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On Abstract Morphemes and Their Treatment
 Morris Halle
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This is a report on joint research by Sylvia Bromberger and me that has been presented since the end of 1988. An earlier report on our progress was presented at a small conference organized by Julius Moravcsik at Stanford University at the end of January 1989. Not unexpectedly in view of the relatively short time that we have been working on this topic there have been a number of fairly fundamental changes in our views in the two months that have elapsed since that conference. It is not unlikely that our views will continue to change quite radically for some time to come.

Knowledge of the words is an essential component of an individual's knowledge of his/her language. We assume that a large part of this knowledge consists of rote memory of items such as *dog*, *usurp*, *difficult*, etc. Specifically, we shall assume that when speakers memorize a word they store a set of phonetic markers, as well as information about the syntactic and semantic nature of the memorized item in a special register, which we shall call here the *vocabulary*. The words that figure in actual sentences, that in a speaker's word list; it is only these words that can be utilized by the speaker in question.

The speaker of English who does not have *dog*, or *usurp* or *difficult* in his word list will experience difficulty in processing utterances containing these words. The difficulty is usually easily remedied, for the word list is, of course, not closed: we constantly learn new words. Once a speaker has learned a new item and included it in his vocabulary, he can immediately use it, for there is no minimum time that must elapse before a word that has been acquired can be put to actual use in processing a sentence.

The words *dog*, *usurp*, *difficult* appear in the vocabulary as unanalyzed units: they have no internal structure. This, of course, is not true of all types of words: a major fraction of the words that speakers know have internal structure, like the words in (1a)

(1a) [[un]gentle] [man] | li | ness |
 A N N A A N

[ancl] [[dis]establish]] ment] arlan]] ism]
 V V N N A A N

We shall assume that when such words are memorized, their full structure is stored in memory. A plausible reason for this might be that our memory is so constituted that structure makes memorization easier.

The term *morpheme* designates the elements that are strung together to make up words. Morphemes are of two major kinds: stems and affixes. Affixes do not normally constitute words by themselves. Stems may constitute words by themselves; e.g., *gentle*, *usurp*, *difficult*, *dog*, *man*, but, as noted in Aronoff (1976) there are stems such as those in (1b), which do not function as independent words.

(1b)

-ceive	-port	-here	-mit
	im-port	in-her	
re-ceive	re-port		re-mit
		ad-her	ad-mit

Affixes usually determine the lexical category of the word that they form; i.e., a word formed with the suffix *-ion* is a noun, whereas one formed with the suffix *-ize* is a verb. Moreover, affixes are not freely combinable; thus the affixations in (1c) are not well-formed in English.

(1c)

seven-ity	*shop-ity	*proverb-ity	*machin-ity
regular-ize	scandal-ize	*usurp-ize	*develop-ize

The starred forms above are ruled out in that the affixes in question do not attach to stems of a particular lexical category; i.e., *-ity* is added to adjectives but not to nouns, or verbs, whereas *-ize* is added to adjectives and nouns, but not to verbs. We conclude from these examples that speakers know not only the words but they also know the morphemes of their language and their privileges of occurrence. We shall hypothesize that the knowledge that English speakers have of the morphemes of their language are of the form illustrated in (2).

(2) I. [[X]+ness]: gentleness, Grammaticalness, uneasiness
 N A
 II. [un+ [X]]: ungrammatical, unaware, unconscious
 A A
 III. [[X]+ity]: serenity, Grammaticality, electricity
 N A

of the stem.

iv. ---> /z.s, Iz/ depending on the final phoneme of noun.

Since we have assumed that Plural is an abstract morpheme that figures in the terminal string, the function of the rules in (5) is to spell out this abstract morpheme correctly in its different contexts. Since these are spell-out rules, they eliminate the abstract morpheme from the string and replace it by a concrete sequence of phonemes or by zero. As a result each earlier rule in (5) bleeds all later rules: for once the Plural morpheme has been spelled out, the condition for all other spell-out rules has been eliminated.

At first sight this may appear to be a rather insignificant technical detail. We see its fuller significance once we compare how English pluralization would be accounted for in a framework where abstract morphemes are never terminal symbols, but are always nonterminal features in the syntactic tree. In place of the rules (5) we would then need the set (6).

