Distributed Morphology: Impoverishment and Fission[*]

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1   Introductory Remarks on Distributed Morphology

Morphology is concerned with the elements that compose words and with the organization of these elements into hierarchical constituents of different kinds. In syntactic discussions we often speak as though words were the elements that make up the terminal strings, which are operated on by the syntax. It is hardly needs saying that this is at best a crude approximation. It is well known, for example, that the Tense morpheme of verbs and the Number and Case morphemes of nouns have the status of independent syntactic entities that require separate nodes in the terminal string, yet none of these morphemes is a word. And a central purpose of morphology is to account for the vastly different ways in which different languages package these universal morphological entities into words.

As an example consider the finite verb forms of English in (1). The verb forms are composed of a stem and a suffix. A simple illustration of their bipartite character is given by the sentences in (2), where the tense morpheme appears at some distance from the verb stem.

(1)   Mary play-s there   Mary play-ed there
(2)   Di-d Mary play there?   Mary doe-s not play there

The suffix /d/ represents the Past tense, whereas the suffix /z/ represents not only the Present tense, but also the fact that the subject of the verb is 3Person and Singular. A more explicit representation of the verbs in (1) is given in (3), where the angled brackets enclose the grammatical—i.e., non-phonetic—information conveyed by the stem and the suffixes, and the phonetic information appears between slashes.

(3)

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            V                              V
          /   \                          /   \
         V     Tense                    V     Tense
         |     |                        |     |
   /pley/ <+Vb>] + [/d/ <PAST>]   [/pley/ <+Vb>] + [/z/ <PRES,3P,SG>]
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The terminal nodes in the syntactic trees in (3) are thus composed of two parts: a string of phonemes and a complex of grammatical features. I shall refer to terminal elements of syntactic trees as *morphemes*, and I shall use the term *phonological* or *phonetic exponent* to designate the phoneme sequence in a morpheme. Since morphemes are the terminal elements of syntactic trees, there are morphemes at every level of representation of a sentence. However, as will be seen below, not every morpheme need have a phonologic exponent.

It is well known that the relationship between the grammatical features of a morpheme and its phonological exponent is many-to-many. That is, a given complex of grammatical features can have several phonological exponents, and a given phonological string can serve as exponent for several distinct grammatical feature complexes. For example, the phonological exponent of the English Past tense is /t/ in *plan-ed, decid-ed* but /t/ in *bough-t, lef-t*. On the other hand, the suffix /z/ is the phonological exponent of the complex of the grammatical features [3P Sg Present] after verbs, but of [Pl] after nouns. Adding further complexity to this relationship is the fact that phonetic NULL can function as the exponent of certain morphemes (e.g., in English NULL is the exponent of Present tense morphemes other than the Sg, as well as of the Past Participle and finite Past tense morphemes for such verbs as *hit, put, write*.

This manifestation of what has been termed *l'arbitraire du signe* has been the source of innumerable problems for designers of mechanical analyzers of speech as well as for linguists. Though a major difficulty for engineers and speech scientists, the arbitrary relation between the exponent of a morpheme and its referent is apparent of little concern to speakers, for examples of this relation are readily found in every language.

The two parts of the morpheme—i.e., the phonological exponent and the set of grammatical and semantic features—play a radically different role in the syntax than they do in the phonology. The syntax is concerned only with the grammatical properties of the morphemes and the phonetic exponents are effectively invisible to the syntax. As far as syntax is concerned it makes no difference whether the phonetic exponent of the Perfect Participle is /t/ or of or NULL. Unlike the syntax, the phonology is not exclusionist in the phonology both phonetic and grammatical features are of concern. The link between these

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NULL is also the phonological marker for the singular of English nouns, and also for the plural of such nouns as *deer, fish, moose* as well as *geese, mice*.

In Nimboran, a New Guinea language discussed by Inkelas (1993) and Anceaux (1965), a whole series of verbs have a phonetically NULL stem: *be, become, bring, dream, extend, go, hear, kiss, laugh, make a cat's cradle, say, sleep*. These stems "are disambiguated by the different particles for which each zero root selects: the zero root particle pair <6> -tir-> 'brings' occurs only when the action of the verb is directional, while the pair <6> -tir-> 'make cat's cradle' occurs only when the action is non-directional. These semantic restrictions are of exactly the same type that characterize overt roots." (Inkelas 1993, 610-611)

two parts of a grammar—the syntax, on the one hand, and the phonology, on the other—is supplied by the morphology in a manner to be sketched below.

The English examples reviewed above have illustrated aspects of Subject-Verb agreement. Languages differ in the manner in which they implement Subject-Verb agreement. Thus, in English the so-called phi-features of the subject are fused into a single morpheme with the Tense features, but as illustrated in (4), both German and Russian keep Tense separate from phi-features.

(4) a.   Agr-   te-   st   Agr-   NULL-   st
           | | | | | |
          say'   Past   2Sg   say'   Pres   2Sg

     b.   ...   .
           | | | | | |
         carry' Past   SgF   carry'   Pres   2Pl

It is assumed here that all phi-features of the subject NP—i.e., Person, Gender, Number, Animacy—are copied onto a special AGR node that is a sister of the Tense node. In Russian and German the Tense and AGR nodes remain distinct and are supplied with phonetic exponents in a manner to be described below. In English, a special rule of the morphology called Fusion combines these two sets of features into a single morpheme; as a result there is only one morpheme into which the English Tense-AGR suffixes may be inserted.

As shown in (4), Russian and German differ with regard to the grammatical features that are signalled by the AGR morpheme. In German the exponent of the AGR morpheme is selected in both tenses by the Person and Number features of the Subject. In Russian, by contrast, the Person and Number features select the AGR exponent only in the Present tense, whereas in the Past tense the AGR exponent represents Gender or Plural.

In Distributed Morphology (Halle and Marantz 1993, 1994), the phonetic exponents of the different morphemes are listed in the Vocabulary. As illustrated in (5) and (6), each Vocabulary item pairs a phonological exponent with information about the grammatical features of the morpheme in which the exponent is inserted. The Vocabulary items constitute an essential part of speakers' knowledge of their language; this is knowledge that speakers must memorize item by item.

It was stated above that the phi-features of the Subject are copied onto the AGR node. This seems to be so in all languages with Subject-Verb agreement and holds in particular for the three languages mentioned above: English, Russian and German. Thus, in all three languages information about Person, Gender, and Number of the Subject is copied onto the AGR node. It is, however, obvious that not all of this information is required for selecting the correct phonetic exponent; specifically, as already noted, in the Russian Present tense forms we need information about Number and Person of the Subject, but not

about its Gender, whereas in Past tense forms we need information about Number and Gender, but not about Person. This fact is reflected in the form of the Russian Vocabulary entries: those of the Past tense, shown in (5), contain no information about the Person of the subject, whereas those of the Present tense, shown in (6), contain no information about the Gender of the subject.

(5) /i/ ↔ [, +Pl]
    /a/ ↔ [+Fem]
    /o/ ↔ [+Neut]
    /Ø/ ↔ [   ]   in env [-Pres] + ___

(6) /m(Ø)/ ↔ [-1, +Pl]
    /te/ ↔ [2, -Pl]
    /u/ ↔ [1]
    /SØ/ ↔ [2]   in env [+Pres] + ___
    /tØ/ ↔ [   ]

The items in (5) and (6) are underspecified: none contains all the information that has been copied onto the AGR node. There would, of course, be little point in providing all this information here because the function of lists such as (5) and (6) is to insert the correct phonological exponent in each AGR node, and for insertion to take place only a subset of the features in the terminal node must be matched by the Vocabulary item. More formally, insertion of phonological exponents into morphemes is governed by the Subset Principle (7).

