The internal structure of the determiner in Beja*

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1. Introduction

Current work in Distributed Morphology (Halle & Marantz 1993 and related work) assumes that the terminal nodes of syntactic trees are bundles of exclusively grammatical features; phonological expressions are inserted only after syntax by an operation called Spell-Out. At Spell-Out the feature bundles specified in the terminal nodes are matched against "vocabulary items", the phonological strings available in the language for the expression of syntactic terminals. Vocabulary items compete for insertion, and the one that matches the highest number of grammatical features specified in the terminal node is inserted in that node. The matching procedure itself bypasses the need for a richly articulated phonological component in two respects. First, a crucial property of phonological strings, namely that they have internal structure, is not exploited. Second, the relation of a particular phonological string to the context in which it is inserted is simply stipulated in the vocabulary of the language. It is an empirical question if this system misses any generalization. In this paper I argue that it does: the insertion of phonological exponents is a more complex procedure than the mere competition between vocabulary items assumed in Distributed Morphology. I examine the phonological properties of the determiner in Beja[1] and suggest that an adequate morphological theory must take the internal phonological structure of the determiner's exponents into account.

The determiner in Beja is a prefix attached to the noun. Its different forms are given in table (1.1) and some examples in (1.2).[2]

(1) 1. The determiner in Beja

	Singular		Plural	
	Subject	**Non-subject**	**Subject**	**Non-subject**
Masculine*	u:-	o:-	a:-	e:-
Feminine	tu:-	to:-	ta:-	te:-

* The masculine determiner prefix is preceded by *w* in the singular and *y* in the plural when the noun to which it is attached begins with *w*, *y*, ʕ, *h*, or a vowel (e.g. u:-ták "the man" vs. wu:-ʕáb "the kid"). This phenomenon will not be dealt with in the present paper.

2. a. ***u:****-me:k* *e:a*
DET-donkey come.3MS.PAST
"The donkey came."
vs. *me:k* *e:a*
donkey come.3MS.PAST
"A donkey came." (Almkvist 1881: §54)

b. ***tó:****-fna* *iháyt*
DET-spear take.3MS.PAST
"He took the spear." (Reinisch 1893b: §122e)

c. ***é:****-mana* *támya*
DET-viscera eat.3MS.PAST
"He ate the viscera." (Reinisch 1893a: 24, 9)

A possible list of the vocabulary items for Beja masculine determiner within Distributed Morphology would be as follows:

Signal ↔ *Context of insertion*
/u:-/ ↔ [+subject, –plural, –feminine]
/o:-/ ↔ [–subject, –plural, –feminine]
/a:-/ ↔ [+subject, +plural, –feminine]
/e:-/ ↔ [–subject, +plural, –feminine]

Although this listing correctly describes the facts in (1.1), it fails to capture the fact that for each gender category the four forms generated by the system are only differentiated by their vowel quality. In (1.1) several grammatical features are expressed by one and only one segment, a vowel. I would like to propose an analysis that accounts for this property of the determiner in Beja.

I will explore the hypothesis that a grammatical feature may be expressed by an object which is not phonetically realized as a separate segment, but which constitutes a segment in composition with another phonological object. In this paper I will defend the most restrictive version of this hypothesis for the Beja determiner:

(2) The One-to-One-Primitive Hypothesis:
   a. Grammatical features, i.e., the primitives of grammatical representations, are expressed by the primitives of phonological representations.
   b. There is a correspondence between the type of grammatical feature and the type of phonological primitive that expresses it.

This article is organized as follows. In Section 2 I lay out the theoretical framework I adopt and define the phonological and grammatical primitives I assume. In Section 3 I identify the phonological primitives that make up the determiner in Beja. In Section 4 I complete the decomposition analysis laid out in Section 3. In Section 5 I discuss the information that has to be lexicalized. Section 6 concludes the paper.

