The Basic Elements of Inflection: Morphophonology of Bosnian Nouns

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1. Introduction

This paper deals with the morphophonology of Bosnian[1] nominal declensions. It proposes a new insight into the behavior of the vocalic alternations occurring throughout the system. It is shown that the final vowel of each Bosnian noun results from the combination of three distinct phonological items, and that these items are the exponents of one and only one morphosyntactic property. These exponents are the basic elements of a Bosnian noun and are combined in one complex marker in the phonology.

The analyses presented in this paper are consistent with the syntactic approach to word formation of Distributed Morphology (hereafter DM; Embick & Halle 2005, Halle & Marantz 1993). In DM, morphemes are feature-bundles associated to syntactic terminal nodes. In what follows, I propose an interpretation of the mechanism of *spell-out*, which is the device responsible for the association of phonological form to these feature-bundles. In representing underlying phonological forms, I make use of the principles of CV phonology (Lowenstamm 1996, Scheer 2004).

The paper is structured in the following way. In section 2, I introduce the data, a few general facts and two crucial observations. Section 3 is dedicated to the phonological analysis of the alternating final vowels, whereas section 4 focuses on the syntactic structures and on surface-apparent irregular forms. Section 5 concludes.

2. Bosnian noun inflectional groups

Bosnian belongs to the west branch of the South-Slavic group. Morphologically, Bosnian is conservative: five different cases have been preserved as well as a stable correlation between a gender and a given inflectional paradigm (cf. Corbett & Browne 2008:337-343).

Each Bosnian noun displays an overt case marker, which changes throughout the paradigm. Two distinct ways of noun classification have traditionally been used: one is based on the genitive singular; the other is built on the relation between gender and nominative case endings. As the former classification is motivated on comparative, historical grounds, I adopt the latter, following Browne (1993) and Corbett & Browne (2008). Thus, nouns of each group are all of the same gender. This is shown below:[2,3]

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[1] I refer to (Bosno-)Serbo-Croatian as simply Bosnian as a tribute to my informant, Arnela, from Bosnia-Herzegovina. I am fully indebted to her for the time she has dedicated to me in answering boring questions on her native language.

[2] I make extensive use of the official spelling rules, which consist in a slightly modified version of Latin alphabet. The following letters involve specific conventions: *š* = [ʃ], *c* = [t], *ć* = [tɕ], *č* = [ts], *dz* = [dʒ], *h* = [x], *j* = [j] and *nj* = [ɲ].

In addition, I use the following conventional abbreviations: Nom = nominative, Gen = genitive, Dat = dative, Loc = locative, Acc = accusative, Instr = instrumental; M = masculine, F = feminine, Neu = neuter; sg = singular, pl = plural; obl = olique, str = structural, sup = superior.

[3] Standard (Bosno-)Serbo-Croatian has distinctive long-short vocal oppositions as well as a pitch accentuation, as illustrated by Matešić (1970): there is a falling and a rising accent which can both be short or long. Vowels vary according to length and pitch. In particular, falling short accent occurs only on the first syllable of a word; hence monosyllabic ones can have only a falling accent. No accent can occur on the final vowel. In addition, Magner & Mateijka (1971) demonstrated that this system is not so well preserved for many speakers, which tend not to distinguish length on unstressed vowels. I will therefore not be concerned with this phonological issue: length in (1) has only illustrative purposes. More recently, Zec & Zsiga (2010) have analyzed the interactions between tone and accent in Serbian, based on Zec's (1999) work on the distribution of the tone.

(1) Gender-based classification[4]

	group 1 M		group 2 F		group 3 Neu	
	sg.	pl.	sg.	pl.	sg.	pl.
a. Nom	*okvir*	*okviri*	*kuća*	*kuće*	*selo*	*sela*
b. Gen	*okvira*	*okvirā*	*kućē*	*kućā*	*sela*	*selā*
c. Dat/Loc	*okviru*	*okvirima*	*kući*	*kućama*	*selu*	*selima*
d. Acc	*okvir(a)*[5]	*okvire*	*kuću*	*kuće*	*selo*	*sela*
e. Instr	*okvirom*	*okvirima*	*kućōm*	*kućama*	*selom*	*selima*
	'frame'	'frames'	'house'	'houses'	'village'	'villages'

All the nouns belonging to group 1 are M; neither F nor Neu nouns exist in this group. Second, nouns with the endings of group 3 are all Neu. The situation is slightly different in group 2: although the F nouns represent the largest set, a small group of M nouns exist, such as *sudija* 'judge'. Then, the way data are organized makes exceptions to be limited to the group 2.

As a first and partial generalization, I consider that, in Bosnian, gender corresponds to the group. In the next section, I investigate the alternations of each inflectional ending.

3. Vocalic alternations and morphological properties

In this section, I propose an interpretation of the case markers appearing on a noun in Bosnian. I explore the vocalic alternations occurring throughout the paradigms shown in (1). First, I introduce the notion of *final vowel*; then I examine the hypothesis that this object has an internal phonological structure. I propose to decompose the final vowel using the Theory of Elements (Kaye et al. 1985, 1990), a theory of segmental representations. Finally, I provide a list of exponents for each morpho-syntactic category involved in the formation of a noun.

