1^{I}/\underline{Lc}$ in MR2.

MR4<MR6, otherwise

$(\left\{\begin{matrix}\underline{La}_2^{I}\\ \underline{Lc}\end{matrix}\right\})/(+1)$ in MR6.

MR5<MR6, otherwise

$(\left\{\begin{matrix}\underline{La}_2^{I}\\ +1\end{matrix}\right\})/(+1)$ in MR6.

MR6<MR8, otherwise

$\#\left\{\begin{matrix}m\\ \underline{La}_k\end{matrix}\right\}/\#$ in MR6.

This more than compensates for the fact that

$\_\_\ldots(+1)/(1)\_\_$ when MR6<MR8.

MR7<MR10, otherwise

$\underline{La}_2\underline{Lp}\xrightarrow{10} t\underline{Lp}\longrightarrow$ *"át" ["atá"].

MR8<MR10, otherwise MR8 must list all forms into which MR10 transforms $\underline{La}_k$.

MR8<MR9, otherwise "or in env. $\_\_\ldots\left\{\begin{matrix}\underline{m}-\\ \underline{F}t\end{matrix}\right\}$" must be added to MR9.

MR10<MR11, otherwise

$\underline{La}_1$+šamór+$\underline{P}\xrightarrow{11}$ $\underline{La}_1$+šamór$\longrightarrow$ *"'ešmór" ["nišmór"].

MR12<MR12', otherwise

im+A/$\underline{P}$ in MR12.

MR11<MR12', otherwise

$\ldots C_3/\ldots$ in MR11.

Also, criterion 2 is violated, since

$\underline{P}\longrightarrow$ u$\longrightarrow$ Ø/$\underline{P}\longrightarrow$ Ø.

MR12'<MR13, otherwise the conditions for $\underline{P}\longrightarrow$ imA would have to be added to MR13(4), and "$\underline{P}\longrightarrow$ Ø in env.__o:t" would have to be added to MR12'.

MR9<MR13, otherwise

α=Ø, RεRe' or $C_2=Y_2$/α=Ø in MR13.

MR13<MR14, otherwise

$\left\{\begin{matrix}\underline{V}\\ \underline{F}\end{matrix}\right\}$/V in MR14(2).

MR13<MR20, otherwise the environment for $\longrightarrow eY_2$ would be very complicated to state, in MR20. And

Y_1álad+im$\underline{A}\underline{F}$+$\underline{S}o\xrightarrow{20}$ Y_1álad+im$\underline{A}\underline{F}$+$\underline{N}$a:$Y_2$+$\underline{S}o\longrightarrow$

*"yladótav" ["yaldotáv"].

MR13<MR16, otherwise

m+kY_2á:m+$\underline{F}\xrightarrow{16}$ kY_2á:m+$\underline{F}\longrightarrow$ *"kámet" ["kamá"].

MR14<MR15, otherwise

$\underline{h}$-+rcá:Y_3+aA$\xrightarrow{15}$ $\underline{h}$-+rc+aA$\longrightarrow$ *"harcá" ["harca'á"],

^{6}aní:Y_3+imA$\xrightarrow{15}$ ^{6}an+imA$\longrightarrow$ *"'aním" ["'aniyím"].

MR16<MR17, otherwise "in U" must be added to MR16.

MR16<MR18, otherwise CY_2a/CY_2 in MR16.

MR15<MR21, otherwise $\underline{S}A/\underline{S}$ in MR15.

MR20<MR21, otherwise both have to be completely and complexly rephrased, with many repetitions, since A is introduced by MR21 on the basis of the transformations resulting from MR20, which, if the order were inverted, would then have to be listed twice.

MR17<MR19, otherwise

$\left\{\begin{matrix} C_{\underline{k}} \\ m_{\underline{i}}\ (\underline{i}=1,2) \end{matrix}\right\}/C_{\underline{k}}$ in MR19, and several consequent complications.

MR18<MR19, otherwise

t+$\underline{h}$-+Psí:k$\xrightarrow{19}$ t+$\underline{h}$-+Psí:k$\longrightarrow$ *"tifsík" ["tafsík"].

