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Serbo-Croatian secondary imperfectivisers consist of theme vowels

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ABSTRACT

Building on the proposal in Marković (2018: p.77) that Serbo-Croatian secondary imperfectivisers, such as iva and ava, are in fact bimorphemic, we develop an autosegmental analysis of these morphemes and their allomorphs, showing that they consist of two theme vowels, *i-a* and *a-a*, respectively. We show that both [ʋ] and [j] in these affixes behave as glides and that [ʋ] in iva and ava is the exponent of floating features affiliated with the theme vowel *a*, whose underlying representation is /$^{\text{ʋ}}$a/. The theme vowel *i* is shown to consist solely of the feature [+high]. These autosegmental representations allow us to explain the allomorphy of the two productive secondary imperfectivisers in Serbo-Croatian, but also the less productive apophony patterns. In addition, the autosegmental analysis of the theme vowels allows us to reduce the number of the theme vowel classes in Serbo-Croatian from 13 to 10.

KEYWORDS Serbo-Croatian · secondary imperfectivisation · theme vowels · autosegmental representations

1 INTRODUCTION

Secondary imperfectivisation is typically defined as a process whereby a verb previously rendered perfective (in Slavic, typically by prefixation) becomes imperfectivised (in Slavic typically by suffixation).

Table 1: The typical three step derivation of secondary imperfectives

'simplex' IPFV	prefixed PFV	secondary IPFV
pit-a-ti 'ask'	is-pit-a-ti 'examine'	is-pit-iva-ti 'examine'
grad-i-ti 'build'	pre-grad-i-ti 'partition'	pre-gradz̨-iva-ti 'partition'
pis-a-ti 'write'	pre-pis-a-ti 'copy'	pre-pis-iva-ti 'copy'
tʃit-a-ti 'read'	u-tʃit-a-ti 'project'	u-tʃit-ava-ti 'project'
prazn-i-ti 'empty'	u-prazn-i-ti 'vacate'	u-praʒɲ-ava-ti 'vacate'
or-a-ti 'plough'	pre-or-a-ti 'rummage through'	pre-or-ava-ti 'rummage through'

Table 1 contains examples from Bosnian/Croatian/Montenegrin/Serbian (BCMS) of the typical three-verb chain, whereby the first member is an imperfective verb which has the minimal structure root+theme vowel(TV)+inflectional morphology (in this case the INF morpheme *-ti*). The second member is a prefixed counterpart, which in triples of this kind typically has a shifted meaning with respect to the base verb. The third member is a secondary imperfective verb, which keeps the meaning of the perfective verb, but is imperfective.

The underlined affixes in Table 1 are so-called secondary imperfectivisers (SIs). The exemplified SIs, /iva/ and /ava/, are also the two most frequent SIs in BCMS. There are pressing arguments against the simplest possible analysis implied by our representation in Table 1, i.e. against assuming morphemes /iva/ and /ava/ which express the feature

[(SEC)IMP]. Already at the level of surface forms, the two affixes do not always surface as [iva] and [ava], but have more complex exponence patterns, which complicate their analysis. First, both affixes sometimes co-occur with palatalisation of the preceding consonant, as attested by the roots /grad/ and /prazn/, which surface as [gradʒ] and [praʒɲ] in the examples in Table 1. This led authors of traditional analyses to postulate four affixes /iva/, /jiva/, /ava/ and /java/ (see, e.g., Babić 2002: p.526). We will return to the palatalising feature in §5, where we will argue that the palatalising feature is a remnant of the theme vowel of the perfective verb. Second, and more importantly, the sequence *iva* does not surface as such in all forms of secondary imperfectives. Rather, it shows up as *uje* in the present-tense forms (and several related forms), as shown in Table 2.