3.1 The notion of *final vowel*
Most of the Bosnian nouns end in a vowel. This fact is very important. It is not phonological: words can end in a consonant, e.g. *okvir* 'frame', *čitaš* 'you.sg read', etc.. In addition, despite the presence of five distinct syntactic cases, three genders and two numbers, the overwhelming majority of inflectional markers is formed by only one vowel. Exceptions to this generalization are found only in two cases. In one case, no marker appears at all: this is the M sg Nom, cf. *okvir* 'frame'. In such forms, a phonological zero replaces the alternating vowel. In the second case, instead of a simple vowel, a complex marker is found: the consonant /m/ follows a vowel (either -*i*- or -*a*-) and precedes either zero or -*a*. These are respectively the markers for Instr sg, Dat/Loc pl and Instr pl.

The statements in (2) summarize the situation as it has just been described:

(2) The phonological nature of the inflectional markers
   a. The only phonologically zero marker is the M sg Nom;[6]
   b. Case markers are formed by one vowel. If a consonant appears:
      i. only the consonant /m/ is accepted,
      ii. /m/ is followed either by zero (Instr sg) or by /a/ (Dat/Loc and Instr pl).

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[4] I will not be concerned with vocative case due to its particular syntactic and morphological status. In addition, Dat and Loc are always phonetically identical (not only in nominal, but also in adjectival and pronominal paradigms): for this reason, I use a unique label Dat/Loc (cf. Corbett & Browne 2008, Hammond 2005).

[5] M nouns are marked by -*a* at sg ACC only when the referent is animate.

[6] Since Jakobson (1948), the interpretation of such a zero in the Slavic nominal systems consists in posing a *yer*, which is erased by a phonological rule. However, Bosnian *yers* never surface as the central high vowel [ɨ] but only as a [a]: cf. nouns displaying -*a* vs. zero alternations, such as *maćak* (Nom) 'a cat' vs. *maćkom* (Instr) 'with a cat'. See Scheer (1997) for a consonantal interaction analysis of these alternations in Slavic, and Halle & Nevins (2009) for a rule-based analysis of *yers* in Serbo-Croatian.

Now recall that gender corresponds to the classification in groups. If so, then gender is marked by one vowel. This vowel is the same object as the one described in (2). A closer scrutiny of the alternations of the final vowel reveals that this item changes following both the syntactic case and the number. Hence, these categories are both involved, in association to gender, in selecting the right quality of the inflectional markers.

As a consequence, each occurrence of the final vowel is the overt marker of gender, number and syntactic case:

(3) Vocalic markers
    a. Gender is overtly marked on nouns by one vowel
    b. Number is overtly marked on nouns by the same vowel
    c. Case is overtly marked on nouns by exactly the same vowel

The observations in (2) and the statements in (3) lead us to make the following hypothesis on the nature of the final vowel:

(4) The final vowel spells out three different morphosyntactic properties: gender, number and syntactic case.

The hypothesis in (4) raises a fundamental question, namely: what is the relation between the final vowel and the morphosyntactic properties that it spells out. Given that one vowel is the exponent of three distinct properties, do we expect the presence of three different phonological exponents at some level of the representation? The answer I propose in this paper is an affirmative one.

A formal analysis must account for the distribution of each occurrence of the final vowel with respect to three categories. Two opposite analytical paths are possible. In one, the final vowel can be interpreted as a *portemanteau* morpheme; in the other, it is regarded as a complex object resulting from the phonological fusion of three more basic items. In the former case, a unique phonological exponent spells out a complex morpheme of the kind {gender, number, case}. Three distinct objects at the morphosyntactic level are associated to only one object at the phonological level. In the latter case, each morphosyntactic object is spelled-out as an independent phonological entity. A one-to-one relationship is established between the form and the function of each morpheme.

If we accept that the final vowel is a unique phonological object, then it has no internal structure. According to such a view, a given morpheme, say {F, sg, Nom}, corresponds to a phonological exponent (here -*a*). The analysis has to account for the merger of three distinct syntactic terminals under a unique node. In DM, the device responsible for such an operation on nodes is called *Fusion* (Halle & Marantz 1993: 136). This kind of analysis, however, cannot capture phonological similarities between the inflectional markers, for example the fact that they are all constituted by one vowel.

Conversely, considering final vowels as complex objects with internal structure has two practical advantages. First, one can get rid of *Fusion*. This is a specific tool that has been conceived to solve the mismatches between the structure and the phonological form. Second, I assume that only the vocalic Elements (in the sense of Kaye et al.'s 1985 Theory of Elements) are involved in the expression of inflection. The exclusivity of vowels as inflectional markers follows. Before introducing the Elements, I summarize the hypothesis on the nature of the final vowel as follows:

(5) The final vowel is the combination of three phonological objects:
    a. one object marks gender,
    b. one object marks number,
    c. one object marks syntactic case.

The next sub-section explores the idea of a unique spell-out per category and defines the morphological role of the basic Elements.

3.2 A morphologically complex object
It is generally assumed that Slavic nouns have an underlying form of the type Root + Theme + Case/Number (cf. Bayilin & Nevins 2008, Halle & Nevins 2009 among the most recent works). Work on the nominal morphology

of both related and unrelated languages has often assumed a similar underlying sequence (Calabrese 1998 for Latin and Italian, Halle 1992 for Latvian, Halle & Vaux 1998 for Latin and Armenian, Müller 2005 for Russian and Weisser 2006 for Croatian).

In this paper, I assume that nouns are sequences of a root followed by three distinct morphemes: gender, number and case. This is shown in (6):

(6) Root + gender + number + case

Each functional morpheme shown in (6) corresponds to an independent terminal node. In addition, (6) corresponds to the linear order of the three phonological exponents hypothesized in (5).