(7)   The phonological exponent of a Vocabulary item is inserted into a morpheme in the terminal string if the item matches all or a subset of the grammatical features specified in the terminal morpheme. Insertion does not take place if the Vocabulary item contains features not present in the morpheme. Where several Vocabulary items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme must be chosen.

The Subset Principle (7) determines, in part, the order of precedence among Vocabulary items that, like the items in (5) and (6), compete for insertion into a given morpheme. Items that match more features take precedence over items that match fewer features. It is for this reason that the Vocabulary items in (5), (6), (8) and elsewhere are listed in the order of decreasing number of features that the items must match.

2.   Impoverishment

Not only affixes but also stems may have multiple exponents. A simple example is the English copular verb be, which has a large number of alternants selected by different Tense-AGR morphemes. In (8) I have given a list of the

environments for the different alternants of be, omitting for the moment the 2PersSg forms.

(8)
am	↔	___ +[+Auth, -Pl, +Pres, +Finite]	1Sg, Pres
is <z>	↔	___ +[-Pl, +Pres, +Finite]	3Sg, Pres
was	↔	___ +[-Pl, +Finite]	1/3Sg, Past
are	↔	___ +[+Pres, +Finite]	Pres elsewhere
were	↔	___ +[+Finite]	Past elsewhere
be	↔	___ <elsewhere>	

In (8) and in the examples below the information about the different grammatical categories is represented by means of binary features. The decision to represent nonphonetic information in morphemes as complexes of binary features is not merely a notational convention. Much of what follows crucially depends on this decision, and to the extent that the analyses below reflect the facts correctly, they also provide support for this decision. While the features for Tense and Number are self-explanatory, the features for Person are not, and a specific proposal is given in (9).

(9)
	1	2	3
Participant in Speech Event	+	+	-
Author of Speech Event	+	-	.

Since this is, of course, not the only way in which grammatical Person might be represented, the proposed features in (9) must be supported with empirical data. One bit of such evidence is the gap in the paradigm (9). Given the features in (9) we expect a 4th Person with the features [-PSE, +A]. There are in fact languages with such a 4th Person. An example is Walbiri as described in Hale 1973 and discussed in section 6 below. In addition to the normal three persons, Walbiri also has a 4th Person, whose referent is "I and someone else, but not you." The 4th Person differs from the other three Persons in that it has no Singular. This follows naturally from the fact that the feature composition [-PSE, +A], which has been assigned to the 4th Person, is one which no single individual can satisfy.

A remark must be made about the number of items that appear in the list (8). Note, in particular, that we have a single entry are for the present tense plural and a single entry were for the past tense plural. There would be no obvious consequences for the empirical coverage of the data if we replaced each of these two entries with the three entries in (10).

The exponent of the 3Sg Present tense includes z enclosed in angled brackets. The notation reflects the fact that in the copular verb is, /t/ is the same 3Pers Present tense exponent as in plays, buys, etc. I owe this observation to Carson Schütze.

In the Person system of some languages, e.g. Mam (see Noyer 1992), [±Addressee] figures in place of [±PSE].

(10) a. are   ↔   [+A, -PSE, +Pl, +Pres, +Fin] + —
         are   ↔   [+A, -PSE, -Pl, -Pres, +Fin]
         are   ↔   [-PSE, +Pl, +Pres, +Fin]

     b. were ↔   [+A, +PSE, +Pl, +Fin] + —
         were ↔   [+A, -PSE, -Pl, +Fin]
         were ↔   [-PSE, +Pl, +Fin]

Although full empirical coverage is not affected, this replacement is unacceptable because what we are trying to characterize is the knowledge that speakers have of the words of their language; and this knowledge is not correctly expressed by means of an exhaustive list of all the words of the language.

An example of this is the fact that children learning English produce sequences of morphemes that they have never encountered previously, e.g., *mouses* or *oxes*. To account for this fact we must assume that the children analyze Plural forms of nouns into stem + Plural morpheme. We explain the incorrect forms by positing that at the stage of acquisition where the mistakes occur the children have still to learn the fact that in addition to /z/, English nouns take as the Plural exponent also /n/, e.g., *ox - en*, and NULL, e.g., *mice* + NULL, *more* + NULL.

There is thus evidence to show that learners do not learn the Plural forms of a noun by adding a new item to the Vocabulary, but instead analyze the new form they encounter into stem - Pl. We shall assume that learners choose analysis over adding new Vocabulary items because the learning process is subject to the constraint (11).

(11) The number of features mentioned in the Vocabulary must be minimized.

Such an economy constraint is entirely plausible, because the Vocabulary entries represent items that speakers must memorize, and since our memories are finite, the load on memory must be minimized. An immediate consequence of (11) is to rule out the multiple entries in (10) in favor of the single entries appearing in (8).

Returning to the suppletive forms of the verb *be*, I have illustrated in (12) how Vocabulary items in (8) are inserted into morphemes.

(12) a. [Cop, +Vb] + [+PSE, -Auth, -Pl, -Pres, +Finite]   *2SgPres*
                         ↓
                        am
         ___ + [+Auth, -Pl, +Pres, +Finite]

     b. [Cop, +Vb] + [+PSE, -Auth, -Pl, -Pres, +Finite] ↔   *1PlPast*
                         ↓
         ___ [+Finite]
                        were

     c. [Cop, +Vb] + [+PSE, -Auth, -Pl, -Pres, +Finite]   *2SgPast*
                         ↓
                        *was
               *<z>
         ___ + [-Pl, +Pres, +Finite]

     d. [Cop, +Vb] + [+PSE, -Auth, -Pl, +Pres, +Finite]   *2SgPres*
         ___ + [-Pl, +Pres, +Finite]

In each of the four examples the item inserted is the earliest in (8) satisfying the subset condition (7). This yields the correct output in the (12a,b), but not in (12c,d). These failures of our procedure could be remedied by adding entries to the Vocabulary. In light of the economy constraint (11), however, this would be a questionable move at best. Moreover, it would fail to capture the fact that in both cases the correct outputs are just not any exponent, but rather the default exponents, i.e., the least marked exponents in the list.

This expansion of the domain of the unmarked exponent was first explored by Bonet (1991) in her discussion of clitic distribution in Catalan. Bonet argued that in view of the subset condition (7) the proper means of expressing the extension of the domain of a default exponent is a special rule of Impoverishment which deletes a feature in the terminal morpheme. In case of the English copular verb under discussion here the Impoverishment rule required is (13), which deletes the feature [-Pl] in 2Pers morphemes.

(13) [-Pl] → 0 in env [___ -PSE, -Author]

Apart from resulting in a formal simplification in the Vocabulary, the Impoverishment rule (13) also expresses a true generalization about English; i.e., that English lacks an exponent for the 2Person Sg.