MR21<MR22, otherwise "or...", where ... is a list of all forms into which a:Y_2 is transformed by MR22, must be added to MR21(2).

síPar+aY_2+A+$\underline{S}$+x$\xrightarrow{22}$ síPar+ayA$\underline{S}$ix$\longrightarrow$ *"sfarayíx" ["sfaráyix"].

MR19<MR22, otherwise

$$\left\{\begin{matrix} mkY_2o{:}m \\ tkY_2u{:}m \\ etc. \end{matrix}\right\} \longrightarrow \quad *\left\{\begin{matrix} \text{"mkom"} \\ \text{"tkum"} \\ etc. \end{matrix}\right\} \left\{\begin{matrix} \text{["makom"]} \\ \text{["takum"]} \\ etc. \end{matrix}\right\}$$

MR19<MR43, otherwise

$$M{+}sm\acute{e}r \xrightarrow{43} m{+}sm\acute{e}r \longrightarrow *\text{"mism\'er"}\ [\text{"masm\'er"}].$$

MR22<MR23, otherwise

$$maKY_2\acute{o}{:}naA \xrightarrow{23} maKY_2\acute{o}{:}naA \longrightarrow *\text{"maxon\'a"}\ [\text{"mxon\'a"}].$$

MR23<MR24, otherwise

$$\text{'}\acute{i}galo{:}t\underline{S}A \xrightarrow{24} \text{'}\acute{i}galo{:}t\underline{S}A \longrightarrow *\text{"'igl}\acute{o}\text{t"}\ [\text{"'eglot"}].$$

MR24<MR25, otherwise all forms into which Y_3 is changed by MR25 must be specified in MR24(2).

MR24<MR28, otherwise

$(\bar{\acute{o}})/\bar{\acute{o}}$ in MR24(3).

MR25<MR26, otherwise

$$zKY_3uyo{:}tA \xrightarrow{26} ziKY_3uyo{:}tA \longrightarrow *\text{"zixuy}\acute{o}\text{t"}\ [\text{"zxuyot"}].$$

MR25<MR28, otherwise criterion 2 would be violated since

$$ra'\acute{a}Y_3{+}a \xrightarrow{28} ra'Y_3{+}a \xrightarrow{25} ra't{+}a;$$ ultimately, "ra'atá", instead of simply

$$ra'\acute{a}Y_3{+}a \xrightarrow{25} ra'ta;$$ ultimately, "ra'atá".

MR26<MR27, otherwise

$$\#C\underset{(V)Y_1}{\_\_\_\_\_}/\underset{VY_1}{\_\_\_}$$ in MR27(4).

MR27<MR29, otherwise "except in env. V__" must be added to MR29.

MR27<MR30, otherwise

cóhrayAim$\xrightarrow{30}$ cóharayAim$\longrightarrow$ *"coharáyim" ["cohoráyim"].

MR28<MR30, otherwise

Ka'áBu$\xrightarrow{30}$ Ka'áBu$\longrightarrow$ *"ka'vú" ["ka'avú"].

MR30<MR31, otherwise

miXno:tA$\underline{S}$A$\xrightarrow{31}$ miXno:tA$\longrightarrow$ *always "maxanót" ["maxanót" or "maxnót"].

MR30<MR39, otherwise

tiKtóB#na$\xrightarrow{39}$ tiKtóB+na$\longrightarrow$ *"tixtávna" ["tixtóvna"].

MR30<MR42, otherwise

zró$^{6}\xrightarrow{42}$ zró'$\longrightarrow$ *"zró'" ["zróa'"].

MR31<MR32, otherwise

<$\underline{S}$><A>/<A> in MR32(2).

MR32<MR35, otherwise

síPrxmA$\xrightarrow{35}$ síPrxm$\longrightarrow$ *"sífrxem" ["sifrxém"].