As a first step in the understanding of the phonological make-up of final vowels, all their occurrences are reproduced in isolation in (7):[7]

(7) Vocalic endings:

	group 1 M		group 2 F		group 3 NEU	
	sg.	pl.	sg.	pl.	sg.	pl.
a. Nom	zero	i	a	e	o	a
b. Gen	a	a	e	a	a	a
c. Dat/Loc	u	i(ma)	i	a(ma)	u	i(ma)
d. Acc	a	e	u	e	o	a
e. Instr	o(m)	i(ma)	o	a(ma)	o(m)	i(ma)

As already observed, only the M sg Nom is marked by a phonological zero. According to the sequence in (6), such a phonological zero must be considered as the result of three underlying morphemes. Only one solution exists, namely that this zero is in fact a sequence of three zeroes. In other words, given a M noun such as *okvir* 'frame', and considering both the hypothesis in (5) and the sequence in (6), the only possible view is that each exponent deriving this zero is phonetically null. This is shown below:

(8) Root   gender   number   case
    | | | |
  okvir ø   ø   ø = [okvir]

From the situation described above, three important generalizations regarding the nature of M, sg, and Nom follow. Each one of these properties is spelled-out as a zero:

(9) Zero morphemes[8]
    a. Gender: M is marked by zero
    b. Number: sg is marked by zero
    c. Case: Nom is marked by zero

The situation in (8) and (9) has important implications for our reasoning. But these can be captured only if we first analyze the phonological nature of the vowels involved in the inflection.

The Theory of Elements (Kaye et al 1985, 1990) allows for the decomposition of the phonological segments. More precisely, Kaye et al.'s approach considers that each vowel is a complex object formed by at least one basic Element. Bosnian has five vowels: [a], [e], [i], [o] and [u]. The Theory of Elements predicts the following underlying expressions:

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[7] I will not deal with -*ma* and -*m* (in parentheses in 7) in this paper.
[8] Phonologically null morphoemes are part and parcel of DM analysis.

(10) Vocalic expressions for Bosnian
    a. [a] = /A/
    b. [e] = /A.I/
    c. [i] = /I/
    d. [o] = /A.U/
    e. [u] = /U/

The data in (7) are replaced by the corresponding vocalic expressions in (10). This is shown below:

(11) Decomposed vocalic case endings

	group 1 M		group 2 F		group 3 NEU	
	sg.	pl.	sg.	pl.	sg.	pl.
a. Nom	ø	I	A	A.I	A.U	A
b. Gen	A	A	A.I	A	A	A
c. Dat/Loc	U	I	I	A	U	I
d. Acc	A	A.I	U	A.I	A.U	A
e. Instr	A.U	I	A.U	A	A.U	I

By hypothesis, the column containing the M sg consists of a sequence of two zeroes (the exponents of M and sg, respectively) followed either by another zero (the exponent of Nom) or a non-null exponent. The latter is the exponent of the syntactic case. For instance, /U/ is the exponent of Dat/Loc case.

Similarly, the row containing the Nom is formed by a sequence of at least one zero (the exponent of Nom) and two other Elements. For instance, in group 2, the Element A appears at the sg. As both the sg and the Nom are spelled-out as a zero, A must be related to the F gender.

In the next sub-section, I focus on the Nom and propose a unique exponent for F and Neu on one side, and pl on the other. Then, I provide a typology of roots for Bosnian nouns. Finally, I propose an exponent for each syntactic case.

3.3 Elements, roots and exponents
3.3.1 The vocalic alternations in Nom: gender and number exponents
Final vowels are involved with gender, number and syntactic case. In order to detect the exponent of each one of these properties, I start from the data of the Nom. This choice is motivated by the fact that the Nom is spelled-out as zero and its occurrences are formed only by two Elements. Therefore, it is possible to focus only on gender and number exponents.

A detailed list including all possible Nom nouns is given below:

(12) Bosnian Nom nouns

	sg.	gender	pl.	gender	gloss
a.	*okvir*	M	*okviri̲*	M	'frame(s)'
b.	*kuća̲*	F	*kuće̲*	F	'house(s)'
c.	*selo̲*	Neu	*sela̲*	Neu	'village(s)'
d.	*polje̲*	Neu	*polja̲*	Neu	'field(s)'

The item in (12.d) represents a subgroup of Neu. The main feature of these nouns is that they end in -*e* (instead of -*o*) in the Nom and Acc of the sg. Conversely, pl Nom and pl Acc display the regular -*a*. Browne (1993) claims that the alternation -*o* vs. -*e* is due to the palatalizing effect of the last radical consonant, namely [ts], [tʃ], [dʒ], [ʃ], [ʒ] and [ʎ].[9] The problem raised by this variation will be returned to immediately below.

Now, recall the sequences underlying each final vowel in the Nom (cf. 11a). These data are recast below with the addition of the Neu in [e]:

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[9] I am aware of only one counterexample to this generalization: *more* 'sea'.

(13)   M   F   Neu
    a. sg   ø   A   A.U ~ A.I
    b. pl   I   A.I   A

M is marked by zero, as stated in the zero-morpheme hypothesis in (9). Sg is also marked by zero. In addition, two further generalizations can be made: first, F is marked by the Element A and, second, M pl and F pl are expressed by the same item, the Element I (henceforth IPL). We do not find the Element I in the Neu pl, a fact I will return to later in section 4.2.2.