Crucial to the accounts above was the assumption that Vocabulary items are inserted into the morphemes of a sentence only after the rules of the morphology have had an opportunity to modify in various ways the feature complexes appearing in the morphemes. This procedure has been termed *late insertion* in the literature, and in what follows I illustrate additional aspects of this procedure.

4   Fission

In addition to Impoverishment and Fusion, the morphology also employs the important device of Fission, discovered by Rolf Noyer (1992). In the examples discussed to this point, Vocabulary Insertion came to an end as soon as the first Vocabulary item that satisfied the Subset Condition (7) was inserted into the morpheme. Noyer noticed that this procedure did not produce the correct results in all cases. In a number of examples from the Afro-Asiatic languages and in some Australian languages (e.g., Nunggubuyu), Noyer discovered that the process did not come to an end with the insertion of an exponent into a

morpheme: instead an additional terminal morpheme was inserted the exponent of a less marked Vocabulary item from the same list. Noyer called this special insertion procedure *Fission*, and this term is used here.[3]

It is assumed here that certain morphemes are marked as being subject to Fission. At this time no principle determining this marking is known, and the marking is therefore purely stipulative: *if and when* such a principle is discovered it will, of course, be incorporated into the formal account.

For morphemes marked to undergo Fission, the initial step of the insertion procedure is identical with that sketched above, but this is not the end of the procedure. Simultaneously with insertion of the phonological exponent, a subsidiary terminal morpheme is generated into which are copied the features—if any such remain—that have not been required for (matched in the first step. This subsidiary morpheme is then itself subject to Vocabulary insertion in the usual manner. Like Impoverishment, Fission extends the domain of less marked exponents, for the subsidiary morpheme contains fewer features than the original morpheme.

As illustrated in the examples below, insertion may or may not stop after a single iteration. I believe that the choice between these two options is determined by whether or not among the items competing for insertion in the original morpheme there is an absolute default item, i.e., one that is inserted without having to match any features in the terminal morpheme. If there is such an item, insertion stops after a single iteration; if not, iteration continues until the features copied into the subsidiary morpheme match no Vocabulary item.

4   The Latin Declension[4]

A simple example of Fission is provided by PIG and PID/Abl forms of the Latin noun declension, to which we now turn.

The Latin noun normally has the tripartite structure in (14).

(14)   [Stem—Theme]—<Number-Case>]
         | | |
         di   e   m
                        'day' 'SgAcc'

Each noun stem belongs to one of the five traditional declension classes of the language. Class membership determines the vowel inserted into the Theme slot, as shown by the entries in (15).

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[3] The treatment of Fission below differs in some respects from that offered by Noyer and makes use of ideas suggested to me by Alec Marantz and Benjamin Bruening.

[4] For more details on the Latin declension, see Halle and Vaux 1997.

(15)   /a/ ↔ [ ] in env. [I] + __
        /o/ ↔ [ ] in env. [II] + __
        /i/ ↔ [ ] in env. [III] + __
        /u/ ↔ [ ] in env. [IV] + __
        /e/ ↔ [ ] in env. [V] + __

The forms of the Fifth declension noun *dies* 'day' are shown in (16).

(16)

	Singular	Plural
N	di-e-s	di-e-s
Acc	di-e-m	di-e-s
G	di-e-i	di-e-r-um
D	di-e-i	di-e-bu-s
Abl	di-e	di-e-bu-s

It is to be noticed that the /s/ suffix figures in both the Singular and the Plural and its distribution is highly irregular. Since, short of making lists (cf. (10) above), there is no way of stating the environments in which the /s/ suffix figures, we (and the learners of Latin) are led to assume that /s/ must be the default suffix. By contrast, the suffix /um/ figures only in the PIG. As shown directly below, /um/ is the exponent of the PIG in all declensions, and in the I, II, V declensions it triggers in addition insertion of /r/, a fact to which we return below.

I urb-i-um 'cities'   III fruct-u-um 'fruits'   V di-e-r-um 'days'

I port-a-r-um 'gates'   II hort-o-r-um 'gardens'

As shown in (16) in the Singular, we find /m/ in the SgAcc, /i:/ in the SgD/G, and NULL in the SgAbl. These simple observations suggest the Vocabulary entries in (18), where the Cases are complexes of the features in (17).[5]

(17)

	N	Acc	G	D	Abl
Oblique	-	-	+	+	+
Structural	+	+	+	-	-
Superior	-	+	+	+	-

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[5] Because of our limited familiarity with the facts, it is at present not possible to motivate properly the case features in (17), and these must be regarded as provisional. [-oblique] is assigned to nominals that are arguments of the verb; [+oblique] is assigned to non-argument nominals. [-superior] is assigned to arguments of the verb; [+superior] is assigned to nominals in governed positions in the syntactic structure; [+structural] is assigned to nominals in non-governed positions. [-structural] is assigned to nominals on non-structural, semantic grounds; [+structural] is assigned to nominals solely on the basis of their position in syntactic structure.

(18) /um/ ↔ [+Obl, +Struct, -Sup, +Pl] PlG
/i/ ↔ [+Obl, +Struct, -Pl] SgG/D
/n/ ↔ [-Obl, -Pl] SgAc
NULL ↔ [-Pl] Sg default
/s/ ↔ [ ] default

As noted above, the /s/ suffix appears in the Plural in a variety of Cases that lack a common denominator. This is reflected in (18), where /s/ is the default exponent and as a result is inserted without having to match even a single feature. The /s/ is the phonological exponent also of various Singular forms: e.g., SgN *horti-s* 'garden' *urb-s* 'city' *fruct-u-s* 'fruit' and SgG *urb-i-s*, *fruct-u-s*. We have here another instance of the extension of the domain of the default exponent, noted above in the discussion of the extension of the allomorphs of the English copular verb (8). As in that case, we capture the extension of the domain of the unmarked exponent by positing the Impoverishment rule (19a), which deletes the feature [-Pl] from Nom morphemes of non-neuter nouns. The morpheme so impoverished can host only the default suffix, since all other entries in (18) are specified for [+Pl] or [-Pl]. This is illustrated in (19b).

(19) a. Impoverishment rule

[-Pl] → Ø in env: [-Neut, II, III, IV, V] + __ [-Obl, +Sup]

b. [/di/, -Fem, -Neut, V] + [-Obl, +Struct, +Sup, -Pl] →
[/di/, -Fem, -Neut, V] + [-Obl, +Struct, -Sup]

Still to be accounted for is the /t/ exponent in the PID/Abl. What differentiates these two from the rest of the endings in (16) is that the PlG and PID/Abl endings are bipartite. The obvious move to account for the bipartite structure of these morphemes is to posit that the PlG and PID/Abl morphemes of the V declension are subject to Fission. In Vocabulary entry for PlG in (18) matches all features of the Number-Case node. The only Vocabulary item that can be inserted in such a "feature-less" morpheme is the default /s/. The /s/ that is thus inserted is then turned into /t/ by the well-known "rhotacism" rule (20) of the Latin phonology.

(20) /s/ → /r/ in env. V __ V

In addition to the appearance of /r/ in *di-e-r-um*, rule (20) is also responsible for such alternations as *rus-s ruris* 'country' *corpus - corporis* 'body' and many others.

The PID/Abl form *di-e-bu-s* also includes the default /s/ suffix. We account for the appearance of *-bu-* by adding (21) to the Vocabulary entries (17).