2. Ingredients: The phonological and grammatical primitives

I assume the autosegmental framework, where phonological representations consist of a segmental tier and a skeletal tier linked to each other by lines of association.

Concerning the segmental tier, I adopt the element theory as introduced in Kaye, Lowenstamm and Vergnaud (1985, 1990) and assume that segments are not the ultimate constituents of phonological representations. Rather, segments are analysable into smaller units called the elements. Within this theory, elements are the primitives of segmental representations. An element is a fully specified matrix and is phonetically interpretable.

Of interest to us here is the representation of Beja vowels. The vocalic system of Beja is given in (3).

(3) i, i: u, u:
e, e: o, o:
a, a:

(cf. Almkvist 1881: §5; Hudson 1964: 18; Reinisch 1893b: §78–79)

The elements involved in Beja vowels are I, A and U. The matrices of these elements are given in (4).

(4)

I	A	U
–round	–round	+round
–back	+back	+back
+high	–high	+high
–low	+low	–low
[i]	[a]	[u]

The phonological structures of Beja vowels appear in (5).[3]

(5)

Phonetic interpretation:	[i]	[a]	[u]	[e]	[o]
Phonological structure:	I	A	U	A.I	A.U

Concerning the skeletal tier, I adopt Lowenstamm's (1996) "CV" model (cf. also Guerssel & Lowenstamm 1990). Within this model, the skeletal level consists of a strict alternation of C- and V-positions. There is only one syllable type: CV. The primitive of the skeletal level is, therefore, the CV unit.

In brief, I assume three types of phonological primitives:

(6) a. The *element*.
b. The *CV unit*.
c. The *association line*.

I take the grammatical features expressed on the determiner in Beja to be as in (7).

(7) a. *Gender* feature: Masculine (Masc), Feminine (Fem).
b. *Number* feature: Singular (Sg), Plural (Pl).
c. *Case* feature: Subject (S), Non-subject (nonS).
d. *Definiteness* feature: The determiner is definite (Def).

Given the hypotheses laid out above, the internal phonological structure and the grammatical feature matrix of each form of the determiner are as in (8).

(8)

	Phonetic exponent	**Cons.**	**Internal structure Voc.**	**Gramm. features**
a.	[u:]	Ø	U	<Masc, Sg, S, Def>
b.	[o:]	Ø	A.U	<Masc, Sg, nonS, Def>
c.	[a:]	Ø	A	<Masc, Pl, S, Def>
d.	[e:]	Ø	A.I	<Masc, Pl, nonS, Def>
e.	[tu:]	t	U	<Fem, Sg, S, Def>
f.	[to:]	t	A.U	<Fem, Sg, nonS, Def>
g.	[ta:]	t	A	<Fem, Pl, S, Def>
h.	[te:]	t	A.I	<Fem, Pl, nonS, Def>

We now have all the ingredients we need in order to determine the phonological identity of the grammatical features of the determiner in Beja.

3. The phonological identity of the grammatical features

3.1 A form of correspondence between the grammatical features and their phonological exponents

The grammatical features of the determiner may be divided into two sets: gender, number and case features on the one hand and the definiteness feature (henceforth, [+definite]) on the other. While [+definite] is not inherited because the determiner, by definition, expresses definiteness, gender, number and case features are inherited from another syntactic node. Gender and number features are inherited from the noun via agreement. Case is assigned to the DP; D inherits case by percolation on a par with all the nodes under DP.

I propose to correlate this difference in status between [+definite] and the inherited features with a difference in the nature of the phonological exponents that express these features. Specifically, I suggest that [+definite] is expressed by the CV primitive on the skeletal tier which is uncontroversially the backbone of phonological representations. As for the inherited features, they are expressed in one of two ways: as elements or as association lines. This hypothesis is formulated in (9).

(9) Phonological Exponents Hypothesis:
   a. The phonological identity of the feature [+definite] is skeletal in nature.
   b. The phonological identity of number, gender, and case features is either an element or an association line.