MR32<MR33, otherwise

l^{I}+hakém$\xrightarrow{33}$ hakém$\longrightarrow$ *"hekém" ["hakém"],

KatáBt$\underline{F}\xrightarrow{33}$ KatáBt$\longrightarrow$ *"katávet" ["katávt"].

MR35<MR45, otherwise

sfareAxa$\xrightarrow{45}$ sfareAxá$\longrightarrow$ *"sfarexá" ["sfaréxa"].

MR35<MR36, otherwise

C_1(A)__/C_1__ in MR36.

MR35<MR37, otherwise "or in env. __...A" must be added to MR37.

MR33<MR34, otherwise

l^{I}iKtóB$\xrightarrow{34}$ l^{I}ixtóv$\rightarrow$ *"xtóv" ["któv"].

MR37<MR38, otherwise

Xók:ím$\xrightarrow{38}$ Xók:ím$\rightarrow$ *"xokím" ["xukím"].

MR38<MR41, otherwise

C≠G^{+}, C≠x/C≠G^{+} in MR38.

MR38<MR44, otherwise

Xok:ím$\xrightarrow{44}$ Xokím$\rightarrow$ *"xokím* ["xukím"].

MR34<MR44, otherwise

kiB:él$\xrightarrow{44}$ kiBél$\rightarrow$ *"kivél" ["kibél"].

MR34<MR40, otherwise

maNBát$\xrightarrow{40}$ maBát$\rightarrow$ *"mavát" ["mabát"].

MR40<MR41, otherwise

G or x/G in MR40.

6. Sample Derivations

Several instances will be given here of the application of the morphophonemic and morphological statements of section 4, in the same manner as the examples (on pp.18, 19) of the application of the syntactic transformations. In each example, the heading is a sequence of morphemes, the final line the corresponding sequence of phonemes, and the number

of each transformation is again placed in parentheses to the right of the sequence resulting from the application of the transformation. Section A consists of selections from U^{+}, thus, essentially, verbs; section B consists of selections from M, thus, essentially, nouns (see p.14).

A.

1. KtB+a--á+Ft+La_3+P

1.	KtB+a--ó+Ft+La_3+P	[MR2]
2.	KatóB+Ft+La_3+P	[MR3]
3.	La_3+KatóB+P	[MR8]
4.	La_3+KtóB+P	[MR9]
5.	y+KtóB+P	[MR10]
6.	y+KtóB+u	[MR12']
7.	yiKtóBu	[MR26]
8.	yiKtBu	[MR28]
9.	yixtvu	[MR34]
10.	yixtvú	[MR45]

2. kY_2m+a--á+m-+F

1.	kY_2m+a--á:+m-+F	[MR2]
2.	kaY_2á:m+m-+F	[MR3]
3.	m+kaY_2á:m+F	[MR8]
4.	m+kY_2á:m+F	[MR9]
5.	m+kY_2á:m+F+A	[MR13.1]
6.	m+kY_2á:m+a+A	[MR13.4]
7.	kY_2á:m+aA	[MR16]
8.	ká:maA	[MR22]
9.	ká:má	[MR35]
10.	ka:má	[MR37]
11.	kamá	[MR44]

3. La3+Lp#NP1+a--á+Ft+La_3

1.	La3Lp#NP1+a--ó+Ft+La3	[MR2]
2.	La3Lp#NaPól+Ft+La3	[MR3]
3.	La3u#NaPól+Ft+La3	[MR7]
4.	La3u#La3+NaPól	[MR8]
5.	La3u#La3+NPól	[MR9]

4. h-+kY_2m+a--á+La1+P

1.	h-+kY_2m+a--í:+La1+P	[MR1]
2.	h-+kaY_2í:m+La1+P	[MR3]
3.	h-+kY_2í:m+La1+P	[MR9]
4.	h-+kY_2í:m+n+P	[MR10]
5.	h-+kY_2í:m+n+u	[MR12']

3. (cont.)

6. hu#yNPól [MR10]
7. hu#yiNPól [MR26]
8. hu#yiNpól [MR34]
9. hu#yipól [MR40]
10. hu#yipól [MR45]

4. (cont.)