(6) In the env. N [Plural]

|
|

i. X + us ---> X + I

ii. Change the quality of the stem vowel where X = goose, mouse, foot, etc.

iii. X ---> X + en where X = child, ox, brother some of which also undergo changes in the quality of the stem vowel.

iv. X ---> X + /z.s, Iz/ depending on final phoneme of noun.

It will have been noticed that there is no counterpart of rule (5ii) in (6). There is (6ii) which accounts for stems that undergo stem Ablaut, but this affects only nouns such as those in (3iii), but not those in (3ii). Since the singular and plural are identical in these nouns there is no reason to postulate a special rule. This, however, gives rise to the following technical problem. An entry such as

N [Plural]
|
|
|
sheep

would normally be subject to rule (6-iv). Since this would generate the incorrect sheeps, a means is required to block application of (6-iv). There have been a number of proposals in the literature to deal with this problem (see Anderson (1977, 1986), which we discuss in the written form of this paper. We shall remark here only that all of them require that special machinery be added to the theory in order to deal with the problem of zero morphemes. We note that the problem arises only because of the decision not to represent abstract morphemes as entities in the terminal string. Once abstract morphemes are represented as entities in the terminal string and are rewritten by means of spell out rules as suggested above, there is no need for machinery especially designed to solve the problem posed by zero morphemes, for no problem arises in the first place.

We have yet to deal with the nouns in (3iii), where the plural is signalled not by suffixation but by a change in the phonetic composition of the stem. Assuming that the spell-out rules are just that -- i.e., narrowly restricted rules that can only replace an abstract morpheme by a sequence of zero or more phonemes -- the stem modifications will have to be dealt with by a separate set of rules, which we shall designate here as Readjustment rules.

To deal with the vowel changes in (3-iii) we shall need the rule (7).

(7) V ---> [-back] in env. ___ + Pl in goose, mouse, foot etc.

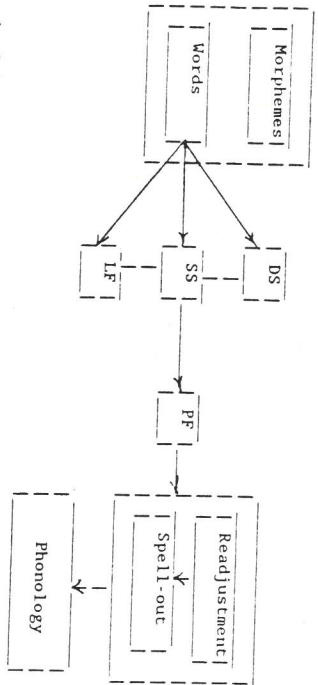
An additional rule will be needed to account for the lengthening and other changes in the stem vowel of feet.

It has often been observed that children learning English produce forms such as those in (8):

(8) feets, mices, geeses

In a framework such as the one presented here, these "mistakes" are accounted for by saying that children have learned the readjustment rule (7) but they have not learned the fact that English is also subject to rule (5-ii), which spells out Plural as zero after nouns such as goose, mouse, foot, etc. Not having this information the children can only apply the regular plural rule (5-v)

We shall illustrate in considerable detail the nature and functioning of the readjustment rules in the remaining portion of this talk. At this point we summarize the main features of the functioning of the proposed theoretical framework in the diagram (9).



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 2. Noun Plurals in Breton

A set of data that shed an interesting light on the theoretical framework developed in the preceding section is provided by the noun plurals of Breton. Our facts are taken from Stump 1989 and Desbordes 1983.

In Breton, as in many other languages, plurals of nouns are formed in a great many different ways. (See Desbordes 1983, p. 24) The most common means of plural formation is the suffixation of -ed for most animate nouns, and of -ou/-iou for the rest: (10a). A number of nouns signal their plural by means of internal stem modification (10b), but without suffixation. They resemble in this respect the English nouns in (3-11f). In this class belong also a few additional nouns which form their plurals with total stem suppletion: e.g., den - tud 'man', ki - chas 'dog'. Moreover, certain small classes of nouns signal their plural by means of other suffixes: -i, -e, -er, -len, -lel, -on, -ez, etc.: e.g., beiz-i 'wolves', bugal-e 'children'.

In addition to the simple plural many Breton nouns have also a double plural (10c). The treatment of these double plurals is the main subject of this discussion.