3.2 Analysis

Let us assume that the phonological identity of the feature [+definite] is the primitive of the skeletal level, a CV unit.

(10) [+definite] = CV

Let us then examine the Gender category. The gender opposition is a binary opposition between the masculine and the feminine. I assume the feminine to be marked and encode the gender opposition as "[+Fem] vs. [–Fem]". The phonological exponents of gender features are as shown in (11).

(11) Gender: [+Fem] = t [–Fem] = Ø

Now, let us turn to the phonological identity of number and case features. The only consonant present in the phonological structure of the determiner is *t*. This segment expresses the feminine only; number and case features must then be ex-

pressed by the vocalic part of the determiner. Consider the four characteristic vowels of the determiner, which I have given in (12).

(12)

	Singular		Plural	
	Subject	**Non-subject**	**Subject**	**Non-subject**
Phonetic realization:	[u:]	[o:]	[a:]	[e:]
Phonological structure:	U	A.U	A	A.I

At first sight the distribution of the vowels seems odd. Whereas the vowels of the singular constitute a natural class in that they are both labial, the vowels of the plural do not. However, a closer look at the phonological structures in (12) reveals a more significant distribution. While the vowel of each subject form is simplex, i.e., consists of one element, the vowel of each non-subject form is complex, i.e., it consists of two elements.

I would like to draw a correlation between phonological complexity and morphosyntactic complexity. Specifically, I submit that the complexity in terms of phonological elements characteristic of non-subject forms reflects morphosyntactic complexity.

(13) Each phonological element present in non-subject forms is the phonological exponent of a grammatical feature.

The question is: What is the grammatical identity of the additional element in the non-subject forms of the determiner?

Perhaps the null hypothesis would be that this additional element is the exponent of the case feature non-subject. Given this hypothesis, the element shared by the two singular forms, i.e. U, would express "singular" and the additional A in the non-subject form would express "non-subject". As for the plural, a similar reasoning would lead to the identification of the element A as the exponent of "plural" and I as the exponent of "non-subject". This decomposition is shown in (14).

(14)

	Singular		Plural	
	Subject	**Non-subject**	**Subject**	**Non-subject**
a. Phonetic realization:	[u:]	[o:]	[a:]	[e:]
b. Phonological structure:	U	A.U	A	A.I
c. Decomposition:	Sg = U	Sg = U	Pl = A	Pl = A
	S = Ø	**nonS = A**	S = Ø	**nonS = I**

The problem with this decomposition resides in the fact that the case feature non-subject has different phonological exponents in the singular and in the plural: A and I respectively.

An alternative would be to focus again on non-subject forms, factor out what they have in common, and identify this element as the exponent of "non-subject". Then, A would be the exponent of "non-subject" and the overall distribution of the elements would be as in (15c).

(15)

	Singular		**Plural**	
	Subject	**Non-subject**	**Subject**	**Non-subject**
a. Phonetic realization:	[u:]	[o:]	[a:]	[e:]
b. Phonological structure:	U	A.U	A	A.I
c. Decomposition:	Sg = U	Sg = U	**Pl = A**	**Pl = I**
	S = Ø	nonS = A	S = Ø	nonS = A

In as much as two different exponents now have to be recognized for "plural", A in subject forms and I in non-subject forms, this analysis is again problematic.

Instead, I want to propose a unified analysis of case features. I submit that the opposition "subject vs. non-subject" is to be construed as the opposition "non-realization vs. realization of the number feature". Subject forms are forms which are not overtly marked for number and non-subject forms are forms which are overtly marked for number.[4] In other words, the additional element in non-subject forms is the exponent of the number feature. Accordingly, the non-subject singular A is the exponent of "singular" and the non-subject plural I is the exponent of "plural". This analysis is summarized in (16).[5]

(16) a. Number: Sg = A Pl = I
b. Case: S = non-association of the number feature exponent.
nonS = association of the number feature exponent.