6. h+kY$_2$í:m+nu [MR18]
7. h+kí:mnu [MR22]
8. hakí:mnu [MR30.3]
9. hakámnu [MR30.5]
10. he(y)kámnu [MR32]

5. La2+Lp#Y$_1$c'+a--á+Ft+La2

1. La2+Lp#Y$_1$c'+a--ó+Ft+La2 [MR2]
2. La2+Lp#Y$_1$acó'+Ft+La2 [MR3]
3. '+La2#Y$_1$acó'+Ft+La2 [MR7]
4. 'La2#La2+Y$_1$acó' [MR8]
5. 'La2#La2+Y$_1$có' [MR9]
6. 'ta#t+Y$_1$có' [MR10]
7. 'ta#tecé' [MR24]
8. 'atá#tecé' [MR30]
9. 'atá#tecé' [MR45]

6. 'Kl+a--á+Ft+La2+P+F

1. 'aKál+Ft+La2+P+F [MR3]
2. La2+'aKál+P+F [MR8]
3. La2+'Kál+P+F [MR9]
4. t+'Kál+PF [MR10]
5. t+'Kál+uF [MR12']
6. t+'Kál#na [MR13.7]
7. te'eKál#na [MR24]
8. toKál#na [MR27]
9. toxál#na [MR34]
10. toxálna [MR39]

7. La3+Lp+PF#r^{6}B+a--á+La3+PF

1. La3LpPF#ra^{6}áB+La3PF [MR3]
2. La3ePF#ra^{6}áB+La3PF [MR7]
3. hePF#ra^{6}áB+PF [MR10]
4. hemF#ra^{6}áB+uF [MR12']

8. h-+BY$_2$'+a--á+Lal

1. h-+BY$_2$'+a--í:+Lal [MR1]
2. h-+BaY$_2$í:'+Lal [MR3]
3. h-+BY$_2$í:'+Lal [MR9]
4. h-+BY$_2$í:'+ti [MR10]
5. h+BY$_2$í:'+ti [MR18]

7. (cont.)

5. hen#ra^{6}áBuF [MR13]
6. hen#ra^{6}BuF [MR28]
7. hen#ra^{6}aBuF [MR30]
8. hen#ra^{6}aBu [MR33]
9. hen#ra^{6}avu [MR34]
10. hen#ra'avu [MR42]
11. hén#ra'avú [MR45]

8. (cont.)

6. h+Bí:'+ti [MR22]
7. h+Be'eti [MR24.1]
8. h+B'eti [MR28]
9. haB'eti [MR30]
10. haBéyti [MR32.4]
11. heyBéyti [MR32.5]
12. he(y)Bé(y)ti [MR32.6]
13. he(y)vé(y)ti [MR34]

9. Y_1šB+a--á+Ft+Lc

1. Y_1šB+a--ó+Ft+Lc [MR2]
2. Y_1ašóB+Ft+Lc [MR3]
3. Y_1ašóB+Ft+l+t [MR4]
4. l+Y_1ašóB+t [MR8]
5. l+Y_1šóB+t [MR9]
6. lešéBt [MR24]
7. lašéBt [MR30]
8. lašéBet [MR32]
9. lašévet [MR34]

10. Y_1d^{6}+a--á+Ft+La_2^I

1. Y_1d^{6}+a--ó+Ft+La_2^I [MR2]
2. Y_1adó^{6}+Ft+La_2^I [MR3]
3. Y_1adó^{6}+Ft+l^I [MR5]
4. l^I+Y_1adó^{6} [MR8]
5. l^I+Ydó^{6} [MR9]
6. l^Iedé^{6} [MR24]
7. l^Ieda^{6} [MR30.1]
8. l^Iada^{6} [MR30.4]
9. da^{6} [MR33]
10. da' [MR42]
11. dá' [MR45]

11. N-+Y_1d^{6}+a--á+Ft+Lc

1. N-+Y_1d^{6}+a:--é+Ft+Lc [MR1]
2. N-+Y_1a:dó^{6}+Ft+Lc [MR3]

12. 'PY_3+a--á+Ft+Lc

1. 'aPáY_3+Ft+Lc [MR3]
2. 'aPáY_3+Ft+l+ot [MR4]
3. l+'aPáY_3+ot [MR6]

11. (cont.)