As for Neu sg, the Elements U and I alternate in the sg. As we have seen, this alternation is phonologically driven: U > I when the root ends in a palatalizing consonant. Thus, the exponent of the Neu gender must be only one of the two Elements. I take this exponent to be the Element U. In addition to the gender exponent, Neu is marked by the Element A both at the sg and the pl. In the former case, the Element A appears alone. I propose that this Element A is the exponent of the Acc for a reason to be explained later, in section 4.2.2.

Each pairing of a phonological exponent and its context of insertion (the feature-matrix) is referred to as a Vocabulary Item (henceforth VI) in DM literature (cf. Embick & Noyer 2007:294-295). The list of the VI's concerning the gender and the number in the Bosnian nouns is shown below:[10]

(14) Gender and number VI's
    a. [+gender, -F] ⇔ zero
    b. [+gender, +F] ⇔ A
    c. [-gender] ⇔ U
    d. [-pl] ⇔ zero
    e. [+pl] ⇔ IPL

Before turning to the syntactic case exponents, the phonological representations of roots in the language must be clarified. This is the topic of the next subsection.

3.3.2 Themes and roots

Indo-European languages display a well-known morphological characteristic that is commonly referred to as *theme vowel*. Each root is associated to one of these vowels, which appear between it and the inflectional morphemes. The morphological sequence root + theme vowel is considered to be the theme. Nouns and verbs are classified according to their theme vowel.

That said, a major difference holds between nouns and verbs as far as the theme vowel is involved. In the verb, the theme vowel is a fundamental morphological requirement that has no correspondence with meaning and/or other morphological properties. In order to correctly create the form of a verb, the speaker has to know the root and the theme vowel. This relation is unpredictable. Take, for instance, Latin verbs: the root *laud*- corresponds to English 'praise'. If one wants to say 'we praise', one needs to know that this root is associated to the theme vowel -*a*- giving the right result *laudāmus* 'we praise'; *laudēmus*, *laudĕmus* or *laudīmus* are excluded. Because of their apparent lack of meaning or predictability, these morphemes have been referred in the DM literature as *ornamental morphology* (cf. Embick & Noyer 2007:305-310).

The theme vowels of nouns, on the other hand, can be related to a property typical of nounness, namely the gender. Let me take Latin again: in this language, there are five declensions that are historically marked by a specific theme. First declension is marked by -*a*-, second one by -*o*-, etc..[11] Unlike for verbs, however, there is a small degree of predictability about the gender once one knows the theme: the first declension nouns, for example, are almost all feminine, whereas the second declension ones are almost all masculine, and so on. Thus, the theme vowel can be predicted to some extent in nouns.

Bosnian is totally consistent with this logic. I propose that each root has an inherent gender, which is spelled-out as a *theme Element*. This happens as the root merges to the first category-defining head, namely *n*. This way, three root groups exist in the language: first, there are roots triggering the spell-out of a zero. These

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[10] I follow Lowenstamm's (2008) in assuming that Neu is the "absence" of gender: [–gender].

[11] Cf. Meiser (1998) for an overview on archaic and classical Latin declensional system.

nouns are M. In the second group, the Element A is spelled-out as the result of the first merge: a F noun is thus created. Finally, Neu nouns are formed by the merger of *n* to roots triggering the spell-out of the Element U (or, if the last radical consonant is palatal, then the theme Element surfaces as I). In addition, I assume that roots bear a template when they enter into the derivation (cf. Lowenstamm 2008). In this template, composed of strictly-alternating C and V slots, the final V slot is always free.

(15) Bosnian Roots

a. *zero*-roots	b. **A**-roots		c. **U**-roots		d. **U**-roots	
o k v i r	k u ć	**A**	s e l	**U**	p o lj	**U > I**
| | | | |	| | |		| | |		| | |	
CVCVCVCV	CVCV		CVCV		CVCV	

In the next subsection, I deal with the phonological exponents of the syntactic cases.

3.3.3 The phonological exponents of the syntactic cases

The identification of each exponent of the syntactic cases follows from the zero-morpheme hypothesis, cf. (8) and (9). As already discussed, both the M and the sg are marked by zero; it follows that each surface final vowel in the M paradigm is the exponent of a syntactic case. The figure below shows this situation in detail:

(16) M sg final vowels decomposition

	M	sg.	case	surface
a. Nom	ø	ø	ø	ø
b. Gen	ø	ø	A	[a]
c. Dat/Loc	ø	ø	U	[u]
d. Acc	ø	ø	A	[a]
e. Instr	ø	ø	A.U	[o]

Before formalizing the VI's for these items, a short detour into the representation of each syntactic case is necessary. Since Jakobson (1962), the syntactic cases have been represented by mean of feature-matrices, and a wide literature exists on the topic: Franks (1995), Halle (1997), Halle & Vaux (1998) and Alexiadou & Müller (2008) among the most relevant ones. In this paper, I propose the following feature-matrices for the Bosnian cases:

(17) Featural decomposition of the Bosnian cases
 a. Nom: [-oblique, +structural, -superior]
 b. Gen: [+oblique, +structural, -superior]
 c. Dat/Loc: [+oblique, α structural, +superior]
 d. Acc: [-oblique, +structural, -superior]
 e. Instr: [+oblique, -structural, -superior]

The matrices depicted above are based on Halle (1997) and Halle & Vaux (1998). The advantage of their analysis is that it accounts for the syncretism between the Dat and the Loc, namely by neutralizing the feature [structural].[12]

We can now return to the exponents of each syntactic case, and formalize them as a list of VI's. For a reason that will become clearer in the next section, I propose to include a unit CV in the representation of each exponent. Thus, each VI is a complex spell-out made of both segmental and skeletal material, as determined by the typology of spell-out proposed in Bendjaballah & Haiden (2008). The full list is shown below:

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[12] This is not possible with the decomposition that Franks (1995) proposes for Russian.