Under the analysis in (16), there is no specific material expressing case on the determiner. A non-subject determiner differs from a subject determiner in that it is overtly marked for number, not in that it bears a specific non-subject case marker.

The proposal laid out above allows us to formulate an interesting generalization concerning the distribution of number markers on the determiner and on the verb in Beja. Consider the representative Beja verbal paradigm given in (17).

(17) Verbal paradigm: *ketib* "write", past. (Reinisch 1893b: §225)

	Sg		**Pl**
1:	á-ktib	*1c:*	ní-ktib
2m:	tí-ktib-a	*2c:*	te-ktíb-na
2f:	tí-ktib-i		
3m:	í-ktib	*3c:*	e-ktíb-na
3f:	tí-ktib		

Two facts are worth noticing. First, the verb in Beja bears subject agreement markers only: the conjugation does not contain any object agreement marker. Second, in each of the three persons, the plural form is phonetically distinct from its singular counterpart. This indicates that the number feature of a subject noun is marked on the verb, whereas the number feature of a non-subject noun is not. Compare now this distribution with the distribution of number markers on the determiner in (16b). The number feature of a subject is marked on the verb, not on the determiner; the number feature of a non-subject is marked on the determiner, but not on the verb. It becomes clear that the differential realizations of the number features of subjects and non-subjects are in strict complementary distribution. Accordingly, I propose the generalization in (18):

(18) The copy of a grammatical feature of the noun is not phonetically realized on the determiner if it is unambiguously recoverable from the verb.[6]

Finally, it is worth mentioning that the elements A and I are respectively associated with the singular and the plural in various Afroasiatic languages. Consider the following examples from Berber and Chadic.

(19) 1. Berber: *Kabyle Berber*

Singular	*Plural*	*Gloss*
argaz	**i**rgazən	"man"
axxam	**i**xxamən	"house"

2. Chadic:

a. *Hausa* (Newman 1990: 28)

Singular	*Plural*	*Gloss*
kàaz**aa**	kàaʒ**ii**	"frog"
fàar**aa**	fàar**ii**	"grasshopper"

b. *Pa'a* (Newman 1990: 29)

Singular	*Plural*	*Gloss*
tàk**a**	tàk**í**	"arrow"
ʃíl**a**	ʃíl**i**	"axe"

Comparative evidence from other Afroasiatic languages thus supports the identities proposed in (16) for Beja number features, that is, A for "singular" and I for

"plural". I take the "plural" to be marked and the number opposition to be encoded as "[+Pl] vs. [–Pl]". The exponents of Beja number features are: [+Pl] = I, [–Pl] = A.

3.3 Summary and questions

The results of the preceding discussion are in table (20).

(20)

Grammatical category	Phonological exponents of the grammatical features
Gender:	[+Fem] = t [–Fem] = Ø
Number:	[+Pl] = I [–Pl] = A
"Case":*	S = non-association of the number feature exponent nonS = association of the number feature exponent
Definiteness:	[+definite] = CV

* I remain neutral with respect to the question whether subject or non subject is marked.

I have given the full representations of our determiners in (21) and (22) below.

(21) Masculine determiner:

	Singular		Plural	
	S	**nonS**	**S**	**nonS**
— gnr —	Ø	Ø	Ø	Ø
— def+?? —	CVCV	CVCV	CVCV	CVCV
	\ /	\ /	\ /	\ /
??	U	U	A	A
— case —		|		|
— num —	A	A	I	I
	[u:]	[o:]	[a:]	[e:]

(22) Feminine determiner:

	Singular		Plural	
	S	**nonS**	**S**	**nonS**
— gnr —	t	t	t	t
	|	|	|	|
— def+?? —	CVCV	CVCV	CVCV	CVCV
	\ /	\ /	\ /	\ /
??	U	U	A	A
— case —		|		|
— num —	A	A	I	I
	[tu:]	[to:]	[ta:]	[te:]