3. N-+Y_1a:dó^6+Ft+l [MR4]
4. hN+Y_1a:dó^6+Ft+l [MR6]
5. l+hN+Y_1a:dó^6 [MR8]
6. lhiNY_1a:dó^6 [MR26]
7. lhiNva:dó^6 [MR29]
8. lhiNva:dá^6 [MR30]
9. lhiva:dá^6 [MR40]
10. lhiva:da' [MR42]
11. lhivada' [MR44]
12. lhivadá' [MR45]

12. (cont.)

4. l'PáY_3ot [MR9]
5. le'ePáY_3ot [MR24]
6. le'ePot [MR25]
7. le'efot [MR34]
8. le'efót [MR45]

13. h-+sY_2B:+i--:é+La2+F

1. h-+siY_2:éB+La2+F [MR3]
2. h-+saY_2:éB+La2+F [MR9]
3. h-+saY_2:éB+t+F [MR10]
4. hstaY_2:éB:tF [MR18]
5. hsto:BéBtF [MR22]
6. histo:BéBtF [MR26]
7. histo:BáBtF [MR30]
8. histo:BáBt [MR33]
9. histo:vávt [MR34]
10. histovávt [MR44]

14. h-+N-+NY_2X+a--â+m+F

1. h-+N-+NY_2X+a--á:+m-+F [MR2]
2. h-+N-+NaY_2á:X+m-+F [MR3]
3. h-+u+NaY_2á:X+m-+F [MR6]
4. m+h-+u+NaY_2á:X+F [MR8]
5. m+h-+u+NY_2á:X+F [MR9]
6. m+h-+u+NY_2á:X+t [MR12.4]
7. muNY_2á:Xt [MR18]
8. muNá:Xt [MR22]
9. muNá:Xat [MR30]
10. munáa:Xat [MR40]
11. munáa:xat [MR41]
12. munáxat [MR44]

B.

1. mlK+á--Ø+P+F

1. málKPF	[MR3]
2. málaKPF	[MR12]
3. málaKimAF	[MR12']
4. málaKo:tA	[MR13]
5. mlaKo:tA	[MR23]
6. mlaxo:tA	[MR34]
7. mlaxó:t	[MR35]
8. mlaxót	[MR44]

2. mlK+á--Ø+P+S

1. málK+P+S	[MR3]
2. málaK+P+S	[MR12]
3. málaK+imA+S	[MR12']
4. málaKeyAS	[MR20]
5. málaKeyASA	[MR21]
6. málKeyASA	[MR23]
7. málKeyA	[MR31]
8. málxeyA	[MR34]
9. málxéy	[MR35]
10. malxéy	[MR37]

3. XBr+í--Ø+PF

1. XíBr+P+F	[MR3]
2. XíBaY$_3$r+P+F	[MR12]
3. XíBaY$_3$r+im+A+F	[MR12']
4. XíBaY$_3$r+o:tA	[MR13]
5. XíBro:tA	[MR15]
6. XeBro:tA	[MR24]
7. Xevro:tA	[MR34]
8. Xevró:t	[MR35]
9. xevró:t	[MR41]
10. xevrót	[MR44]

4. c^{6}k+a--á+F+S+La2+P+F

1. ca^{6}ák+F+S+La2+P+F	[MR3]
2. ca^{6}ák+FS+x+PF	[MR10]
3. ca^{6}ák+FS+x+mF	[MR12']
4. ca^{6}ák+atS+x+mF	[MR13.3,4]
5. ca^{6}ák+atS+xn	[MR13.5]
6. ca^{6}ák+atS+xnA	[MR21]
7. c^{6}ákatSxnA	[MR23]
c^{6}katSxnA	[MR23]
8. ci^{6}katSxnA	[MR26]
9. ca^{6}akatSxnA	[MR30]
10. ca^{6}akatxnA	[MR31]
11. ca^{6}akatxenA	[MR32.2]

4. (cont.)