Table 2: iva~uje alternation in secondary imperfectives

INF	PRS.1PL	gloss
is-pit-iva-ti	is-pit-uje-mo	'examine'
pre-gradʒ-iva-ti	pre-gradʒ-uje-mo	'partition'

The allomorphy pattern shown in Table 2 is not just an argument for assuming two allomorphs of the morpheme iva. Rather, the two allomorphs iva~uje tellingly contain the exponents of the theme vowel a/je, which is widely attested in other verbs and illustrated by, e.g., the verb pis-a-ti~piʃ-e-mo (from underlying /pis-je-mo/) 'to write~we write'.[1] Segmenting iva~uje as iv-a~u-je is therefore a plausible next step. This analysis straightforwardly extends to ava~ava, which can be segmented as av-a~av-a, *a/a* being the most common theme vowel class in the language. Such an analysis has been proposed by Quaglia et al. (2022), who argue more generally that Slavic SIs can be viewed as light verbs, contributing their own TV, which surfaces preceding inflectional morphology. This is based on the observation that "secondary imperfectivisers, at least in Slovenian and BCMS, end in a theme vowel".[2]

The same observation has been made by Marković (2018: p.78) for several common SIs and a dozen other verbal affixes in BCMS. Where the analyses in Quaglia et al. (2022) and Marković (2018) differ is the status of the remaining sequences iv~u and av~av. Quaglia et al. (2022) assume that these are bound roots which can display phonologically unpredictable root allomorphy, comparable to that in sl-a-ti~ʃaʎ-e-mo (from underlying /ʃal-je-mo/) 'to send~we send' or kl-a-ti~koʎ-e-mo (from underlying /kol-je-mo/) 'to slaughter~we slaughter'. Marković (2018), on the other hand, assumes underlying representations of iva~uje and ava~ava which only consist of vowels, i.e. i-a~u-e and a-a~a-a respectively. He further assumes that the segments [v] and [j] are inserted by a morphologised process which removes hiatus.

In this paper, we present a detailed autosegmental analysis of the two most frequent SIs in BCMS iv-a~u-je and av-a~av-a. Our analysis follows Quaglia et al. (2022) and Marković (2018) in assuming that SIs are bimorphemic, but goes a step further, in arguing that they consist of multiple TVs. Specifically, we argue that iv-a~u-je corresponds to the sequence of the TV *i* and the TV *a/je*, whereas av-a~av-a consists of two instances of the TV *a*. As for the consonant [v], we show that it is the exponent of floating features on the TVs *a/a* and *a/je*, whose underlying representations are /^{v}a/ and /^{v}a~^{v}je/, respectively. The TV *i* is shown to consist solely of the specification [+high] linked to a mora.

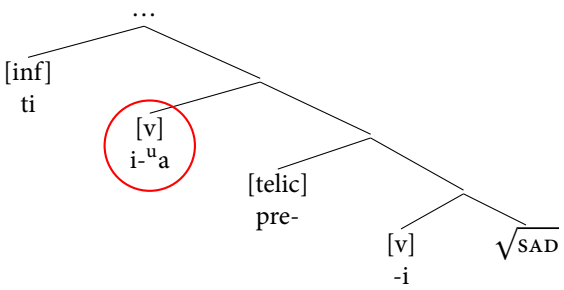
Our structural assumptions are the following. Taking the perspective of Distributed Morphology (Halle & Marantz 1993), and with much previous literature (e.g. Svenonius 2004, Fábregas 2017, and in particular Milosavljević & Arsenijević 2022 for BCMS), we assume that theme vowels realise the verbal category head. Considering that we

[1] As will be discussed in detail in §2, BCMS theme vowel classes are established considering two forms, in this case the infinitive and the present tense.

[2] An analysis of the vowels preceding inflection as TVs is also proposed for Russian in Gribanova (2015).

analyse SIs as a complex of two theme vowels, it follows that SIs too realise the verbal category feature, specifically, the one which derives a verb from another verb. The relevant structure is in Figure (1) for the verb form [presadzi̯ʊati] 'transplant.IPFV.INF', where the SI iʊa corresponds to the higher verbal projection, whereas the lower theme vowel *i* (realised as a palatalising feature) corresponds to the lower verbal projection. The aspect interpetation of the full structure is fully in line with Arsenijević (2018), who analyses traditional imperfectivity as the interpretation of a bare vP, unspecified for aspect. SIs reverbalise a perfective verb to neutralise the perfective restriction, while keeping the conceptual content contributed by the perfectiviser (typically a prefix).