The status of U and A in the singular and the plural respectively, and the status of vocalic length are still unclear. Therefore, these ingredients are associated with a double question mark in the left-hand side column of (21) and (22). In this paper I concentrate on the substance of the segments involved in the determiner and leave the question of the status of vowel length for further research.[7] In the following section, I will examine the status of the elements we have not identified yet, U in singular forms and A in plural forms. Why do the representations of the determiner comprise additional elements? Why specifically an additional U in the singular and an additional A in the plural?

4. Why additional elements

4.1 Proposal

Let us first construct the representations of the four forms of the masculine determiner on the basis of the definitions in (20). The resulting representations and their interpretations are given in (23).

(23)

		Singular			Plural	
		S	**nonS**		**S**	**nonS**
Representation:	*def*	CV	CV	*def*	CV	CV
	"*case*"		|	"*case*"		|
	num	A	A	*num*	I	I
Interpretation:		Ø	[a]		Ø	[i]

In (23) both subject forms have the same phonetic interpretation: they are both inaudible.

Notice now that in system (1.1) each phonetic exponent expresses one and only one grammatical feature matrix; conversely, each of the eight grammatical

feature matrices generated by the system has one and only one phonetic exponent. In other words, the system in (1.1) does not comprise any ambiguous form; no grammatical opposition is neutralized. I take this situation not to be accidental, but the result of a necessity stemming from the presence of the following parameter in the grammar of Beja:

(24) The grammatical features associated with the determiner must be phonetically expressed.

I further submit that parameter (24) is enforced by a phonological mechanism, the addition of an element. Now we know the reason for the presence of additional elements in representations (21) and (22): both subject forms in (23) have the same phonetic interpretation; this situation contravenes parameter (24); and so, in order for this parameter to be satisfied, an element is added to the representations.

Let us now concentrate on the identities of the additional elements, U in the singular and A in the plural. Are they random? In other words, could they be different? Since I propose that the addition of elements in representations is motivated by a parameter of the language, I expect the identities of the additional elements to be chosen in a principled manner. We will now see that they are.

Compare below the elements present in representations (23) with the elements added to the representations in order to satisfy parameter (24):

	Element in (23)	*Additional element*
Singular:	A	U
Plural:	I	A

There is a clear connection between the elements in the second column and the ones in the first column: element addition obeys a regularity that has been shown to be at work in a series of languages, namely, the Apophonic Path (AP).[8]

(25) Apophonic Path (Guerssel & Lowenstamm 1990, 1996):
Ø→ I → A → U → U

The apophonic relation in (25) has the shape a → b, that is, a basic term is the source of one and only one derived term; the derived term is thus predictable without ambiguity on the basis of the source vowel. The Apophonic Path predicts that if a basic term is an I (A respectively), the derived one is an A (U respectively).

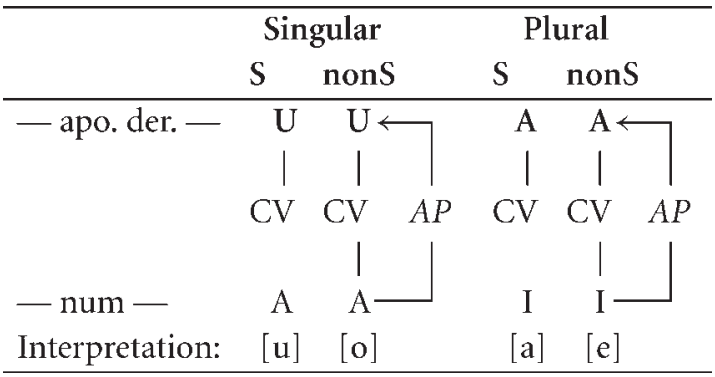
Going back to the Beja determiner, the additional element in both the singular and the plural is the apophonic output of the element present in the representation:

(26)

	Element in the representation	Additional element	Apophonic step
Singular:	A	U	A → U
Plural:	I	A	I → A

To sum up: parameter (24) is enforced by the addition of the apophonic output of the element present in the representation. This mechanism is illustrated in (27).