(10) a. merc'h - merc'h-ed 'girl'; loen - loen-ed 'beast';
preuv - preuv-ed 'worm'; ronse - ronse-ed 'horse';

tra - tra-ou 'thing'; mamm - mamm-ou 'mother'; skol - skol-iou 'school'; poan - poan-iou 'pains';
 b. louarn - lern 'fox'; gevr - gevr 'goat'; houarn - hern 'iron';
den - tud 'man', ki - chas 'dog';

c. ban - bin 'cow'; trud - trud 'standing'; maestr - maestri 'master';
blaz - blaz 'wolves'; bugal - bugal 'children';

c. lern-ed 'foxes'; gevr-ed 'goats'; hern-iou 'irons';
merc'h-ed-ou 'girls'; loen-ed-ou 'beasts'; preuv-ed-ou 'worms';
ronse-ed-ou 'horses';

We propose to deal with these facts in the following fashion. For the single plurals in (10a) and (10b) we assume that there exist spell-out rules of the form (11).

(11) Plural ---> 0 after lern, gevr, hern, tud, chas etc. I.

---> i after beiz, etc. II.

---> e after bugal, etc. III.

... <Additional irregular plural suffixes>

---> ed after [+anim] IV.

---> (1)ou V.

Rules (11-iv,v) are the spell-out rule for the plural in the unmarked case. The fact that some animate nouns use the suffix ou rather than ed is readily handled by postulating special markings of these nouns as exceptions to rule (11-iv). The choice between ou and ed is determined by considerations that are left out of account here.

As already noted, in our framework spell-out rules are sharply restricted so that they can only replace an abstract terminal morpheme or consecutive sequence of morphemes. As a result we must account for the plurals in (10b) by means of two rules: the spell-out rule (11-i), which deletes the plural morpheme from the string, if the noun stem is among those in the list appended to the rule, and a readjustment rule of vowel Ablaut, which affects noun stems in the environment ___ Plural. This rule is the Breton analog of the English rule (?) that was given above. (As we have not studied the effects of Ablaut in Breton we shall only mention this rule but not state its effects.) It appears that all nouns that undergo Ablaut are also subject to rule (10-1); i.e., have a zero plural suffix, but the converse is not the case. As illustrated in (12):

(12) alouns 'moths'; buzhug 'earthworms'; dilhad 'clothes'; frouezh 'fruits';

These nouns have no overt plural marking, yet 'behave exactly like simple plurals with respect to agreement and anaphora.' (p. 4) This fact is readily accounted for if we assume that in their lexical representation these nouns are provided with an abstract Plural morpheme which plays a role in agreement and anaphora, but is spelled out as zero by rule (11-1). In these nouns the abstract morpheme Pl thus plays the role of a derivational, rather than

1
inflectional suffix.

Preparatory to dealing with the double plurals in (10c), we note that Breton has double plurals whose base is one of the basic collectives of (12).

- (13) $\begin{matrix} \text{altous-ed} & \text{'worms'} & & \text{buzhug-ed} & \text{'earthworms'} \\ & \swarrow & & \swarrow & \\ \text{dilhaj-ou} & \text{'clothes'} & & \text{frouezh-ou} & \text{'fruits'} \end{matrix}$

Since we have assumed that these nouns are entered in the lexicon with a pl morpheme that functions like an ordinary derivational suffix, we expect that these nouns will be subject to the ordinary plural rule of the language, which will generate forms such as those in (14).

- (14) $\text{altous} + \text{pl} + \text{pl} \quad \text{dilhaj} + \text{pl} + \text{pl}$

We assume, moreover, that both nouns are marked as triggering the pl deletion rule (11-1). Moreover, since altous and buzhug are animate they will suffix -ed, whereas frouezh and dilhaj being inanimate will suffix -ou. We have shown this in the derivations in (15).

- (15) $\begin{matrix} \text{altous} + \text{pl} + \text{pl} & \text{--->} & \text{altous} + \text{pl} & \text{--->} & \text{altous} + \text{ed} \\ & & \text{11-1} & & \\ \text{dilhaj} + \text{pl} + \text{pl} & \text{--->} & \text{dilhaj} + \text{pl} & \text{--->} & \text{dilhaj} + \text{ou} \\ & & \text{11-1} & & \end{matrix}$

It is worth noting here that the derivations above are based on the assumption that the two plural morphemes are in the same cyclic constituent. If we had assumed that the plural morphemes are in separate constituents, we would have had difficulty in explaining why on the second cycle rule (11-1) does not reapply and incorrectly block the subsequent application of rule (11). We shall see below (cf. (18)) this class of nouns is special in this respect. All other nouns have nested constituent structure, with the two plural morphemes belonging to separate constituents. We shall assume that the language has a special readjustment rule deleting the internal constituent in this class of nouns.