(18) Syntactic case VI's

    a. Nom: [-obl, +str, -sup] ⇔   zero   d. Acc: [-obl, +str, -sup] ⇔   A
                                    | |
                                  CV   CV

    b. Gen: [+obl, +str, -sup] ⇔   A   e. Instr: [+obl, -str, -sup] ⇔   A.U
                                    | |
                                  CV   CV

    c. Dat/Loc: [+obl, α str, +sup] ⇔   U
                                        |
                                      CV

Each terminal in structure receives the VI corresponding to the feature-matrix associated to it. Note that the Instr has a complex exponent, made by two distinct Elements. As will be shown later, this does not affect the proposal put forth in this paper.

3.3.4 Interim results
In the first part of the paper, I have argued that the final vowel of each noun is a complex object. In particular, I proposed that each category (gender, number and case) spells out as a distinct phonological exponent. As a consequence, each final vowel is the result of a phonological operation that applies independently of the syntactic derivation. Most importantly, I have proposed only one VI per morpho-syntactic category.
    The second part of the paper is devoted to show how nouns are formed in syntax and how the phonological items are put together once terminal nodes have been spelled-out.

4. The syntactic formation of a noun

So far, the discussion has focused on the phonological facets of the analysis. From this section on, I deal with the syntactic aspect of the noun formation in Bosnian. The argumentation is built as follows: first, I discuss a few general issues of the mechanism of noun formation, then I introduce the structures of the Nom nouns and, finally, I show the cases other than Nom.

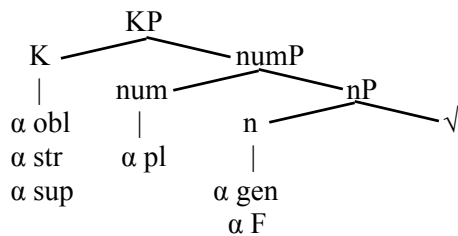### 4.1 The mechanism of noun formation
The formation of a noun proceeds in three stages, as shown below:

(19) Noun formation
    a. The syntactic structure
    b. The spell-out of the terminal nodes
    c. The creation of a complex head

The first stage corresponds to the underlying syntactic structure. For the nouns we are interested in here, I propose the following structure:

(20) Basic structure of a Bosnian noun

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              KP
      K               numP
      |        num            nP
   α obl        |        n          √
   α str       α pl       |
   α sup               α gen
                        α F
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The category-defining head *n* contains the matrix corresponding to gender (cf. Lowenstamm 2008), whereas *num* introduces number features. Finally, a projection *K* is needed to account for the syntactic case (cf. Bittner & Hale 1996).

Terminal nodes are subsequently spelled out. According to the theory of phases (Chomsky 2001), spell-out is triggered as a result of the merger between the head of a phase and a part of the structure. Following Embick (2010:37ff.), I take the head *n* to be the only phase head in the structure above. Once a phase is completed, its complement is phonologically computed. The first spell-out thus includes only the root, whereas the second contains the exponents of the gender, the number and the case.[13] A restrictive condition, known as the Phase Impenetrability Condition (Chomsky 2001, PIC) states that the phonological material is excluded from further phonological computation once it has been spelled out. According to the PIC, the three exponents of gender, number and case can be phonologically computed together precisely because they are spelled-out in the same phase.

According to Embick (2010), once all the terminal nodes have been spelled-out, a complex head is created. For the case at hand, a complex head is shown below:

(21) Basic complex head
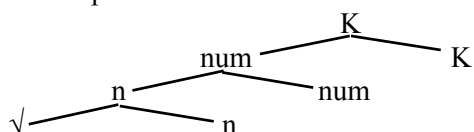
The next subsection, which is devoted to the analysis of the Nom nouns, discusses how the exponents are combined into a well-formed noun.

4.2 Complex heads and linearization of the Nom nouns

Once a complex head has been created, the linearization process applies. This is the stage where all the phonological exponents are combined into a well-formed noun. I start by showing two M and one F noun, and then I propose an analysis for the Neu.
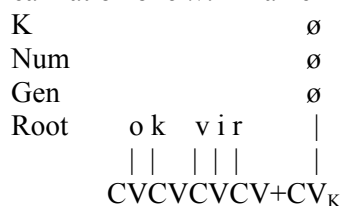
4.2.1 M and F nouns

The M sg Nom nouns display the simplest occurrence of the final vowel, i.e. zero. Below, I show the complex head and the linearization of *okvir* 'frame':

(22) Complex head of *okvir* 'frame' M sg. Nom
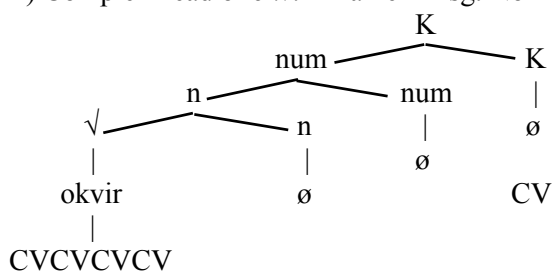
(23) Linearization of *okvir* 'frame' M sg. Nom

The linearization of *okvir* proceeds without problem. However, because all three exponents are segmentally null, (22) cannot indicate the role played by the external CV unit (labeled CV_K). This CV unit, as already mentioned, is part of the representation of the spelled out form of each syntactic case.