(1) Structural representation: SIs as deverbal verbalisers



pre-sad-i-i-va-ti [presadzi̯ʊati]
over-plant-TV-TV-TV-INF 'transplant.IPFV.INF'

The rest of this paper is organised as follows. In §2, we present the TV classes and the SIs in BCMS, dedicating special attention to the two most frequent SIs, iʊa~uje and aʊa~aʊa. §3 presents our general analysis of SIs in BCMS as sequences of TVs. We show that apart from the two sequences which lead to the two most frequent SIs (*i+a/je* and *a+a*), other combinations of these three TVs are attested in smaller domains (e.g., *a+a/je* and *i+a*). §4 focuses on the autosegmental representations, especially on the floating element /ᵘ/, which is part of the lexical representation of the TVs *a/a* and *a/je*, and surfaces either as the consonant [ʊ], e.g. in the SI a-ʊ-a~a-ʊ-a, or as the vowel [u], e.g., in the present-tense allomorph of the SI i-ʊ-a~u̲-je. As we show in this section, one further welcome result of the proposed analysis is that it allows analysing some 'simplex' verbs which were previously taken to justify separate theme-vowel classes as having the TV *a/je*, e.g. ko-ʊa-ti~ku-je-mo 'to forge~we forge', previously analysed as having the TV *ova/uje* or bɅu-ʊa-ti~bɅu-je-mo 'to vomit~we vomit', previously analysed as having the theme sequence *va/je*. §5 turns to the issue of the palatalising feature preceding iʊa~uje and aʊa~aʊa, arguing that this feature originates from the original TV of the perfective verb and is not part of the representation of the SI itself. In §6 we turn to the syntactic and semantic rationale behind the proposed analysis of secondary imperfectivisation as the addition of multiple TVs. §7 concludes this paper.

2 THEME VOWEL CLASSES AND SECONDARY IMPERFECTIVISERS IN BCMS

2.1 OVERVIEWING THEME-VOWEL CLASSES IN BCMS

A prominent feature of the morphology of a range of languages, best described for the Indo-European family, are formatives occurring at the edge of the stem before inflection. These formatives, which show a more systematic presence in the verbal domain, are referred to as theme vowels, or thematic vowels. They are traditionally described as forming the verbal (or nominal, adjectival etc.) stem, which then combines with inflection or enters further derivation. The same language typically has different theme vowels within a category, and all lexemes displaying the same theme vowel are referred to as a theme-vowel class (see Oltra-Massuet 2020 for an overview and Milosavljević &

Arsenijević 2022 for a recent analysis of BCMS theme vowels).

As already briefly mentioned above, BCMS verbal theme-vowel classes refer to two exponents of theme vowels, the one encountered in the infinitive and the other in the present tense. BCMS verbs are traditionally described as forming two verbal stems, the infinitive stem and the present stem. For instance, for the verb pis-a-ti~piʃ-e-mo (from underlying /pis-je-mo/) 'to write~we write' the root is pis, the infinitive stem is pis-a whereas the present stem is piʃ-e (from /pis-je/).

2.1.1 INITIAL OVERVIEW OF THE THEME VOWEL CLASSES

An initial overview of the verbal theme-vowel classes in BCMS is provided in Table 3. The pairs of TVs presented are based on the sequences that precede inflection in the infinitive and the present tense forms. The size of each class (N (%)) is based on 5300 verbs from the Database of Western South Slavic Verbal System (Arsenijević et al. to appear).[3,4]

The three TV classes in gray (*iva/uje*, *ova/uje* and *va/je*) will be removed from the list and included in the TV class *a/je* in §4.

2.1.2 FORM OF THEME VOWELS AND OVERLAP WITH DERIVATIONAL MORPHEMES

As previewed above, the theme-vowel classes in Table 3 are based on a surface-oriented comparison between the infinitive and the present-tense forms. Stem-final vowels, as well as all other material alternating between the two forms were taken to be the exponents of theme vowels. Six classes have clearly vocalic exponents, which either alternate between the infinitive and the present tense (*e/i*, *a/i*, *a/e*) or have the same vowel in both forms (*a/a*, *i/i*, *e/e*).[5] The class nu/ne could have been modified into a purely vocalic class *u/e*, but we refrained from doing so because *u/e* is not attested without the preceding [n]. Classes ∅/*e* and ∅/*ne* have a zero in the position where other theme vowel classes have vowel material. The class *a/je* has vocalic exponents, but the present-tense theme vowel has an additional palatalising element realised on the preceding consonant. The remaining three theme-vowel classes, *iva/uje*, *ova/uje* and *va/je* (which are the three classes we will dispense with in this paper) also have a [ʊ] as part of the infinitive theme vowel and two of these classes have disyllabic exponents (*iva/uje* and *ova/uje*).