1. The forms in (12) resemble such English nouns as parts, scissors, cattle, people, which are entered in the lexicon as part + pl, scissor + pl, cattle + pl, people + pl. We shall assume that the syntax, which functions without exception, supplies these nouns with a second pl morpheme. Since unlike Breton (see below) English does not allow double plural we postulate that in English the second pl is deleted by a readjustment rule which applies in the environment pl.

The next class to be considered are the diminutives, which are formed with the concrete suffix ig. Stump reports that "given a diminutive noun of the form N + ig, the corresponding plural form is marked in two ways: first, the productive suffix -ou . . . is added to the diminutive as a whole; in addition, N itself appears in its usual plural form." (p. 6) We illustrate this in (16).

- (16)

$\begin{matrix} \text{labous} & \text{'bird'} & \text{labous-ed} & \text{'birds'} & \text{labous-ig} & \text{'birdy'} & \text{labous-ed-ig-ou} & \text{'birdies'} \\ & & & & \swarrow & & \swarrow & \\ \text{bag} & \text{'boat'} & \text{bag-ou} & \text{'boats'} & \text{bag-ig} & \text{'small boat'} & \text{bag-ou-ig-ou} & \text{'small boats'} \end{matrix}$

These forms can readily be accounted for if we postulate the readjustment rule (17), which copies the pl morpheme and inserts it as a suffix of the noun base.²

- (17) $\text{N} \text{ --->} \text{N} + \text{Plural} / \text{---} (+ \text{ig}) + \text{Plural}$

The reason for parenthesizing (+ig) in (17) will be explained later. Rule (17) clearly cannot be a spell-out rule and must therefore be ordered among the rules of the Readjustment block. This ordering allows us to account for all relevant facts with no machinery added to that developed above as shown in (18).

- (18) $\begin{matrix} [[\text{den} + \text{ig}] + \text{pl}] & \text{--->} & [[\text{den} + \text{pl} + \text{ig}] + \text{pl}] & \text{--->} & & \\ & & \text{17} & & \text{Sp. rule} & \text{3} \\ [[\text{tud} + \text{pl} + \text{ig}] + \text{pl}] & \text{--->} & [[\text{tud} + \text{ig} + \text{pl}] + \text{pl}] & \text{--->} & [[\text{tud} + \text{ig} + \text{ou}]] & \\ & & \text{11-1} & & \text{11-1} & \\ [[\text{bag} + \text{ig}] + \text{pl}] & \text{--->} & [[\text{bag} + \text{pl} + \text{ig}] + \text{pl}] & \text{--->} & [[\text{bag} + \text{ou} + \text{ig}] + \text{pl}] & \\ & & \text{17} & & \text{11-v} & \\ [[\text{bag} + \text{ou} + \text{ig} + \text{ou}]] & & & & & \\ & & & & & \\ [[\text{labous} + \text{ig}] + \text{pl}] & \text{--->} & [[\text{labous} + \text{pl} + \text{ig}] + \text{pl}] & \text{--->} & & \\ & & \text{17} & & \text{11-iv} & \end{matrix}$

2. We have enclosed the diminutive suffix -ig in parentheses because, as we shall see directly, rule (17) applies also to other nouns than the diminutives.

3. As noted in fn. above, den 'man' forms plural by suppletion.

[[labous + ed + Ig] + Pl] ---> [labous + ed + Ig + ou] 11-v

We note that the outer plural of all diminutives is ou regardless of whether or not the diminutive is animate. This follows directly from the statement of rule (11-iv), which requires that the Pl morpheme be directly adjacent to the animate noun stem. Since in the diminutives the noun stem is separated from the outer plural morpheme by intervening morphemes, rule (11-iv) cannot apply and the words then automatically are subject to rule (11-v).

The application of rule (17) appears to be restricted to noun stems that do not carry a plural morpheme in their vocabulary representation. Thus, the basic collective *dilhad* 'clothes' yields the diminutive plural *dilhad-ig-ou* (see Stump (12)) and not *dilhah-ou-ig-ou*. With this exception double plural markings are obligatory for all diminutives. Diminutives differ thus from other double plurals, which are only optional variants of the single plural.