As stated, rule (19a) applies to non-neuter nouns in all but the I declension. It can be shown that the list of declension classes in (19a) applies is unnecessary; for details see Halle and Vaux 1997.

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that compete for insertion in the Number-Case slot, and we mark these suffixes as being subject to Fission.

(21) /bu/ ↔ [+Obl, +Sup, +Pl] in env. [III, IV, V] + __

The PID/Abl exponent of a class III, IV, V noun will then be derived as shown in (22).

(22) [+Obl, +Sup, <±Struct>, +Pl] →
[/bu/, +Obl, +Sup, +Pl] + [<±Struct>] →
[/bu/, +Obl, +Sup, +Pl] + [/s/, <±Struct>]

A comparison of the derivation (22) with that of the PlGen in (19b) shows that the linear order of the inserted morphemes is not determined by the order of insertion of Vocabulary items. The Latin facts may be accounted for by some simple assumptions about the admissible syllable structure. Other evidence — especially that of the Afro-Asiatic languages discussed below, as well as that of Catalan (see Harris 1997) and of Chukchi (see Halle and Halle in preparation) — suggests that factors in addition to syllabification must be at play, as well. I leave this as a question for further study.

5. Fission in the Afro-Asiatic Languages

As discussed in detail in Noyer 1992, Fission plays an important role in the morphology of the Semitic languages, as well as of many other Afro-Asiatic languages.

I begin with a few elementary facts of Biblical Hebrew. In Hebrew, like in many other Afro-Asiatic languages, there are two patterns of verbal inflection: the so-called Perfect conjugation, which employs suffixation exclusively, and the Imperfect conjugation, where both prefixation and suffixation are employed. This is illustrated in (23), with forms of the verb /zrq/ 'to throw'.

(23) a.

Perfect	Singular	Plural
1	za:raq-ti:	za:raq-nu:
2m	za:raq-ta:	zEraq-tem
2f	za:raq-t	zEraq-ten
3m	za:raq	za:rq-u:
3f	za:rq-a:	za:rq-u:

b.

Imperfect	Singular	Plural
1	?e-zroq	ni-zroq
2m	ti-zroq	ti-zrEq-u:
2f	ti-zrEq-i:	ti-zroq-na:
3m	yi-zroq	yi-zrEq-u:
3f	ti-zroq	ti-zrEq-u:

Like in English, Tense and AGR are fused in Hebrew into a single morpheme. In the Perfect tense the fused Tense-AGR morpheme is subject to Vocabulary insertion of the unmarked (non-Fission) kind. A list of the items competing for insertion in the Tense-AGR slot of the Perfect is given in (24). The Person features are those of (9) above.

(24)
/en/ → [+PSE, -Auth, +Fem, +Pl]
/em/ → [+PSE, -Auth, +Pl]
/u/ → [+PSE, -Auth, +Pl]
/na:/ → [+Auth, +Fem]
/nu:/ → [+Auth]
/a:/ → [+Pl]
[+Fem]   in env. ___ +Perf]

Since the Hebrew Perfect is not subject to Fission, the first Vocabulary item in (24) satisfying the Subset Condition (7) is inserted into a Perfect morpheme, and no special account is taken of any unmatched features. For example, the 1SgFem morpheme has the feature composition [+PSE, +Auth, +Fem, -Pl]. This morpheme will host the item /ti:/ in (24), which will leave the features [+PSE, +Fem, -Pl] unmatched. If Fission applied here these three features would be fissioned off into a subsidiary morpheme, which would host the item /a:/ generating an incorrect output. Since the Perfect is not subject to Fission no subsidiary morpheme is generated, and the derivation ends—correctly—with the insertion of /ti:/.

The situation is radically different in the Hebrew Imperfect, for here Vocabulary insertion is subject to Fission. The affixes of the Hebrew Imperfect are in part prefixes, in part suffixes of the stem. I assume that this is an idiosyncratic property of a given item which is reflected directly in its Vocabulary entry as shown in (25). Since (25) includes an "elsewhere" default entry, Fission comes to an end after a single iteration.

(25)
/ti:/ → [+PSE, -Auth, +Fem, -Pl]   Suff
/na:/ → [-Auth, +Fem, +Pl]   Suff
/n/ → [+Auth, +Pl]   Suff
/u/ → [-Auth, +Pl]   Pref
/y/ → [-PSE, -Fem]   Pref
/ti/ → [-PSE]   Pref
/t/ → [+Auth]   Pref
/i/ → ∴ elsewhere   Pref   in env. ___ Impf]

The examples in (26) illustrate the insertion of these items into the fissioned Imperfect morphemes.

(26) a.   [-PSE, -Auth, -Fem, +Pl] →
           [-Auth, -Fem] + [/u:/, -PSE, +Pl] →
           [/y/, -Auth, -Fem] + [/u:/, -PSE, +Pl]   yi-ztEq-u: 3PlMasc

      b.   [ ] + [/ti:/, +PSE, -Auth, +Fem, -Pl] →
           [/u:/,]+[/ti:/, +PSE, -Auth, +Fem, -Pl]   ti-ztEq-i: 2SgFem

      c.   [+PSE, -Auth, -Fem, -Pl] →
           [/u:/] + [+PSE, -Auth, -Fem, -Pl]   ti-ztoq 2SgMasc

      d.   [+PSE, +Auth, +Pl] + [+PSE, ±Fem, +Pl] →
           [/n/, +Auth, +Pl] + [+PSE, ±Fem]   ni-ztoq 1PlFem/Masc

As explained above, Fission involves the generation of a subsidiary morpheme into which are copied the features remaining unmatched in earlier steps. Thus, as illustrated in (26a) with the morpheme of the 3PlMasc—i.e., [-PSE, -Auth, -Fem, +Pl]—the first item to be chosen from (25) is the suffix /u:/. Insertion of this item copies the unmatched features [-Auth, -Fem] onto the subsidiary morpheme. The prefix /y/ is inserted into the subsidiary morpheme, and since in view of the default entry in (25) only a single iteration of Fission is admitted here, the derivation comes to an end.

Consider next the 2SgFem morpheme in (26b). Since all four phi-features of the Hebrew verb figure in the first Vocabulary item /ti:/ in (25), no feature remains to be copied onto the subsidiary morpheme. The featureless morpheme however can—and therefore must—host the default prefix /ti/, thus yielding the correct output.

The 2SgMasc morpheme in (26c) can host only the default /ti/ prefix. As shown in (26c) this will generate a subsidiary morpheme containing all the features of the original morpheme into which the default prefix can be inserted, generating the plainly incorrect output /ti-ti-ztoq/. To prevent this from happening I posit the language-specific prohibition (27).

(27) Imperfect forms may include only one Prefix.

Prohibition (27), which holds also in the other Afro-Asiatic languages reviewed below, prevents the generation of prefix sequences in all other suffixless forms of the Imperfect paradigm, including the 1Pl form which is illustrated in (26d).

As Noyer points out (1992: 105) the Imperfect conjugation is very ancient: it is attested in the earliest records of Akkadian, which date from 2500 BC. It is moreover found in numerous other Afro-Asiatic languages and therefore constitutes one of the main bits of evidence for the existence of this language family. Below I review some of this evidence in an attempt to show that the machinery introduced to this point readily handles the additional data.