The representation of the plural (24 and 25), on the other hand, does bear empirical evidence supporting the external unit. The plural consists of the insertion of the exponent IPL under the node *num*. The external CV unit is the site where the inflectional vowel realizes. Now, why do we need this external position although the root has a free V slot in its template (the underlined position in 23)?

This question has two answers. First, the root is spelled-out in the phase headed by *n*. Thus, when the three exponents under *n*, *num* and *K* are spelled-out, the complement of *n* (the root) cannot be modified (cf. PIC). The

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[13] I assume that D is the head of the phase containing *n*, *num* and *K*.

V position in the template of the root is therefore inaccessible to inflection.[14] The second answer comes from the existence of a few particular nouns, which end in a vowel but are M. These nouns are stress-final and loanwords: *tabure* 'stool', *buro* 'office', etc..[15] Surprisingly, they have a M paradigm: *tabure* sg. Nom, *taburea* sg. Gen, *taburei* pl. Nom, *taburea* pl. Gen, etc..[16] As these nouns end in a vowel, their template has no free V position. Then, an external site is necessary for the final vowel to surface. This is the unit CV_K. The comparison of the linearization of both *okviri* 'frames' and *taburei* 'stools' makes the situation clearer:

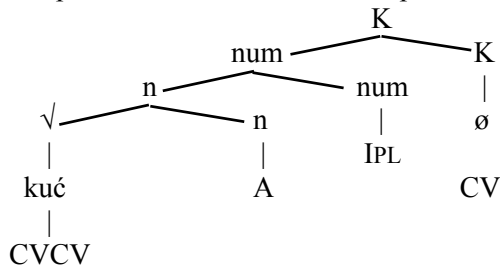(24) Linearization of *okviri* 'frames' M pl. Nom

```
K                      ø
Num                    IPL
Gen                    ø
Root      o k  v i r    |
          | |  | | |    |
          CVCVCVCV+CVK
```

(25) Linearization of *taburei* 'stools' M pl. Nom

```
K                      ø
Num                    IPL
Gen                    ø
Root    t a b u r e     |
        | | | | | |     |
        CVCVCV+CVK
```

As for F nouns, they differ on the phonological nature of the gender exponent. The plural *kuće* 'houses' best illustrate this:

(26) Complex head of *kuće* 'houses' F pl. Nom

```
                    K
          num              K
      n          num        |
  √        n      |    ø
  |        |     IPL
 kuć       A            CV
  |
 CVCV
```

(27) Linearization of *kuće* 'houses' F pl. Nom

```
K              ø
Num            IPL
Gen            A
Root    k u ć   |
        | | |   |
        CVCV+CVK
```

The representations of *okvir* 'frame', *taburei* 'stool' and *kuće* 'houses' follow from the phonological analysis I have proposed in the first part of the paper. The next subsection analyzes the Neu nouns that have been left aside in section 3.3.1, in the discussion of the exponents of gender and number.

4.2.2 Neu nouns
Neu nouns are slightly more complicated than M and F ones. As observed above (cf. section 3.3.1), this is due to two facts: first, the presence of the Element A at both the sg and the pl and, second, the lack of the exponent IPL in the pl.

For the sake of clarity, the data are repeated below:

(28) Neu Nom

	Neu	examples	
a. sg	A + U/I	*selo*	*polje*
b. pl	A	*sela*	*polja*
		'village(s)'	'field(s)'

A peculiar feature of the Neu paradigm is the syncretism between the Nom and the Acc forms. This is a common aspect of the Neu throughout the Indo-European languages. In Bosnian, the Element to account for in the Nom is of the same quality as the exponent of the Acc: both are the Element A. Thus, the syncretism can be formalized by generalizing the presence of the Element A in both the Acc and the Nom. A Neu noun is marked by A in the

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[14] Determining the exact boundaries of a phase and the limits of PIC is an open debate that cannot be discussed in this paper; cf. Lowenstamm (2010), Piggott & Newell (2006) and Scheer (2008) among the most relevant ones.
[15] A loan ending in an unstressed vowel is interpreted as an F noun: *jedna gorila* one.F.sg gorilla.F.sg 'a gorilla'.
[16] They are clearly M: *taj tabure* this.M.sg stool.M.sg 'this stool' vs. *ti taburei* this.M.pl stool.M.pl 'these stools'.
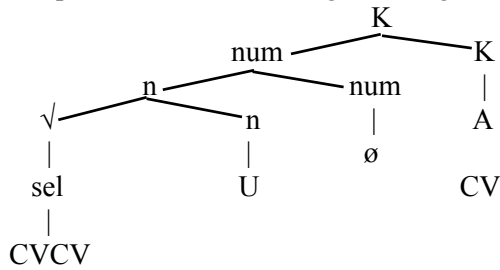
Nom precisely because this exponent replaces the zero proper to the Nom. An operation on feature-matrices must be postulated: technically, this is achieved by manipulating the feature [superior] in the following manner:

(29) Nom-Acc syncretism at Neu
    a. [-oblique, +structural, +*superior*] (Nom) => [-oblique, +structural, -*superior*] (Acc)
    b. a unique VI: Nom/Acc ⇔ A

In (29a), the value of the feature [superior] is inverted in the Acc. This way, A is the unique VI for both Nom and Acc (cf. 29b). The structure and the linearization of a Nom/Acc Neu noun are given below:

(30) Complex head of *selo* 'village' Neu sg Nom/Acc

```
                         K
              num ──────────── K
          n ──────── num       |
       √ ──── n       |    A
       |      |       |    ø
      sel     U       CV
       |
     CVCV
```

(31) Linearization of *selo* 'villages' Neu sg Nom/Acc

```
     K              A
     Num            |
     Gen            U
     Root   s e l   |
            | | |   |
           CVCV+CVK
```
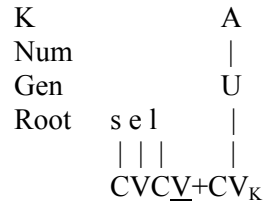
The hypothesis on a unique exponent for the Nom/Acc accounts for the presence of the Element A in both the sg and the pl. However, this does not explain why the pl lacks the regular exponent IPL. In fact, we expect a Neu pl Nom/Acc to be marked by a sequence containing the exponents U (Neu), IPL and A (Nom/Acc), as shown below:

(32) Root gen num   case
      | | | |
     SEL   U   IPL   A   [*sele] 'villages' (grammatical form: *sela*)
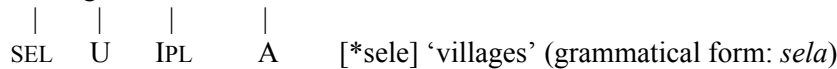
The Theory of Elements predicts that in a five-vowel system, front rounded vowels are prevented from surfacing. Bosnian has five vowels and none of them is a front rounded one. I consider that when Elements U and I co-occur, it's I that surfaces.[17] Thus, the combination between U and IPL in (32) cannot take place and only IPL will fuse with A. In addition, I consider that an allomorphy rule applies. Following Embick (2010, 2011), I take such rules to be post-syntactic and to apply exclusively on the phonological strings. However, they are sensitive to the position of each phonological exponent with regard to the syntactic terminals. The rule I postulate is the following:

(33) Neu Nom/Acc allomorphy
    IPL => zero / ___A_NOM/ACC.

This rule erases IPL in the context of the direct cases, Nom and Acc.
    In this subsection, I showed the formation of a Neu noun. In particular, I focused on the way the phonological exponents combine. This is primarily a phonological matter. The next section is devoted to the formation of the rest of the syntactic cases.

4.3 The cases from Gen to Instr
In this section, I analyze the syntactic cases Gen, Dat/Loc, Acc and Instr. In particular, I focus on the final vowels and the differences between the forms I predict and those that appear on the surface. In the first part, I introduce the predictions that my proposal makes for the quality of final vowels, and in the second part I propose an analysis of those cases where the surface vowel is not the predicted one.

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[17] Note that the Theory of Elements does not predict what Element will surface, rather it does predict that they cannot fuse into [y] or [ø]. Passino (2009) detects an identical phenomenon in Italian: /lupU+I/ = [lupi] 'wolves' instead of [*lupy].

4.3.1 Morpheme sequences

The mechanism depicted in this paper tests the hypothesis that each morphosyntactic category spells-out as a unique phonological exponent. The relation between a phonological sequence and a given category is conceived of as a one-to-one relation. As a consequence, the VI's established for gender, number and syntactic case apply everywhere in the noun paradigm (that shown in 1).

Given a root, and knowing its gender, we can then build a grill containing three-exponent sequences. This is shown below:

(34) Predicted morpheme sequences

	group 1 M		group 2 F		group 3 NEU	
	sg	pl	sg	pl	sg	pl
a. Nom	ø.ø.ø	ø.Ipl.ø	*A*.ø.ø	*A*.Ipl.ø	*U*.ø.A	*U*.Ipl.A
b. Gen	ø.ø.A	ø.Ipl.A	*A*.ø.A	*A*.Ipl.A	*U*.ø.A	*U*.Ipl.A
c. Dat/Loc	ø.ø.U	ø.Ipl.U	*A*.ø.U	*A*.Ipl.U	*U*.ø.U	*U*.Ipl.U
d. Acc	ø.ø.A	ø.Ipl.A	*A*.ø.A	*A*.Ipl.A	*U*.ø.A	*U*.Ipl.A
f. Instr	ø.ø.[A.U]	ø.Ipl.[A.U]	*A*.ø.[A.U]	*A*.Ipl.[A.U]	*U*.ø.[A.U]	*U*.Ipl.[A.U]

Thirty different sequences must be accounted for. The first line, corresponding to the Nom, has already been analyzed, cf. the previous section. Each additional line contains the data of the other syntactic cases. The color of the cell points to the degree of correctness of the analysis. White cells indicate that the predictions are borne out: the sequence shown in the table above surfaces as the correct surface vowel. These are mainly the sg patterns (with the exception of the Gen, Dat/Loc and Acc in the F) with the addition of the Nom and four instances among six of the Acc. On the other hand, colored cells contain those sequences that are not predicted by the current system. These include mainly plurals and Neu sg. Gen. The Gen (cf. 34b) seems to be the most problematic case for our analysis.[18]

Consider the degree of grey of each cell. Differences in shading point to a particular situation, which becomes clearer if we observe the attested final vowels corresponding to each colored cell:

(35) Attested final vowels

	M sg	M pl	F sg	F pl	Neu sg	Neu pl
a. Nom						A
b. Gen		A	A.I	A	A	A
c. Dat/Loc		IPL	I	A		IPL
d. Acc			U			A
e. Instr		IPL		A		IPL

Two observations are crucial. On the one hand, light-grey cells contain the final vowel [i] and they are all in the pl. I consider that [i] corresponds to the exponent IPL. On the other hand, dark-grey cells contain the vowel [a] in most cases. Observe that the majority of dark-grey cells include the Element A in their underlying sequences (cf. 34).