As already remarked in Breton many nouns freely admit double plural markings. Stump notes that "if a Breton noun has both a simple plural and a double plural, the two forms are generally felt to be semantically distinct. . . The specific nature of this semantic distinction is, however, quite variable, both from noun to noun and from dialect to dialect." (p. 10) It seems to us that this distinction between the two types of plural is typical of the ad hoc semantic distinction that speakers commonly attribute to forms in free variation. We therefore generate the underlying representations of the double plurals in (10c) by marking them as being optionally subject to the second subcase of rule (17): i.e., where the *tlg* morpheme is omitted. In this manner we generate the strings in (19) as input to the derivation of the forms for the nouns in (10c).

(19) [[merc'h + Pl] + Pl] [[loen + Pl] + Pl]
 [[louarn + Pl] + Pl] [[gavr + Pl] + Pl]

The application of Ablaut, and the spell out rules (11) will yield the correct outputs, as illustrated in (20).

(20) [[gavr + Pl] + Pl] ---> [[gevr + Pl] + Pl] ---> [[gevr + Pl] + ed]
 Abl 11-I 11-iv
 [[merc'h + Pl] + Pl] ---> [[merc'h + ed + ou] + Pl] ---> [[merc'h + ed + ou]]
 11-iv 11-v

In the derivation of *merc'h* the application of (11-iv) bleeds the reappliation of (11-iv) on any subsequent cycle. As remarked above, this follows from the formalization of (11-iv) which requires that Pl be directly adjacent to a [+animate] stem. Since in *merc'h* the morpheme *-ed* intervenes between the stem and the (second) Pl, the rule is blocked. By contrast in *gevr* the first Pl is deleted by rule (11-i) and as a result the

condition for the application of (11-iv) is created.

In the volume on Theoretical Morphology edited by Hammond and Noonan, Perlmutter discusses the double plurals of diminutives in Yiddish which are very similar to those of Breton. The Yiddish double plurals differ from those of Breton in that with single exceptions, they are formed only by diminutives with stems belonging to the lexical sub-class of Semitic nouns which signal their plural not by the general plural rule of Yiddish (the analog of the rules (11-iv,v), but rather by a special rule of their own (the analog of one of the rules (11-i-11j)). According to Perlmutter, this restriction is an automatic consequence of the fact that in his theoretical framework the general plural rule is extra-lexical, whereas all special plurals must be listed in the lexicon. Given his framework there is no way in which double plurals can be formed with stems that have regular plurals. But this consequence is not borne out by the Breton facts that we have just reviewed. Since the consequence is a feature of the theoretical framework, it must hold not only for Yiddish but also for Breton. The fact that Breton freely admits double plurals of diminutives whose stem is subject to the general plural rule of the language thus constitutes a counter-example to the theoretical framework adopted by Perlmutter.

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3. More on Readjustment Rules
 3.1 Subject and Object Affixes in Georgian Verbs.

The Georgian verbal inflection discussed in many of the papers by Anderson involves affixes that signal the person and number of the object and/or the subject. Georgian verbs signal by means of affixation both subject and object agreement. The major facts to be accounted for in the case of a transitive verb are given in (21).

(21)	Subject	Object
1. + sg.	(v-)	m-
2. + sg.	zero	g-
3. + sg.	-s, -a	zero
1. + pl.	(v-) . . . -t	gv-
2. + pl.	-t	g- . . . (-t)
3. + pl.	-en	zero

Examination of (21) shows that in their majority the subject morphemes are suffixes whereas the object morphemes are prefixes. The exceptions are 1. pl. subj. and 2. pl. obj. which appear to take "circumfixes", and 1. sg. subj. which is a prefix, rather than a suffix. Since spell-out rules can

discussion here is framed in terms of the metrical theory of Halle and Vergnaud 1987, which differs from their framework in a number of important respects, most importantly with respect to the "mora" entity introduced by McCarthy and Prince. At the end of sec. 3.4 a brief argument in support of our procedure is given.

To calculate the location of the foot boundaries we postulate the rules (27).

(27) a. Syllabify the word.

- b. All and only time heads are metrical -- i.e., projected on line 0 of the metrical grid.
- c. Place right foot boundaries at the end of heavy syllables.
- d. Construct binary feet from left to right.

Since the construction of metrical constituents by rule must respect previously assigned structure, these rules yield the foot structures shown in (28), where square brackets indicate a foot boundary assigned by the special rule, and regular parentheses indicate the boundaries of feet constructed by the rules of foot construction.