(27) The Apophonic Addition:



Notice finally that given the phonological exponents assumed in (20), the Apophonic Addition is the only mechanism yielding the attested vowels:

(28)

	Singular			Plural		
	After (20)		*V attested*	*After (20)*		*V attested*
S:	Ø	→	[u]	Ø	→	[a]
nonS:	[a]	→	[o]	[i]	→	[e]
The only function is:	+U				+A	

4.2 Uniqueness of the Apophonic Addition

We have seen in the preceding section that the Apophonic Addition satisfies parameter (24). In this section, I will argue that:

(29) Given the identities of the grammatical features in (20), the only plausible mechanism satisfying parameter (24) is the Apophonic Addition.

Among the mechanisms that add an element to representations, only two are plausible, i.e., show a coherent pattern. The first one consists in adding an element only to the representations that have the same phonetic interpretation, i.e., to both subject forms. The non-subject forms represented in (23) are distinct and do not need to receive any additional element. Since subject forms must be distinct, the elements added to these forms must be different. The operations meeting this con-

dition are listed in the first column of table (30). In the second column of (30) I give the internal structures of the vowels after addition. Finally, the third column gives the resulting phonetic realizations.

(30)

Additional elements				**Elements of the det**				**Phonetic realization**			
Sg		**Pl**		**Sg**		**Pl**		**Sg**		**Pl**	
S	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**
I	Ø	A	Ø	I	A	A	I	[i]	[a]	[a]	[i]
I	Ø	U	Ø	I	A	U	I	[i]	[a]	[u]	[i]
A	Ø	I	Ø	A	A	I	I	[a]	[a]	[i]	[i]
A	Ø	U	Ø	A	A	U	I	[a]	[a]	[u]	[i]
U	Ø	I	Ø	U	A	I	I	[u]	[a]	[i]	[i]
U	Ø	A	Ø	U	A	A	I	[u]	[a]	[a]	[i]

As can be seen from the third column of table (30), neither of these operations derives four different vowels.

The mechanism enforcing parameter (24) should not randomly add an element to the representations, but be sensitive to natural classes. Therefore, the second plausible procedure consists in adding the same element to both forms within a given number category: both singular forms on the one hand, both plural forms on the other hand, receive the same element. The possibilities are listed in (31).

(31)

Additional elements				**Elements of the det**				**Phonetic realization**			
Sg		**Pl**		**Sg**		**Pl**		**Sg**		**Pl**	
S	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**	**S**	**nonS**
I	I	A	A	I	A.I	A	A.I	[i]	[e]	[a]	[e]
I	I	U	U	I	A.I	U	I	[i]	[e]	[u]	[i]
A	A	I	I	A	A	I	I	[a]	[a]	[i]	[i]
A	A	U	U	A	A	U	I	[a]	[a]	[u]	[i]
U	U	I	I	U	A.U	I	I	[u]	[o]	[i]	[i]
U	**U**	**A**	**A**	**U**	**A.U**	**A**	**A.I**	**[u]**	**[o]**	**[a]**	**[e]**

Only one operation derives four different vowels, namely the one on the last line of table (31): +U in the singular and +A in the plural. It is the Apophonic Addition.

5. What has to be lexicalized?

The aim of this section is to show that within my analysis, the lexical information associated with the determiner is reduced to a very simple set of stipulations.

Consider first the Gender category which opposes [+Fem] to [–Fem]. The simplest way to realize this opposition is to phonetically express the feature that is marked and leave the unmarked feature unexpressed. Then, it is sufficient to lexicalize the exponent of [+Fem]; the exponent of [–Fem] will be automatically Ø.