(28) Egyptian Arabic

	Singular	Plural
1	?a-ktib	na-ktib
2m	ti-ktib	ti-ktib-u
2f	ti-ktib-i	ti-ktib-u
3m	yi-ktib	yi-ktib-u
3f	ti-ktib	yi-ktib-u

* Here and in other examples in this section. I have omitted the post-prefixal vowel, on the assumption that it is inserted by phonological rules, which differ somewhat in the different languages.

I begin with the Egyptian Arabic paradigm in (28). As a comparison with (23b) shows, there are two main differences between Egyptian and Hebrew. First, Egyptian lacks the /na/ suffix in the Plural Feminine forms. Formally, this is captured by the simple expedient of not listing this item in the Egyptian analog of (25). Second, in Egyptian the /y/ prefix is not limited to 3Masc forms, but occurs also in 3PlFem forms. We express this formally by generalizing the /y/ entry to all 3Person forms (cf. 22a). We prevent insertion of /y/ in the 3SgFem by positing the Impoverishment rule (29b)."

(29) a.

/i/	↔	[+PSE, -Auth, +Fem, -Pl]	Suff
/n/	↔	[+Auth, -Pl]	Pref
/u/	↔	[+Pl]	Suff
/y/	↔	[-PSE]	Pref
/t/	↔	[+Auth]	Pref
/t/	↔	elsewhere	Pref

b.   Delete [-PSE] in env. [___ +Fem, -Pl]

The Imperfect conjugation of Beja, a Northern Cushitic language spoken in the Sudan and Northern Ethiopia, is given in (30).

(30)   Beja /tiw/ 'burn'

	Singular	Plural
1	a-tiw	ni-tiw
2m	ti-tiw-a	ti-tiw-na
2f	ti-tiw-i	ti-tiw-na
3m	ti-tiw	ti-tiw-na
3f	ti-tiw	ti-tiw-na

Except for the special /a/ suffix in the 2SgMasc the Beja paradigm is structurally all but identical with that of Egyptian Arabic illustrated in (28). This near identity is also reflected in the Vocabulary items of the two languages (cf. (31) and (29)) and the fact that the two languages have the same Impoverishment rule.

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* In view of (29b) it may be asked whether the distribution of the 3Pers prefix in Hebrew (see (23) above) should also be captured by means of an Impoverishment rule. This would allow us to eliminate the specification [-Fem] in the Vocabulary entry for /y/ in (25). This saving would, however, be counterbalanced by the cost of the Impoverishment rule "Delete [-PSE] in env. [___ +Fem]," where two features must be specified. While in the synchronic grammar of Hebrew, there would thus be no motivation for Impoverishment, the Impoverishment rule is likely to have been part of the language at an earlier stage.

---

(31) a.

/i/	↔	[+PSE, -Auth, +Fem, -Pl]	Suff
/a/	↔	[+PSE, -Auth, -Pl]	Pref
/n/	↔	[+Auth, +Pl]	Pref
/na/	↔	[+Pl]	Suff
/y/	↔	[-PSE]	Pref
/a/	↔	[+Auth]	Pref
/t/	↔	elsewhere	Pref

b.   Delete [-PSE] in env. [___ +Fem, -Pl]

The Imperfect paradigm of MeHri, a language spoken by small populations in Yemen and Oman, is shown in (32), where the /i/ in angled brackets indicates that it appears only in some forms.

(32)   MeHri /rkz/ 'straighten'

	Singular	Dual	Plural
1	ə-rú:kəz	ə-rəkz-o:	nə-rú:kəz
2m	tə-rú:kəz	tə-rəkz-o:	tə-rəkz-əm
2f	tə-rə:kəz<-i>	tə-rəkz-o:	tə-rəkz-ən
3m	yə-rú:kəz	yə-rəkz-o:	yə-rəkz-əm
3f	tə-rú:kəz	tə-rəkz-o:	tə-rəkz-ən

Since MeHri distinguishes three numbers, the [±Plural] feature is supplemented here by the feature [±Singular], as shown in (33).

(33)

	Sg	Du	Pl
Singular	+	-	-
Plural	-	-	+

The Vocabulary items of the Imperfect paradigm in MeHri are shown in (34), where a rule of the phonology is assumed to replace word initial /a/ by /ə/.

(34)

/i/	↔	[+PSE, -Auth, +Sg, -Fem] in env. XYZ	Suff
/n/	↔	[+Auth, +Pl]	Pref
/o:/	↔	[-Sg, -Pl]	Suff
/ən/	↔	[+Pl, +Fem]	Suff
/y/	↔	[-PSE, -F]	Pref
/a/	↔	[+Auth]	Pref
/əm/	↔	[+Pl]	Suff
/a/	↔	[+Pl]	Pref
/t/	↔	elsewhere	Pref

The similarities between (34) and (31) and the lists of the other languages presented above is readily apparent. Like Hebrew, MeHri has no Impoverishment rule for 3Pers affixes. I have illustrated in (35) the derivation of the three 1Pers forms of MeHri.

(35) a.   [+PSE, +Auth, -Sg, +Pl, ±Fem] → [/n/; +Auth, +Pl] + [+PSE, -Sg, ±Fem]   **nə-rú:kəz** /Pl/

b. [+PSE, +Auth, +Sg, -Pl, ±Fem] →
   /ʔ/: [+Auth] + [+PSE, +Sg, -Pl, ±Fem]

c. [+PSE, +Auth, -Sg, -Pl, ±Fem] + /o/: [+Fem] →   ə-rri-kaz 1Sg
   [+PSE, +Auth, ±Fem] + [/o/: -Sg, -Pl] →
   [/a/: +Auth] + [/o/: -Sg, -Pl] + [+PSE, ±Fem]   ə-rəkz-a: 1Du

The 1Pl morpheme in (35a) is host to the prefix /n/, which matches the features [+Auth, +Pl]. The subsidiary morpheme contains the features [+PSE, -Sg, ±Fem] into which none of the items in (34) can be inserted; (27) blocks insertion of /t/.

The derivation of the 1Sg morpheme in (35b) is quite similar. The morpheme hosts only the NULL prefix, and (27) prevents the insertion of the default "elsewhere" prefix in the subsidiary morpheme.

The derivation of the 1Du in (35c) begins with the insertion of the [-Sg, -Pl] suffix /o/ and the fissioning off into the subsidiary morpheme of the features [+PSE, +Auth, ±Fem]. This morpheme can host the [-Auth] prefix, which is inserted next and which blocks insertion of the elsewhere prefix /t/.

I have illustrated in (36a) one of the three prefixal paradigms of Classical Arabic. I have chosen the Jussive here since it is the simplest of the three and reveals most readily similarities to the other paradigms discussed above. The Vocabulary entries for Classical Arabic and its Impoverishment rule are given in (36b).