(28) Line 0 (*)(*)(*) (*)(***) (**)(***) (**)(*) (**)(***)
 baskarna dangpana ana laka karasmak walahdana

It is obvious that the Construct State morpheme is inserted after the first foot, as illustrated in (29), where the boundary of the first foot is symbolized by a dash.

(29) bas-karna dang-pana ana-laka walah-dana
 | | | |
 V V V V
 bas-CS-karna dang-CS-pana ana-CS-laka walah-CS-dana

4. Metrical theory as developed to this time has countenanced the introduction of stresses by rule or by idiosyncratic marking in the underlying representation, but has not done the same with regard to boundaries of metrical constituents. In Halle 1989 it has been argued that there is need for parallel treatment of constituent boundaries; i.e., for boundaries introduced by special rule or marked in underlying representations. Our treatment makes use of this new device. For additional in support of this practice see end of sec. 3.4.

The correct output is then readily produced by the spell-out rule which replaces CS by /Ka/.

We see thus that the Construct State form is generated by a fairly complex modification of the stem. Though complex the modification employs devices that are amply attested in other parts of the morphology. The Uluwa facts are in essential respects similar to the 'broken plurals' of Arabic, see McCarthy and Prince 1989, which we examine next.

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3.3 The broken plurals of Arabic

The examples in (30), which we have copied from McCarthy and Prince 1989 illustrate the main principles of the formation of broken plurals in Arabic, which are summarized in (31). Except for a number of details our treatment is identical with that of McCarthy and Prince 1989.

(30)

	<i>Singular</i>	<i>Plural</i>	
a. CVCC	nafa	nufuu	'soul'
	qadh	qadaH	'arrow'
	Huba	/HuKaam/	'judgment' [ʔaikaam]
b. CVCCVC	ʔasad	ʔusuu	'lion'
	raʔul	raʔaal	'man'
	ʔinab	/ʔanaab/	'grape' [ʔaʔnaab]
c. CVCCVCʔac	saħaabʔac	saħaaʔib	'cloud'
	ʔazilʔac	ʔazaʔiʔ	'island'
	karilmaʔac	karaaʔim	'noble'
	Halubʔac	Halaaʔib	'milk-camel'
d. CVCCVCʔʔac	faaħyʔac	faawaħih	'fruit'
	ʔaanlaʔac	ʔawaanils	'cheerful'
e. CVCCVC(V)C	xaacan	xawaaciim	'signet-ring'
	ʔaanuus	ʔawaanils	'buffalo'
f. CVCCVC(V)C	ʔundub	ʔanaadib	'locust'
	suʔtaan	saʔaaʔiin	'sultan'

(31)

- a. In nouns formed with the suffix -at delete the suffix.
- b. Syllabify the noun stem, disregarding the last consonant.
- c. Both syllable heads and the following time element (if any) are metrical -- i.e., projected on line 0 of the metrical grid.
- d. Construct right-headed binary feet from left to right.
- e. Factor the word into the Base consisting of the initial foot and the Residue including unsyllabified consonant.
- f. Impose the syllable structure CVCV on the Base and reassociate the consonants of the first foot to the new syllable structure from left to right.
- g. Leave unchanged the syllable structure of the Residue as well as the links of its consonants. In nouns of pattern (30c), where hiatus is generated by the procedure above, the hiatus is eliminated by inserting an Onset slot before the Residue.
- h. Replace the vowel(s) of the Base by /a/ /u/ in certain cases) and that of the Residue by /i/, provided that the Residue is syllabic.
- i. Assign /w/ to any timing slots that the procedure above leaves without link to a melody segment.
- j. (Levy's rule) #CaCV . . . --> #?aCCV . . .
- k. (Brame's rule) /jazawit/ --> /jazaa?it/ (p. 58)

The Broken Plural rules given above are part of the Readjustment component. The spell out rule for the nouns subject to the broken plural rules is Pl --> 0. With a handful of exceptions these nouns include the basic noun stock of Arabic, which McCarthy and Prince designate by the term "canonical." The language places strong restrictions on the base (singular) form of canonical nouns. McCarthy and Prince write: "Noun stems, like all bases, are minimally bimoraic. . . . No noun stem contains more than two syllables, and every disyllabic noun stem must begin and end in exactly one consonant (peripheral vowels and consonant clusters are prohibited except in monosyllabic nouns, which require CVCC)." (p.86). Almost all and only nouns conforming to this canonical structure are subject to the Broken Plural rules.