(32) Gender: [+Fem] = t

Let us now consider the Number category. I repeat in (33) the main result of Section 4.

(33) The grammatical features associated with the determiner must be phonetically expressed. This is enforced by the Apophonic Addition.

The statement in (33) implies, I argue, that the "singular" is expressed by A and the "plural" by I. I first show that (33) implies that the couple of number features ([–Pl], [+Pl]) is expressed either by (A, I) or by (I, A).

Let us define four elements x, y, x' and y' as follows: *x* is the exponent of "singular", *y* is the exponent of "plural", *x*' is the apophonic output of x and *y*' is the apophonic output of y. We have: x, y ∈ {Ø, I, A, U}, x', y' ∈ {I, A, U} and x ≠ y. Given these conventions, the representations of the four forms of the masculine determiner are as in (34).

(34)

	Singular		Plural	
	S	nonS	S	nonS
— gnr —	Ø	Ø	Ø	Ø
— num —	x	x	y	y
		|		|
— def —	CV	CV	CV	CV
	|	|	|	|
— apo. der. —	x'	x'	y'	y'
Phon. structure:	x'	x.x'	y'	y.y'

The four vowels represented in (34) must be different. Hence x and y must be such that the following conditions are met:

(35) a. x' ≠ x.x' b. x' ≠ y' c. x' ≠ y.y'
d. x.x' ≠ y' e. x.x' ≠ y.y' f. y' ≠ y.y'

Let us concentrate on (35a) and (35f). These conditions straightforwardly give x ≠ Ø and y ≠ Ø. Notice next that the apophonic output of U is U (apophonic step U → U). That is, with our conventions, for x = U, x' = U. Thus, for x = U, x = x' = x.x', which is in contradiction with (35a). Of course, the same is true of y and y': for y = U, y = y' = y.y'. We conclude that (35a) and (35f) require x and y to

be different from U. The remaining possibilities for (x, y) are (A, I) and (I, A). We have shown that the exponents of the number features must be different from Ø and U, hence they may only be A or I.

The second step consists in showing that the exponent of ([–Pl], [+Pl]) is (A, I) and not (I, A). Suppose first that "[+Pl] = A, and [–Pl] = I" is lexicalized. Such a scenario forces us to lexicalize both the exponent of the marked feature, [+Pl], and the exponent of the unmarked feature, [–Pl]. As a matter of fact, the exponent of [–Pl] cannot be derived from the exponent of [+Pl] since there is no mechanism of the shape A → I. The second option consists in lexicalizing "[+Pl] = I". In this case the exponent of [–Pl], A, can be derived from the exponent of [+Pl]: it is its apophonic output (apophonic step I → A). I submit that Beja adopts this strategy and lexicalizes [+Pl] = I. The exponent of [–Pl] does not need to be lexicalized since it can be derived from the exponent of [+Pl] by AP.

(36) Number: [+Pl] = I

Consider now the exponents of [+Fem] and [+Pl] in (32) and (36): [+Fem] is expressed by *t*, and [+Pl] by *I*. These exponents share a striking characteristic: they are the least marked segments in their respective categories, consonant and vowel. On the basis of this observation, I suggest reformulating (32) and (36) as in (37):[9]

(37) a. Gender: "Mark [+Fem]", i.e., "Take the least marked consonant."
b. Number: "Mark [+Pl]", i.e., "Take the least marked vowel."

Consider finally the definiteness feature. The exponent of [+definite] is CV. This is exactly the skeletal material necessary for the realization of Gender and Number features exponents, the consonant *t* and the vowel *I*/*A* respectively.

The true residues of lexicalized information are listed in (38).

(38) 1. In Beja, the grammatical features associated with the determiner must be phonetically expressed.
2. *Apophonic Path*: Ø → I → A → U → U
3. *Gender*: Mark [+Fem].
Number: Mark [+Pl].
Definiteness: The exponent of [+definite] is the support necessary for the realization of gender and number features.
4. The copy of a grammatical feature of the noun is not phonetically realized on the determiner if it is unambiguously recoverable from the verb.