12. ca^{6}akatxén [MR35]

13. ca'akatxén [MR42]

5. h-+šP^{6}+a--á+F+S+La3+P

1. h-+šP^{6}+a--a:+F+S+La3+P [MR2]
2. h-+šaPá:^{6}+F+S+La3+P [MR3]
3. h-+šPá:^{6}+F+S+La3+P [MR9]
4. h-+šPá:^{6}+F+S+h+P [MR10]
5. h-+šPá:^{6}+F+S+h+m [MR12']
6. h-+šPá:^{6}+at+S+hm [MR13.3,4]
7. h+šPá:^{6}+at+S+hm [MR18]
8. hašPá:^{6}+at+S+hm [MR19]
9. hašPá:^{6}+at+S+hmA [MR21]
10. hašPá:^{6}+at+S+hamA [MR30.6]
11. hašPá:^{6}+at+hamA [MR31]
12. haš pá:^{6}+at+hamA [MR34]
13. haš pá:^{6}at+hám [MR35]
14. haš pá:^{6}at+ám [MR36]
15. haš pa:^{6}atám [MR37]
16. haš pa:'atám [MR42]
17. haš pa'atám [MR44]

6. Y_1Y_2d+a--á+a:Y_2+P+S+La2+F

1. Y_1aY_2ád+a:Y_2+P+S+La2+F [MR3]
2. Y_1aY_2ád+a:Y_2+P+S+x+F [MR10]
3. Y_1aY_2ád+a:Y_2+m+S+x+F [MR12']
4. Y_1aY_2ád+a:Y_2+m+S+x [MR13.9]
5. Y_1aY_2ád+a:Y_2+aY_2+S+x [MR20]
6. Y_1aY_2ád+a:Y_2A+aY_2+S+x [MR21.2]
7. Y_1aY_2ád+a:Y_2A+ayiSx [MR22.2]
8. Y_1ád+aAyiSx [MR22.3]
9. yádaAyiSx [MR29]
10. yádaAyix [MR31]
11. yádáyix [MR35]
12. yadáyix [MR37]

7. sPr+í--Ø+P+S+La3+F

1. síPr+P+S+La3+F [MR3]
2. síPr+P+S+h+F [MR10]
3. síPar+P+S+h+F [MR12]
4. síPar+im+A+S+h+F [MR12']
5. síPar+im+A+S+ha [MR13.8]
6. síPar+eY$_2$+A+S+ha [MR20]
7. síPar+eA+S+ha [MR22]
8. sPar+eA+S+ha [MR23]
9. sPareAha [MR31]
10. sfareAha [MR34]
11. sfaréha [MR35]

8. ml+XnY$_3$+a--á+P+F+S+La1

1. ml+XanáY$_3$+P+F+S+La1 [MR3]
2. ml+XnáY$_3$+P+F+S+La1 [MR9]
3. ml+XnáY$_3$+P+F+S+i [MR10]
4. ml+XnáY$_3$+imA+F+S+i [MR12']
5. ml+XnáY$_3$+o:tA+S+i [MR13]
6. ml+Xn+o:tA+S+i [MR15]
7. m+Xn+o:tA+S+i [MR17]
8. m+Xn+o:taY$_2$+A+S+i [MR20]
9. m+Xn+o:tayAS [MR22]
10. miXno:tayAS [MR26]
11. maXno:tayAS [MR30]
12. maXno:tayA [MR31]
13. maXno:táy [MR35]
14. maxno:táy [MR41]
15. maxnotáy [MR44]

7. Omissions

The following classes of words are omitted from consideration in the foregoing morphological statement.

1. Words which are more efficiently constructed without vowel patterns, including loan words and certain

common nouns ("'av', "'ax", etc.). Also omitted are roots with more than three consonants (see p.22).

2. All cases of morphemic alternation, including morpheme sequence alternation (e.g., nouns which contain F only in the plural).