Noun stems that deviate from these requirements are called "noncanonical" by McCarthy and Prince, who describe the salient characteristics of these nouns

5. MP (p. 55): Singulars with a medial geminate are created as though they were a sequence of two consonants.

as follows: ". . . they are themselves never created by any root-based templatic morphology. . . . Second, they do not normally contribute their roots to further derivational processes -- for instance, denominal verbs are almost never created from noncanonical nouns. Third, they are always loanwords, and in fact many can be identified synchronically as loans independently of syllabic noncanonicity because they violate the native restrictions on consonant and vowel and cooccurrence. Fourth, with rare exceptions noncanonical loans do not participate in broken plural or diminutive morphology." (p. 86) In their majority the noncanonical nouns form their plurals by suffixing /uun/ if they are masculine, and /aat/ if they are feminine. The spell out rules for the Arabic plural are therefore those in (32).

(32) Pl --> 0 if noun stem is canonical

--> /uun/ / [mascl] ---
 ---> /aat/ / [fem] ---

Attention should be paid to the different manner in which the base (-first foot) is calculated in Arabic and in Ulwa. In Ulwa the metrical relevant units (represented as asterisks on line 0 of the grid) were time heads, whereas in Arabic all time slots are metrically relevant. Moreover, in Ulwa a special rule marks boundaries of closed syllables as right foot boundaries, whereas in calculating the base in Arabic all metrical structure is assigned by the rule constructing binary feet from left to right. As a result in Arabic a foot boundary can occur syllable medially. (An example of a syllable medial foot boundary is provided by the nouns (30c)). On the other hand, in Ulwa all foot boundaries coincide with syllable boundaries. Ulwa construct state forms such as walah-ka-dana, karas-ka-mak show that closed syllables cannot be analyzed as having two metrically relevant positions (moras) because if there were two moras in the second syllable, the boundary of the Base foot would fall in the middle of the second syllable, not at its end.

>>This is file b:tuca5.1ec on diskette Morris Lectures Spring 1988.<<

3.4 Definite Adjective Inflection in Latvian

The Latvian nominal declension is illustrated in (33).

(33)a.		Maculine	II	III
nom. sg.	I	zīrg-s 'horse'	gullb-i-s 'swan'	clīrg-u-s 'market'
gen.		zīrg-a	gullb-j-a	clīrg-u-s
dat.		zīrg-a-m	gullb-i-m	clīrg-um
acc.		zīrg-u	gullb-i	clīrg-u
loc.		zīrg-a:	gullb-i:	clīrg-u:

nom. pl.	zīrg-i	gubl-j-i	tīrg-i
gen.	zīrg-u	gubl-j-u	tīrg-u
dat.	zīrg-īe-m	gubl-j-īe-m	tīrg-īem
acc.	zīrg-u-s	gubl-j-u-s	tīrg-u-s
loc.	zīrg-uo-s	gubl-j-uo-s	tīrg-uo-s

Feminine

	I	II	IV
nom. sg.	ma:s-a 'sister'	guov-s 'cow'	zem-e 'earth'
gen.	ma:s-a-s	guov-s	zem-e-s
dat.	ma:s-a-j	guov-i-j	zem-e-j
acc.	ma:s-u	guov-i	zem-i
loc.	ma:s-a:	guov-i:	zem-e:
nom. pl.	ma:s-a-s	guov-i-s	zem-e-s
gen.	ma:s-u	guov-j-u	zem-j-u
dat.	ma:s-a:-m	guov-i:-m	zem-e:-m
acc.	ma:s-a-s	guov-i-s	zem-e-s
loc.	ma:s-a:-s	guov-i:-s	zem-e:-s

It is obvious from an examination of (33) that the Latvian noun forms are composed of a stem which is followed by a class marker vowel. The class marker in turn is followed by a case ending. In order to obtain the correct forms in (33) we need the rules in (34).