(36) a.   Classical Arabic

	Singular	Dual	Plural
1	ʔ-aktub	n-aktub	n-aktub
2m	t-aktub	t-aktub-aa	t-aktub-uu
2f	t-aktub-ii	t-aktub-aa	t-aktub-na
3m	y-aktub	y-aktub-aa	y-aktub-uu
3f	t-aktub	y-aktub-aa	y-aktub-na

b.
/i/	↔	[+PSE, -Auth, +Sg, -Fem]	Suff
/n/	↔	[+Auth, -Pl]	Pref
/aa/	↔	[-Sg, -Pl]	Suff
/na/	↔	[-Sg, +Fem]	Suff
/y/	↔	[-PSE]	Pref
/t/	↔	[+Auth]	Pref
/uu/	↔	[-Sg]	Suff
/t/	↔	elsewhere	Pref

c.   Delete [-PSE] in env. [___ +Fem, -Sg]

This concludes our survey of the Imperfect conjugation in the five Afro-Asiatic languages. A comparison of the Vocabulary entries for the five languages reveals striking similarities. All five languages are subject to the prohibition (27) against multiple prefixes. In all five languages there are four

Vocabulary items competing for insertion in the prefix position. These are /n/ 1Pl; /ʔ/ (or its direct phonetic reflex) 1Sg; /t/ the default prefix; and /y/, which is the only exponent that represents somewhat differing grammatical feature complexes in the different languages: In Classical Arabic, Beja and Egyptian Arabic the /y/ prefix is the exponent of the 3Pers, with certain exceptions that are formally expressed by an Impoverishment rule, whereas in Hebrew and MeHri /y/ is the exponent of 3PersMasc and there is no Impoverishment.

The similarities in the suffixes are only slightly less striking. All five languages have the /i/ suffix in the 2SgFem; they also share the fact that there is no suffix in the 1Pl, but in all other Plural forms there is a suffix. There is also no suffix in the 1Sg and the 3Sg, but languages differ with regard to suffixation in the 2SgMasc.

Most important from the theoretical perspective of this paper is the important role that Fission plays in the Imperfect conjugation of all the languages surveyed here. The fact that the same principles govern the data of all the languages widely separated both in time and space must be counted as strong evidence for the reality of these principles.

6.   Walbiri

A different test for the principles of Distributed Morphology is provided by the Australian language Walbiri, which has become relatively well-known as a result of the extensive investigations of K. Hale. The information that is basic to this discussion is that in Hale 1973; it has been supplemented with data and suggestions provided by Hale (p.c.). Hale's 1973 paper is remarkable not only for its data, but also for its theoretical prescience: Hale's treatment of the data anticipates in many ways the theoretical positions of Distributed Morphology.

The Walbiri verb has a bipartite structure consisting of an auxiliary and a main verb. The main verb is composed of a stem followed by a Tense-Aspect suffix. According to Hale, the auxiliary, which is the topic of main interest here, is "enclitic to the first nonauxiliary constituent of the sentence. The auxiliary is unstressed and, particularly, where the base is monosyllabic or empty, it forms a prosodic unit with the preceding word." Hale notes that "[t]his refers not only to the behavior.... with respect to stress and intonation.... but also to the phenomenon of vowel assimilation" (p. 313). He observes that where the base of the auxiliary is disyllabic or longer, it may optionally appear in sentence-initial position. He concludes therefore that "the auxiliary is basically initial in Walbiri and that it is moved into second position by... rule" (p. 312). Except for this restriction on the positioning of the auxiliary, word order in Walbiri is essentially free. The auxiliary is composed of a Tense morpheme followed by one or more AGR morphemes. The Vocabulary items competing for insertion in the Tense morpheme of the auxiliary are given in (37) (cf. p. 310).

(37)

kapi	↔	Future
ka	↔	Present
lpa	↔	Past
NULL	↔	elsewhere

As shown in (38), the pronominal system of Walbiri is based on the same two features as those of more familiar languages. The Walbiri system differs from that illustrated in (9) above, in that it makes full use of its two features to define four distinct persons. As noted in section 2, the fourth person refers to a set of individuals that includes both the author of the speech event *and* one or more nonparticipants; i.e., "I and he/they, but not you." Hale terms these "1Pers Exclusive" pronouns; I shall call them here simply 4Pers.

(38)

	1	2	3	4
Participant in Speech Event (PSE)	+	+	–	–
Author	+	–	–	+

The Walbiri verb expresses three grammatical numbers, singular, dual, and plural. The feature composition of the three numbers is identical with that given in (33) for the Afro-Asiatic languages. As there are four pronominal categories and three numbers, we would expect Walbiri to have 12 personal pronouns. However, as remarked in section 2, since no single individual can be both Author of a Speech Event and a Nonparticipant, a Singular 4Pers pronoun designates a logical impossibility. There are, therefore, only 11 distinct pronouns in Walbiri.

As noted above, in addition to a Tense morpheme the auxiliary includes one or more AGR morphemes. In normal intransitive clauses there is only a single AGR morpheme, reflecting the features of the subject. In transitive sentences the auxiliary normally has two Agr morphemes: one for the subject and one for the object. Finally, in certain transitive sentences with a benefactive, such as "I'm looking for a boomerang for you" (Hale 1973, p. 335), the auxiliary includes three AGR morphemes. The structure of the auxiliary is given in (39), where elements enclosed in angled brackets are optional.

(39)

```
          Aux
         /   \
        T     AGR
            /  |  \
        AgrS <AgrO> <AgrB>
```
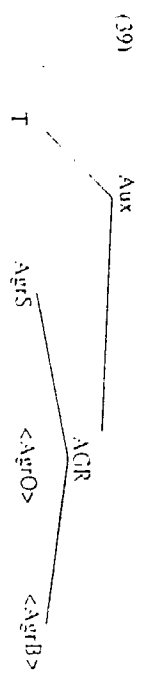
In a sentence each AGR slot is composed of different combinations of the features [PSE, Auth, Sg, Pl]. As already noted there are 11 such combinations. The crucial fact for an understanding of the distribution of the different AGR exponents is that in Walbiri *Agr morphemes are subject to Fission*; i.e. to the mandatory generation of a subsidiary morpheme, onto which features unmatched in the first step of Vocabulary Insertion are copied. The Vocabulary items competing for insertion in the AgrS morpheme are given in (40). (Cf. Hale, p. 315. N, L represent retroflex consonants.)

(40)

Lipa	↔	[–PSE, +Auth, –Sg, +Pl]	4Pl
Li	↔	[–PSE, +Auth, –Sg]	4Du
Lirijara	↔	[+Auth, –Sg, –Pl]	2Pl
nku	↔	[+PSE, –Auth, +Pl]	2Sg/Du
npa	↔	[–Sg, –Pl]	Du
pala	↔	[+PSE, –Auth]	1Pers
Na	↔	[+Auth]	Pl
lu	↔	[–Sg]	
NULL	↔	[ ]	elsewhere

Each of the 11 combinations of Person and Number features can appear in the AgrS slot of an auxiliary. The derivation of a few AgrS strings is illustrated in (41).

(41)

a. [+PSE, –Auth, –Sg, +Pl] →
   /nku/, +PSE, –Auth, +Pl] + [/lu/, –Sg]   [nku-lu] 2Pl

b. [+PSE, –Auth, –Sg, –Pl] →
   [/npa/, +PSE, –Auth] + [/pala/, –Sg, –Pl]   [ir<pa>pala] 2Du

c. [+PSE, +Auth, –Sg, –Pl] →
   [/Lirijara/, –Auth, –Sg, –Pl] + [NULL, +PSE]   [Lirijara] 1Du

d. [–PSE, –Auth, –Sg, –Pl] →
   [NULL, –PSE, –Auth, –Sg, –Pl] + [NULL,]   [ ] 3Sg

Like in the Hebrew examples in (35) and in those of McHri in (32), it can be seen in (41) that features remaining unmatched in the initial insertion are transferred to the subsidiary morpheme, into which other items are inserted. The main difference between Walbiri and the Afro-Asiatic languages is that the Vocabulary items of Walbiri are not affixes of the verb stem.