As previewed in §1, we will eventually argue for an analysis where SIs iʊa~uje and aʊa~aʊa contain sequences of theme vowels. In the preliminary list presented in Table 3, theme vowels were only identified in the position preceding inflection. Moreover, traditional derivational affixes were analysed as containing theme vowel only in cases where such an analysis did not usher in any additional phonological complications. In the few cases where derivational affixes could not be analysed as containing independently motivated theme vowels without any further assumptions, such affixes were added to the list of the theme vowel for the time being. This means that elements which have similar functions (e.g., SIs) are not all treated on a par. For instance, examples of the class *a/a* include, among others, the SI aʊ-a~aʊ-a and the derivational affix ir-a~ir-a. By the same token, the derivational affix is-a~iʃ-e has been included under the theme-vowel class *a/je*. On the other hand, the other SI discussed in the previous section, iʊa~uje, is still listed as a separate class, since its inclusion into the class *a/je* is less straightforward, because productive phonology cannot give an account of the iʊ~u altenation without some additional assumptions (to which we will turn in §4).

[3]While the Database has yet to be published in its entirety, the first two parts are available (i.e., on inflection in Marušič et al. (2022) and on derivation in Milosavljević et al. (2023)).

[4]The segments between brackets are present in some of the regional variants but not in others. The Ekavian theme vowel classes *e/i* and *e/e* have Ijekavian correspondents *je/i* and *je/ije*, whereby *je* and *ije* are exponent of the yat phoneme, so the more precise names would be *ě/i* and *ě/ě*.

[5]In this discussion we are focusing on the Ekavian versions of the theme vowel classes for simplicity.

Table 3: Theme vowel classes

TV class	N (%)	INF	PRS.1PL	GLOSS
a/a	1702 (32.1%)	pit-a-ti	pit-a-mo	'ask'
		pro-ʊ(j)er-aʊ-a-ti	pro-ʊ(j)er-aʊ-a-mo	'check'
		domin-ir-a-ti	domin-ir-a-mo	'dominate'
i/i	1601 (30.2%)	vis-i-ti	vis-i-mo	'hang'
		grad-i-ti	grad-i-mo	'build'
		od-laz-i-ti	od-laz-i-mo	'leave'
a/je	437 (8.2%)	plak-a-ti	platʃ-e-mo	'cry'
			(< /plak-je-mo/)	
		trep-t-a-ti	trep-tɕ-e-mo	'blink'
			(< /trep-t-je-mo/)	
		formul-is-a-ti	formul-iʃ-e-mo	'formulate'
			(< /formul-is-je-mo/)	
iva/uje	324 (6.1%)	is-pit-iva-ti	is-pit-uje-mo	'question'
		za-braɲ-iva-ti	za-braɲ-uje-mo	'forbid'
		do-d(j)eʎ-iva-ti	do-d(j)eʎ-uje-mo	'assign'
Ø/e	298 (5.6%)	pas-Ø-ti	pas-e-mo	'graze'
		bos-Ø-ti	bod-e-mo	'stab'
		(/bod-Ø-ti/)		
		pi-Ø-ti	pij-e-mo	'drink'
		tʃu-Ø-ti	tʃuj-e-mo	'hear'
		do-n(ij)e-Ø-ti	do-nes-e-mo	'bring'
		u-mr(ij)e-Ø-ti	u-mr-e-mo	'die'
nu/ne	258 (4.9%)	gur-nu-ti	gur-ne-mo	'push'
		skok-nu-ti	skok-ne-mo	'jump'
		bri-nu-ti	bri-ne-mo	'worry'
ova/uje	247 (4.7%)	k-oʊa-ti	k-uje-mo	'mint'
		ʊ(j)er-oʊa-ti	ʊ(j)er-uje-mo	'believe'
		rezult-oʊa-ti	rezult-uje-mo	'result'
(j)e/i	184 (3.5%)	gor-(j)e-ti	gor-i-mo	'burn'
		tsrven-(j)e-ti	tsrven-i-mo	'become red'
		zr-e-ti	zr-i-mo	'ripen'
Ø/ne	124 (2.3%)	sta-Ø-ti	sta-ne-mo	'stop'
		pas-Ø-ti	pad-ne-mo	'fall'
		(/pad-Ø-ti/)		
a/i	62 (1.2%)	struj-a-ti	struj-i-mo	'flow'
		leʒ-a-ti	leʒ-i-mo	'lie'
		za-sp-a-ti	za-sp-i-mo	'fall asleep'
va/je	21 (0.4%)	da-ʊa-ti	da-je-mo	'give'
		sa-zna-ʊa-ti	sa-zna-je-mo	'find out'
a/e	19 (0.4%)	(x)rʊ-a-ti	(x)rʊ-e-mo	'wrestle'
		greb-a-ti	greb-e-mo	'scratch'
(j)e/(ij)e	17 (0.3%)	sm-(j)e-ti	sm-(ij)e-mo	'be permitted'
		pro-xt-(j)e-ti	pro-xt-(ij)e-mo	'desire'