(34)

a. Readjustment rules:

- N --> N + a / [class I] ___
- > N + i / [class II] ___
- > N + u / [class III] ___
- > N + e / [class IV] ___
- nom --> gen / [fem] + i + ___ + sg

- gen --> nom / [masc] + u + ___ + sg
- V --> V: / ___ + loc. sg., dat. pl. fem, loc. pl. fem.
- V --> [+high] / ___ + acc. sg.
- /a/ --> 0 / [masc] + ___ + nom. sg.
- /i/ --> 0 / [fem] + ___ + gen. sg.

b. Spell Out Rules

- nom. sg. --> s / [masc] + ___ nom. sg. --> 0 / [fem] + ___
- gen. sg. --> a / [masc] + ___ gen. sg. --> s / [fem] + ___
- dat. sg. --> m / [masc] + ___ dat. sg. --> j / [fem] + ___
- acc. sg. --> 0
- loc. sg. --> 0
- nom. pl. --> i / [masc] + ___ nom. pl. --> s / [fem] + ___
- gen. pl. --> u
- dat. pl. --> īe + m / [masc] + ___ dat. pl. --> m / [fem] + ___
- acc. pl. --> u + s / [masc] + ___ acc. pl. --> s / [fem] + ___
- loc. sg. --> uo + s / [masc] + ___ loc. sg. --> s / [fem] + ___

Given the rules in (34) most of the forms in (33) are readily generated. An exception is constituted by the forms that contain Vowel + Vowel sequences generated by the above rules. To account for these forms it is necessary to postulate that the phonology includes in its cyclic stratum the rules given in (36).

(36) [-back] --> /j/

V --> 0 In the env. ___ + V

We have given in (37) the paradigms of the Latvian adjective declension. The paradigm on the left represents the indefinite adjective, that on the definite adjective.

(37)

	Indefinite		Definite	
	Masc.	Fem.	Masc.	Fem.
nom. sg.	lab-s 'good'	lab-a	lab-a]-s	lab-a:
gen.	lab-a	lab-a-s	lab-a:	lab-a:-s
dat.	lab-a-m	lab-a]-j	lab-a]-a-m	lab-a]-a]-j
acc.	lab-u	lab-u	lab-uo	lab-u
loc.	lab-a:	lab-a:	lab-a]-a:	lab-a]-a:
nom. pl.	lab-i	lab-a-s	lab-ie	lab-a:-s
gen.	lab-u	lab-u	lab-uo	lab-uo
dat.	lab-iem	lab-a:-m	lab-a]-ie-m	lab-a]-a:-m
acc.	lab-u-s	lab-a-s	lab-uo-s	lab-a:-s
loc.	lab-uo-s	lab-a:-s	lab-a]-uo-s	lab-a]-a:-s

The indefinite adjectives are declined exactly like class I nouns, i.e., like /a/ stems. The definite adjectives are a bit more complex. It is clear that in the loc. and dat. sg. and in the nom. sg. masc. the definite adjective is marked by the insertion of the string /a]/. Such forms as the gen. sg. fem. suggest that in these cases definiteness is marked by the insertion of /a/, as illustrated in (38).

(38) [[lab+a]+s] (indef.) [[lab+a+a]+s] (def.)

We shall assume that definiteness is marked on an adjective stem by means of a special rule which is part of the syntax that deals with adjective-noun concord. In addition the readjustment component contains the rule (39).

(39) X --> X + /a]/ in env. [Adj, +def] loc. sg., dat. sg. etc.
 /a/ in env. [Adj, +def] elsewhere

The problem that we have to resolve at once is how to prevent vowel deletion by rule (36) from taking place in these cases. We would obtain this result if we assumed that (36) is a cyclic rule and therefore subject to strict cyclicity. This fact would prevent (36) from applying to a string such as (40a) but not (40 b).

(40) a. [[lab + a +a] + s] (e.g. f.d.) b. [[lab + a] + u + s] (a.pl.m.indef.)

In addition it is necessary to postulate a phonological rule which merges identical vowels into a single long vowel. In the view of the preceding the acc. sg. and the nom. pl. forms would have the underlying strings in (41).

(41) [lab + a + a + u] [[lab + a + a] + i] [[lab + a + a] + s]

It is readily seen that the rules postulated to this point would leave the acc. sg. unaffected, they would produce the string lab + a + a + i from the second underlying representation, and lab + a + a + s in the third example. The required surface output is produced if we assume that in addition to the lengthening rule the noncyclic rule block also includes a rule of metathesis.

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6. It might be noted that the account presented above has at various stages involved sequences of identical vowels and that these sequences were crucially not subject to OCP. These facts must evidently not be lost sight of in any discussion of the OCP.