3. Certain purely literary and very rare forms of the verbs of the form CY_2C: (the so-called 'mediae geminatae').

4. All cases of forms which are not introduced in the syntactic section. Included here are certain common forms (e.g., "bá́yta"), as well as many rare literary forms (e.g., pronominal verb suffixes, infinitive construct forms, etc.).

Other occasional omissions and exceptions have been noted in the text, although not exhaustively or systematically.

Footnotes

1. Such considerations are in general not trivial or 'merely esthetic'. It has been recognized of philosophical systems, and it is, I think, no less true of grammatical systems, that the motives behind the demand for economy are in many ways the same as those behind the demand that there be a system at all. Cf. Goodman (1943).

2. Though not necessarily finite. Thus the resulting grammar will in general contain a recursive specification of a denumerable set of sentences.

3. Cf. Harris (1951), Appendix to 20.3. A 'grammar of lists' results from the process of discovery conceived as the process of determining the extension of the terms ('phoneme', 'morpheme', etc.) which are defined (or, at the present state, for which procedures of discovery are given) in linguistic methodology.

4. This is clearly brought out in Harris (1951), Chapter 12, and Hockett (1950).

5. For an elaboration of the point of view sketched here and its methodological consequences, see my paper "Some Comments on Simplicity and the Form of Grammars" (unpublished).

6. This formulation explicitly and arbitrarily isolates morphophonemics for special study. More generally, a com-

plete grammar in these terms could be described as a single set of 'transformation statements' generating, from the most general representation of any sentence, i.e., 'sentence', the specific representations, i.e., all grammatical phone sequences.

7. See Greenberg (1950) for a discussion of morpheme constituency.

8. Actually the ordering imposed is only partial (see p. 39ff.).

9. See Chomsky (unpub.) for a fuller statement of the problem.

10. The account of the actual form of the grammar, and the interpretation and explanation of the notation is imprecise and oversimplified, but I think adequate to provide understandability. It could be given formally, but this is premature in the absence of a more general study of notations. The notations themselves are not developed in general form, as they would have to be if presented for grammar in general, but are specifically adapted to the needs of this particular grammar.

11. Those morpheme designations which will appear in the morphology, and which are not given in morphophonemic spelling, will be underlined to distinguish them clearly from sequences of morphophonemes.

12. Common 'compound nouns' of the form N_1LCSN_1LC are often

treated as a single N_1, and the ha is prefixed to the first N_1 rather than the second, giving forms like "habetsé́fer", "haxadar'ó́xel" instead of "bet hasé́fer" ('school), "xadár ha'ó́xel" ('dining room').

13. In particular, it follows from this that the definite article ha is followed by #. This is necessary if, as seems to be the case, there is a contrast between such forms as "ha#cdaká́" ('the charity') and "hacdaká́" ('justification' If there were no contrast, it would be possible to omit the juncture (following the orthography) and take the definite article morphophonemically as haN, although this would complicate some of the statements of the grammar.
There is one point at which a real internal juncture might have to be introduced, although this is not done below. Consonant clusters seem to be all voiced or all unvoiced, e.g.

hisbir⟶ hizbir

hitnagšu⟶ hitnakšu,

etc., but before the verbal suffixes ti, ta, tem, ten, consonants seem to preserve voicing, e.g., "la'á́gti", "ganávta". If this is true then a juncture must be introduced before personal suffixes of the verb. Further investigation is necessary on this point. (I am indebted to Haim Blanc for information concerning this situation.)

14. This formulation illustrates a case in which a decision was made to simplify the morphology at the expense of the syntax. The morphology is simplified if $N_{1b} \varepsilon U^+$ or M^+, but

the syntax is simplified if $N_{1b} \epsilon M$. If this formulation were accepted, (v) could be dropped from S6, M^+ and U^+ could be dropped, and S8 could be reformulated:

S8*. Let $M^*=\{N_{\underline{n}}+LC(\underline{S}(\underline{\underline{La}}_{\underline{k}}+LC))\}$ [n=1,2]

$U^*=\{V_1+\underline{\underline{La}}_{\underline{k}}+LC, V_2\}$

Then S11* will be:

$N_1=\{N_s(M_1), M_0...etc., h-+R\begin{Bmatrix} a--\acute{a}...etc. \\ i--:\dot{e}...etc. \end{Bmatrix}, U_0...etc.\}$

Specification in the morphology of the relevant environments for a given transformation would then be more complex.