6. Conclusion

In this paper I explore the hypothesis that grammatical features are realized by phonological primitives. This view implies that syntactic operations may manipulate phonological primitives. Such a position directly supports neither standard Minimalist assumptions nor realizational frameworks like Distributed Morphology. On the one hand, in the Minimalist framework, the computational system carries along phonological matrices, but it cannot read them. Syntactic operations do not have access to the individual phonological features. On the other hand, Distributed Morphology would be hard-pressed to express a direct relation between syntactic terminals and the internal structure of phonological representations, as it is defended here.

I propose that definiteness, the feature which defines the category determiner and supports other features like gender, number and case, is realized in the phonology of Beja as the support to which the exponents of the other features attach. Since the backbone of phonological representations is the skeleton, the definiteness feature of the Beja determiner is expressed by the skeletal primitive, CV.

More generally, I claim that skeletal positions may express grammatical features autonomously, i.e. independently from segmental material. This article is meant as a starting point in the pursuit of the hypothesis that the segmental and the skeletal levels of phonological representations express different types of grammatical features.

Notes

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1. Beja is a language spoken in Sudan, Eritrea and southern Egypt. It is classified as the only member of the North Cushitic branch of the Afroasiatic family.

2. The data in this article are taken from Almkvist (1881), Hudson (1974) and Reinisch (1893a, b).

3. For more details, see Kaye, Lowenstamm and Vergnaud (1985).

4. The fact that the subject determiner has two different realizations in the singular and in the plural seems to contravene this hypothesis. I will show in Section 4 how this fact may be accounted for.

5. Vycichl (1953:377) reconstructs as well Sg = A and Pl = I. His argument is a diachronic one.

6. Let us briefly examine whether gender marking fits in generalization (18). Of course, for this purpose, only 3rd person verbal forms are relevant. The copy of the gender feature of a noun is phonetically realized on the determiner. (18) predicts that it is not recoverable from the verb. Object nouns straightforwardly comply: their gender feature is never recoverable from the verb. The case of subject nouns is more complicated. Notice first that the gender of the subject noun in the plural is not recoverable from the verb: plural verbal forms are not marked for gender. However, singular verbal forms seem to be problematic for (18) since the 3rd masculine and the 3rd feminine are distinct. In order to gain insight in the system of verbal gender marking, let us have a look at 2nd singular forms. In these forms gender contrast is exclusively rendered by the suffixes *-a* and *-i*. A possible interpretation of this fact is that gender is marked by means of suffixes in verbs. Going back to the 3rd singular, we notice that these forms have null suffixes. Under the preceding assumption, this means that gender is not marked in the 3rd singular, which is consistent with (18). I thus propose to explore the hypothesis that the different prefixes *i-* and *ti-* in 3rd singular forms do not express gender features.

7. The reason for this is insufficient data to state the exact distribution of vowel length in the determiner.

8. See Guerssel and Lowenstamm (1990, 1996) and Chekayri and Scheer (1996) for Classical Arabic, Bendjaballah (1999) for Kabyle Berber, Ségéral (1995) for Akkadian, Ségéral and Scheer (1998) for German, and Boyé (2000) for French and Spanish.

9. One additional stipulation has to be made here, namely that Gender is expressed by a consonant and Number is expressed by a vowel. This stipulation may be derived as follows. The exponent of [+Fem] makes it possible to realize a binary opposition: [+Fem] vs. [–Fem]. The exponents of number features oppose four terms <S, Sg>, <S, Pl>, <nonS, Sg>, <nonS, Pl>. We need a mechanism in order to achieve this. The grammar of Beja has AP. AP establishes a relation between vowels. And so, the exponents of number features are vowels.

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