In the next sub-section, I will propose a set of allomorphy rules that formalize the behavior of the deviating final vowels.

4.3.2 Phonology vs. allomorphy

Light grey cells contain only the Dat/Loc and the Instr plurals of both the M and the Neu. Consider that the Dat/Loc and the Instr can be merged in other Indo-European languages, e.g. in Ancient Greek, and that the same fact holds for the M and the Neu (cf. Modern Romance Languages). Thus, the fact that, in Bosnian, the Dat/Loc

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[18] The shaded cells involve precisely the most marked categories in the system. The Gen, the Dat/Loc and the Instr are marked since they are [+oblique], whereas pl is [+pl] and F is [+gender,+F]. Cf. Calabrese (2010).

and the Instr plurals of the [-F] genders form a unique group with respect to their inflectional ending is not surprising. As for the reason why only the Element I surfaces, the solution must be found in the Theory of Elements itself.

Consider the underlying sequences of each light-grey cell:

(36) Underlying sequences (light grey cells)
    a. M pl Dat/Loc: zero.IPL.U => [i]   c. Neu pl Dat/Loc: U.IPL.U => [i]
    b. M pl Instr: zero.IPL.[A.U] => [i]   d. Neu pl Instr: U.IPL.[A.U] => [i]

As already mentioned above in section 4.2.2, the Elements U and I cannot undergo fusion in a five-vowel system such as the Bosnian one. Only one Element surfaces. Again, this is I.

Unlikely cases in (36), dark-grey cells are slightly more complicated. We have already observed that in the majority of these cases, the surface vowel is [a]. The only exceptions are the Gen, the Dat/Loc and the Acc of the F sg paradigm. These sequences display an additional problem: the Element that surfaces is not there underlyingly:

(37) Problematic sequences.
    a. F sg Gen: A.zero.A *=> [e] (recall: [a]=/A.I/)   c. F sg Instr: A.zero.A *=> [u]
    b. F sg Dat/Loc: A.zero.U *=> [i]

I propose a set of allomorphy rules like the one applying to the Neu Nom/Acc, cf. (33). The problematic cases in (37) can then be solved by the three rules below:

(38) Problematic sequences allomorphy rules
    a. Dat/Loc => I / √___A$_F$.   c. Element => zero / √___Dat/Loc-Acc.
    b. Acc => U / √___ A$_F$.

Rules (38a) and (38b) enforce Dat/Loc and Acc to surface as I and U, respectively (instead of U and A). This happens only when their exponents are adjacent to both the root and the exponent of the F gender. Rule (38c) erases any Element being between the root and either the Dat/Loc or the Acc.

In all the other dark-grey cells, the surfacing Element is [a] and this is there underlyingly (cf. 34 above). The Gen being the most complex case, I postulate the following two rules:

(39) Gen allomorphy
    a. Element => zero / ___A$_{GEN}$.   b. zero => I / √$_{F/sg}$___A$_{GEN}$.

Rule (39a) erases any Element adjacent to the exponent of the Gen. Note that the fusion between U and I is not possible, thus only the Element I surfaces in the Gen Neu pl. Then rule (39a) erases this I as it precedes A$_{GEN}$. On the other hand, rule (39b) inserts I in the Gen F sg. The former rule explains the Gen M pl, the Gen F pl, the Gen Neu sg and the Gen Neu pl. The latter formalizes the presence of an additional Element in the Gen F sg.

In addition to (38) and (39), we need the following set of rules. These apply to the F pl Dat/Loc and Instr:

(40) F pl. Dat/Loc and Instr allomorphy:
    a. IPL.U => zero / A$_F$___Dat/Loc and Instr.   b. IPL.[A.U] => zero / A$_F$___Dat/Loc and Instr.

The two rules above account for the presence of [a] in the F of both the Dat/Loc pl and the Instr pl.

An additional allomorphy rule is necessary. Recall that the condition for such rules to apply consists of the adjacency between the item that triggers the allomorphy and the one that undergoes it. Consider the M sg Acc. As just mentioned in ft 5 above, two different inflectional endings occur in this case. When the referent is animate, the final vowel is [a]; on the other hand, when the referent is inanimate, the Acc is zero. I propose that this situation is due to an allomorphy rule:

(41) M sg Nom allomorphy

$A_{ACC} =>$ zero $/ \sqrt{}_{[inanimate]}\_\_\_\_$

In addition to the rule (41), an adjacency condition must be satisfied. This condition obliges the root to stay close to the exponent of the Acc for the allomorphy rule to apply. The formalization of this condition is shown below:

(42) $\sqrt{}\hat{}K$

In Embick's (2010, 2011) terms, the adjacency is satisfied insofar as no intervening object appears between the root and the allomorphic exponent. When the exponent IPL is spelled-out, condition (42) cannot be satisfied. As IPL is under the node *num*, it is precisely between the root and the material spelled-out by *K*.[19] The prediction is that the pl never displays the Acc allomorphy. Indeed, M pl Acc is always [e] and no exception exists.

5. Conclusion

In this paper, I proposed a novel analysis of the final vowel of the Bosnian nouns. I showed that this vowel is always formed by the combination of three phonological objects. Each one of these represents the unique spell-out of a particular gender, number or syntactic case. The phonological nature of these items is restricted to three basic Elements: A, U and I with the addition of zero.

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[19] Recall that M gender is marked by zero.

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