In (41a) the insertion of the 2Pl exponent /nku/ matches all but the [–Sg] feature. This feature is therefore transferred to the subsidiary morpheme, into which the item /lu/ is inserted. In (41b) the features in the terminal are similarly split into two parts, each of which finds its own entry in the list (40). A rule of the phonology deletes the parenthesized <pa> before a following *pa.* In (41c) the unmatched feature is [+PSE]. Since the default item in (40) is NULL, the output is [Lirijara]. In (41d) the default NULL is inserted in both steps of the derivation.

In Walbiri transitive sentences the AgrS clitic is normally followed by an AgrO clitic. The list of Vocabulary items to be inserted in the AgrO morpheme is given in (42).

ŋaraŋku	↔ [+PSE, +Auth, -Sg, -Pl]	/1Du
ŋaliŋki	↔ [+Auth, -Sg, -Pl]	/4Du
palaŋu	↔ [-PSE, -Sg, -Pl]	/3Du
njara	↔ [+PSE, -Auth, +Pl]	/2Pl
nanpa	↔ [+PSE, -Sg]	/1Pl
ŋalpa	↔ [+Auth, -Sg]	/1Pl
tjana	↔ [-PSE, +Pl]	/3Pl
ŋku	↔ [+PSE, -Auth]	/2Sg/Du
pala	↔ [-Sg, -Pl]	/Du
ŋu	↔ [+Auth]	/1Sg
lu	↔ [+Pl]	/Pl
NULL	↔ [ ]	/elsewhere

Like that of the AgrS morpheme, Vocabulary Insertion of AgrO morphemes is subject to Fission. Because the list of items for the AgrO is larger than that for AgrS, there are fewer instances where two non-NULL morphemes will appear in output forms. In fact, the only AgrO where Fission is completely transparent is that shown in (43a). I have given in (43b) an actual sentence with this AgrO.

(43) a. [-PSE, -Auth, -Sg, -Pl] → [/ŋku/, -PSE, -Auth] - [/pala/, -Sg, -Pl]

b. ŋajulu-Lu ka-nipa-pala-tjana   wawiri-patu   nja-nji
   1-Erg Pres-1-Pers-Sg-2Pers-Du kangaroo-pauc see-nonPast
   'I see you two.'

As shown in (44), when the dual marker is that of the AgrO, it appears to the left of the AgrO marker /tjana/. As noted above, the parenthesized string *pu* is deleted before *pu*.

(44) njum-pala-Lu   ka-npa-NULL-nku-pala   nja-nji
     2-Du-Erg   Pres-2-Du-3Pl   see-nonPast
     'You two see the several kangaroos.'

This straightforward behavior is, however, obscured in a number of instances. Hale observes that "whenever a subject clitic which is analyzable into a person marker followed by one of the number markers... precedes one of the object clitic /tju/ 'I' or /ŋku/ 'you', the number marker follows rather than precedes the object clitic" (p. 328). This is illustrated in (45), where the Subject Plural exponent /lu/ appears not next to the subject marker, but is metathesized to the right of the object marker.

(45) njurula-Lu   ka-nku-tju-lu   ŋatju   nja-nji
     2Pl-Erg   Pres-2-1-Pl   1Sg   see-nonPast
     'You (pl) see me.'

Following Hale, we account for this fact with the help of a rule of Metathesis, which permutes the Number morpheme with a following /tju/ 'I' or /ŋku/ 'you'. It is to be noted that the Metathesis rule must be ordered after Vocabulary insertion. Metathesis differs in this respect from the Impoverishment rules above, all of which must apply before Vocabulary insertion.

As Hale remarks (p. 328), the Metathesis rule provides important justification for Fission, for without prior fissioning there would be no Number morpheme to be moved by the Metathesis rule.

This example is of special importance because it provides motivation for Fission as a special device available to the morphology. Since the theory allows us to add items to the Vocabulary, the different cases in which Fission has been invoked have an alternative account. E.g., instead of analyzing the Latin PIG morpheme in *die-:-r-um* as an instance of fission, as was done in section 4 above, it is possible to add to the list in (18) the following item:

(46) /rum/ ↔ [+Obl, +Struct, -Sup, +Pl] in env. {I, II, V} + ___

A reason needs to be given why recourse to Fission is to be preferred to the addition of item (46). Our first answer is basically to reiterate Noyer's observation that in the cases where Fission is invoked, the morpheme to be added is invariably composed of sequences of existing Vocabulary items. The addition of a new item would therefore fail to take explicit account of the fact that the new item literally contains items already in the list. Implicit in this answer is the further proposition that language acquisition in humans is constrained so as to force the learner to utilize maximally already existing Vocabulary items and therefore always choose Fission over the addition of a new Vocabulary item. One might think of this as a generalization of the injunction (11) to minimize the features in the Vocabulary.
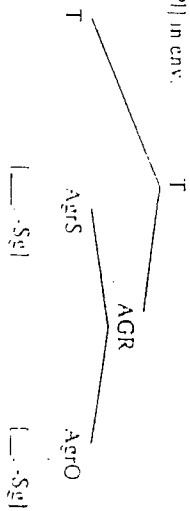
The Walbiri evidence tells us that this is the right move, for in example (45), the addition of another Vocabulary item over recourse to Fission would have led to the wrong result. Specifically, by eliminating Fission and adding to the AgrS items in (42) the item

ŋkulu ↔ [+PSE, -Auth, -Sg, -Pl]

we would make it impossible to account for the facts in (45) because in the absence of a morpheme /lu/ the Metathesis rule would have nothing to move. There are other facts in Walbiri, in addition to Metathesis, that argue in favor of the same conclusion.

Hale writes: "It is not the case that clitic sequences correspond exactly to the possible co-occurrences of subject and object noun phrases. Thus, while it is possible of course to have a dual subject and dual object in a given sentence, it is not possible, in the auxiliary, to have subject and object clitics which are both of dual form..." (p. 329) In the Eastern Walbiri dialect this is the result of the Impoverishment rule (47), which deletes the feature [-Pl] in auxiliaries with multiple Agr morphemes wherever both morphemes are [-Sg].

(47) Delete [-Pl] in env:

```
              T
        _____|_____
       T          AGR
                ___|___
   [__ -Sg]  AgrS     AgrO

              [__ -Sg]   [__ -Sg]
```

Before continuing with the discussion, it is necessary to introduce an important result of the functioning of Impoverishment rules. It may have been noticed that the Impoverishment rules discussed to this point affected unmarked features. Whenever unmarked features are deleted these features are removed from the morpheme. Research of the last few years—see especially Noyer 1996—has established that this is not the case when a marked feature is deleted. When a marked feature is deleted by Impoverishment, the feature is not removed but rather replaced by its unmarked counterpart.

The Impoverishment rule (47) is a case in point. To express the fact that the Dual is marked with respect to the Plural, we assume that the feature [-Pl] is marked in the complex [-Sg, -Pl]. In view of Noyer's results cited above, the Warlbiri Impoverishment rule (47) then has the effect of replacing [-Pl] by [-Pl].