The reason for using surface-oriented criteria for our initial inventory of theme-vowel classes lies in the fact that a strict distinction between TVs and verbal (derivational) suffixes cannot be straightforwardly drawn based on the function of the relevant formatives. For instance, while examples with the SI aʊa~aʊa make it plausible to see secondary imperfectivisation as the domain of derivational affixes, there are cases where secondary imperfectivisation is (at least prima facie) effected just by the theme vowel (e.g., in na-

pas-a-ti 'graze.IPFV' from na-pas-Ø-ti 'graze.PFV'). The same is true of morphemes used for loanword integration. On the one hand, there are integration morphemes which are never considered TVs, e.g., *ir(a)* in ʃut-ira-ti 'kick' (based on the English *shoot*) and dʒog-ira-ti 'jog', but the same function can be performed by a single theme vowel, e.g., ʃut-a-ti 'kick' and print-a-ti 'print'. Our analysis of SIs proposed in §3 and 4 will not resolve all aspects of the vexing issue of the relation between theme vowels and derivational affixes, but it will simplify the system considerably. First, we will remove from the list of theme vowels the SI iva~uje, which is now the only theme vowel that *always* has the function of a secondary imperfectiviser. Second, our analysis, in which secondary imperfectivisation amounts to reverbalisation, offers a straightforward account of cases where theme vowels appear to effect secondary imperfectivisation, such as na-pas-a-ti 'graze.IPFV' (from na-pas-Ø-ti 'graze.PFV') above. We will show that na-pas-a-ti actually has (at least) two theme vowels: na-pas-Ø-a-ti 'graze.PFV'.

Before presenting the inventory of SIs in §2.2, §2.1.3 and §2.1.4 we discuss the issues of classifying "simplex" verbs into theme-vowel classes.

2.1.3 BOUNDARIES AND OVERLAPS BETWEEN THEME VOWEL CLASSES

As described above, separate theme-vowel classes were assumed in cases where inclusion into existing classes would require phonological processes which cannot be independently justified. Furthermore, we tried to avoid assuming TV classes restricted to particular phonological environments, and attempted to subsume such cases under larger classes and derive the differences in exponents phonologically. For instance, verbs like pi-Ø-ti~pi-je-mo 'to drink~we drink' or tʃu-Ø-ti~tʃu-je-mo 'to hear~we hear' could be taken to justify the introduction of a separate TV class Ø/*je* (alongside the well established class Ø/*e*). However, this Ø/*je* class would be strangely restricted to bases which end in a vowel, since there are no verbs of this type with consonant-final bases, e.g., there are no verbs like pas-Ø-ti~paʃ-e-mo (comparable to the actual verb pas-Ø-ti~pas-e-mo 'to graze~we graze'). On the other hand, on this analysis, the class Ø/*e* would be strangely restricted to members with a consonant-final base, as there are no verbs of the type pi-Ø-ti~pi-e-mo or tʃu-Ø-ti~tʃu-e-mo (so without the extra glide). In sum, we have pressing evidence for including verbs like pi-Ø-ti~pi-je-mo 'to drink~we drink' or tʃu-Ø-ti~tʃu-je-mo 'to hear~we hear' in the class Ø/*e* and assuming that the glide arises due to a productive process. We will return to the exact analysis of these classes in §4.