15. I.e., if there is an $LC_{\underline{i}}$ in env. $\begin{bmatrix} a:Y_2 \\ u \end{bmatrix}\_\_$, then $\underline{i} \longrightarrow \begin{bmatrix} 3 \\ 2 \text{ or } 4 \end{bmatrix}$ throughout. Thus all segments of any one long component become the same morpheme.

16. Designated 'L' because these are the forms taken by $\underline{\underline{La}}_{\underline{k}}$ in certain positions. $\underline{Lc} \longrightarrow$ 1 (see MR4).

17. It is apparently disappearing as a separate subset, partly through analogy (yašán, yošén--see MR1), partly through disuse in the distinctive forms (as verbs).

18. Many of the members of VlP_{1b} are rare, as is ú--Ø of VlP_{1a}. Patterns V--Ø are traditionally called 'segholates'.

19. This gives the purely literary form "nxunóti", etc.

20. Only sometimes, see fn. 17, above.

21. This formulation eliminates the possibility of a form "heCCeCót". Such forms may arise from an alternation heCCéC~heCCéCF, the latter occurring before plural (e.g., the Talmudic form "hekdešót"). Although I have been unable to find any such alternations for this form of stems in Modern Hebrew, they are fairly common with other stems. If morpheme alternation were considered in the grammar, then the statement of this alternation would have to follow 2, where the F occurring is the Long Component.

22. Also in env. uC_3__ in the case of the quadriliteral 'šmr, giving "'ašmurá" alongside of "'ašmóret". See p.22.

23. The parenthesized transformation, when applied, leads to the rare and apparently disappearing second and third person feminine plural "tiCCóCna", etc., in Verb Future. In addition, the following transformation sometimes holds:

$$\# \longrightarrow + \text{ in env. } \left[\#\left[{}^{N}_{G}\left[tY_1a\ldots C_3 \right] \right] \right]\_\_,\ C_3 \neq Y_3$$

giving such forms as "tikatávna", "teládna", "hodá'na", by MR30.5.

24. The forms in which F⟶ FA are related to the verb forms, generally, forms like "kabalá" being related to the Ø+i--:é form (Pi^{6}el), forms like "šmira" being related to

the Ø+a--á form (Kal).

25. Thus "šixvá", "kirvá" must be derived from šKv, krv, alternants of šKB, krB, respectively.

26. There seems to be some fluctuation in such forms even perhaps for one speaker. I cannot at present state the situation more explicitly.

27. Only sometimes in env. X__. This is a complex and perhaps fluctuating situation which requires further investigation for a complete specification, although it could be given more explicitly than this. Apparently never in M except in env. $\_\_C_3\#$.

28. Except when R=r'Y_3, which occurs in this form as "her'á", etc.

29. Exceptions to (6) are "bóhen", "'óhel", "léxem", "réxem", and forms from the root hyY_3 (e.g., "yihyé"). "mixyá", "yixyé", etc., can be derived from the root xyY_3 (x≠G).

30. As an alternative treatment, the first two lines of this could be extracted and given in a separate statement with MR27.2. MR38 could be incorporated into this statement. This would lead to certain changes in the ordering.

31. Exception: "dáysa". Other exceptions which are not included in this study for other reasons, are "láyla", "habáyta", "xaydák". See section 7.

32. This formulation is tentative. Further research is necessary to give an authoritative account of the occurrence of ey and e, but, although the situation may turn out to be more complicated, it seems to me now that operation and non-operation of (6) correspond to two dialects. (But for certain words, e.g., "bét" as in "bétsé́fer", it apparently holds universally.)

33. It might be necessary to make further mechanical adjustments in the output to provide a more adequate phonemic transcription.

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