Consider now a sentence with a 1PersDu subject and a 2PersDu object. In (48) I have shown the derivation of the two AGR nodes when they are not subject to the Impoverishment rule

(48) a   [-PSE, -Auth, -Sg, -Pl] →
       [/Lajara/ +Auth, -Sg, -Pl] + [NULL, -PSE]

     b   [-PSE, -Auth, -Sg, -Pl] → [/nku/ +PSE, -Auth, -Sg, -Pl]

When the two morphemes appear under a single AGR node they are subject to the Impoverishment rule (47). The effects of (47) are shown in (49a), and Vocabulary Insertion into the modified morphemes is given in (49b).

(49) a   [+PSE, -Auth, -Sg, +Pl] [-PSE, -Auth, -Sg, +Pl]

     b   [+PSE, -Auth, -Sg, +Pl] → [/ŋala/ +Auth] + [/lu/ +PSE, -Sg, +Pl]

        [+PSE, -Auth, -Sg, +Pl] → [/npara/, +PSE, -Auth, +Pl] + [-Sg]

It is to be noted that the phonetic exponent /lu/ represents [-Sg] in the AgrS morpheme list (40), but [+Pl] in the AgrO list (42). This difference is crucial in generating the correct output in (49). That (49b) represents the correct output is shown by the auxiliary in the sentence (50) cited by Hale (p. 330).

---

(50)   ŋajara-Lu   ka-Na-lu-ŋjara   njumpala   nja-nji
      we.Du-Erg   Pres-1-Pl-2Pl   you.Du   see-nonpast
      'We two see you two.'

The underlying AGR string

     Pres + [+PSE, +Auth, -Sg, -Pl] + [+PSE, -Auth, -Sg, -Pl]

is impoverished by rule (47) to yield

     Pres + [+PSE, +Auth, -Sg, -Pl] + [+PSE, -Auth, -Sg, +Pl]

The items in (48) compete for insertion in the first of the two pronominal clitic slots, and those in (50) are inserted in the second slot:

     [/ka/ Pres] + [/Na/ +Auth] + [/lu/ +PSE, -Sg, +Pl] +

     [/ŋjara/ +PSE, -Auth, +Pl] + [NULL, -Sg]

Additional examples of interest are discussed by Hale 1973 and will amply reward careful study by anyone interested in morphology.

7   Concluding Remarks

The theory of Distributed Morphology on which the preceding discussion was based views Morphology as a separate module of the grammar on a par with Syntax and Phonology. In all three modules the structure of sentences and words is represented by the familiar nested trees. The terminal nodes of the trees—i.e., the morphemes—are made up of complexes of features, both phonological and non-phonological. The Syntax module is concerned exclusively with the non-phonological features of morphemes. In the Phonology, primary attention is focused on phonological features, and non-phonological features play only a subsidiary role. Both kinds of feature are central in the Morphology, whose main function is to serve as a bridge between Syntax and Phonology. The heart of the Morphology is the Vocabulary, which is a list composed of the phonological exponents to be inserted into terminal morphemes of the tree. Insertion is subject to the subset convention (7). As stated in (7), when several Vocabulary items satisfy the conditions on insertion for a given morpheme, preference is given to the more marked, more restricted item over items that are less marked.

In addition to supplying phonological exponents to morphemes, the Morphology may also modify the structure of the trees and change the feature complexes in the terminal morphemes. Impoverishment deletes features in morphemes and as a result extends the domain of the morphemes into which a default (or less marked) exponents may be inserted. The fact that well-known instances of syncretism are of this kind constitutes empirical support for Impoverishment.

Changes in the tree structures are implemented by Fusion, on the one hand, and by Fission, on the other. Fusion, as noted above, accounts for the fact

that in the English verb a single exponent expresses both the Tense and Agr features. (English differs in this respect from German and Russian and many other languages, where Tense and Agr are separate suffixes.) The device of Fission splits certain marked morphemes in the special way discussed at length above. Like Impoverishment, Fission extends the domain of the exponent of the less marked Vocabulary items at the expense of the more marked items.

Much attention was focused on the conventions that govern Vocabulary insertion in morphemes specially marked as undergoing Fission. As illustrated above, a morpheme subject to Fission, in addition to being subject to normal insertion, generates a subsidiary morpheme into which are copied the features not matched for insertion in the first step. An exponent is then inserted into the subsidiary morpheme in the normal manner. As noted, a puzzling aspect of the process is that the linear order of the two affixes inserted into a morpheme subject to Fission is not fixed, but rather varies in accordance with principles that are not understood at this time. For additional facts and discussion bearing on these question, see Harris 1997 and Hale and Halle in preparation.

Last but not least, as illustrated by many examples discussed above, for Vocabulary insertion to yield the correct output the changes resulting from the application of Impoverishment, Fusion and Fission must be in place, i.e. ordered before insertion. This is an instance of *late insertion*, one of the most striking features of Distributed Morphology.

References

Anceaux, J. C. 1965. *The Nimboran language: Phonology and morphology*. Verhandelingen van het koninklijke Instituut voor Taal-, Land- en Volkenkunde. Deel 44. The Hague: Martinus Nijhoff.

Bonet, Eulàlia. 1991. *Morphology after syntax. Pronominal clitics in Romance*. Doctoral dissertation. MIT. Distributed by MIT Working Papers in Linguistics.

Hale, Kenneth. 1973. Person marking in Walbiri. In *A Festschrift for Morris Halle*, ed. Stephen R. Anderson and Paul Kiparsky, 308-344. New York: Holt, Rinehart, and Winston, Inc.

Hale, Kenneth and Morris Halle. In preparation. Chukchi transitive and antipassive constructions. Ms. MIT.

Halle, Morris and Alec Marantz. 1993. Distributed Morphology and the pieces of inflection. In *The view from Building 20: Essays in honor of Sylvain Bromberger*, ed. K. Hale and S.J. Keyser, 111-176. Cambridge. MA: MIT Press.

Halle, Morris and Alec Marantz. 1994. Some key features of Distributed Morphology. In *MITWPL 21: Papers on phonology and morphology*, ed. Andrew Carnie, Heidi Harley and Tony Bures, 275-288. Cambridge. MA: MIT Working Papers in Linguistics.

Halle, Morris and Bert Vaux. 1997. Theoretical aspects of the declension of nouns in Latin and Armenian. Ms. Harvard University and MIT.

Harris, James. 1997. Why *n-ho* is pronounced [li] in Barceloni Catalan: Morphological impoverishment, merger, fusion, and fission. In this volume.

Inkelas, Sharon. 1993. Nimboran position class morphology. *Natural Language and Linguistic Theory* 11: 559-624.

Marantz, Alec. 1997. No escape from syntax: Don't try morphological analysis in privacy of your own lexicon. Paper presented at the 21st Penn Linguistics Colloquium. To appear in U. Penn Working Papers in Linguistics, Volume...

Noyer, Rolf. 1992. Features, positions and affixes in autonomous morphological structure. Doctoral dissertation. MIT. Distributed by MIT Working Papers in Linguistics.

Noyer, Rolf. 1996. Impoverishment theory and morphosyntactic markedness. University of Pennsylvania. To appear in *Morphology and its relation to syntax and phonology*, ed. Steven Lapointe, Diane Brentari and Patrick Far... Stanford: CSLI.

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