An apparently comparable case arises in a small class of verbs which justify the TV class *a/e* (along with the well established class *a/je*), because their present-tense forms lack the expected palatalisation/iotation of the root-final consonant. Our database comprises 4 such roots (attested in 19 verbs): greb-a-ti~greb-e-mo (*grebʎemo) 'to scratch~we scratch', (x)rʊ-a-ti~(x)rʊ-e-mo (*(x)rʊʎemo) 'to wrestle~we wrestle', jeb-a-ti~jeb-e-mo (*jebʎemo) 'to fuck~we fuck' and zʊ-a-ti~zoʊ-e-mo (*zoʊʎemo) 'to call~we call'. In deciding how to classify these four roots, the first question we asked is whether there are uncontroversial *a/je* verbs with labial-final bases, which would constitute minimal pairs with the verbs just listed. Our database contains two such verbs: kap-a-ti~kap-ʎe-mo 'to drip~we drip' and xram-a-ti~xram-ʎe-mo 'to limp~we limp'. The database contains no verbs in -bati or -ʊati which predominantly belong to the class *a/je* (so no perfect minimal pairs can be found with the *a/e* verbs), but there are a significant number of such verbs that primarily fall into class *a/a*, while also having attested forms in the class *a/je*. Examples of such verbs are gib-a-ti~gib-a-mo (but gibʎemo is also attested) 'to move~we move' and pri-zivʊ-a-ti~pri-zivʊ-a-mo (but prizivʎemo is also attested) 'to invoke~we invoke'. We take the existence of such verbs as an argument for singling out the four verbs which lack palatalisation and keeping the *a/e* class. Note, however, that this TV class is extremely small and restricted to roots ending in [ʊ] or [b], which is quite an unexpected class. One further disadvantage of having both *a/e* and *a/je* lies in the fact that many verbs become in principle ambiguous between the two classes (e.g. any verb

ending in a consonant that does not palatalise receives the same surface realisation with the *a/e* as with the *a/je* theme). We address the issue of ambiguity between theme vowel classes in the next section.

2.1.4 RESOLVING STRUCTURAL AMBIGUITIES BETWEEN THEME VOWEL CLASSES

In the system described in Table 3, there are many cases where the exponents of one TV class contain those of another class. For instance, it is not only the case that the exponents of the TV combination *iva/uje* contain those of the TV combination *a/je*, but also the latter contain those of the TV combination *a/e*, which in turn contain those of the TV combination ∅/*e*.

Such a constellation has the consequence that some verbs will remain structurally ambiguous and can be classified as belonging to multiple classes. One example comes from the containment relation between the class *a/je* and the class *a/e*, discussed in the previous section. While a verb like pis-a-ti~piʃ-e-mo (from underlying /pis-je-mo/) 'to write~we write' can be uniquivocally assigned to the class *a/je* (because otherwise the s~ʃ alternation would be unmotivated), a verb like or-a-ti~or-e-mo 'to plough~we plough' can be assigned to either of the two classes, because the surface form [or-e-mo] would result from both underlying /or-e-mo/ and /or-je-mo/. The situation becomes even more ambiguous in the case of verbs which display root allomorphy. For instance, slati~ʃaɾ̂emo 'to send~we send', can be analysed either as belonging to the TV class ∅/e (implying the segmentation sla-∅-ti~ʃaɾ̂-e-mo) or to the TV class *a/e* (implying the segmentation sl-a-ti~ʃaɾ̂-e-mo) or to the TV class *a/je* (implying the segmentation sl-a-ti~ʃaɾ̂-e-mo, the latter deriving from the underlying /ʃal-je-mo/).

While some ambiguous cases can only be resolved by arbitrary choices, in many cases prosodic generalisations which hold of unambiguous cases help us decide between the different analyses. For instance, all verbs in the ∅/*e* class which display unpredictable root allomorphy have a long root-final vowel in the infinitive (e.g. uze:-∅-ti~uzm-e:-mo 'to take~we take' or don(ij)e:-∅-ti~dones-e:-mo 'to bring~we bring'), so slati~ʃaɾ̂emo would be an outlier in this class. In deciding between the classes *a/e* and *a/je*, the distribution of the High tone is instrumental. All unambiguous members of the TV class *a/e* have the High tone on the TV (e.g. ˈgreb-á-ti~ˈgreb-é:-mo 'to scratch~we scratch') , potentially also justifying terming this class á/é. On the other hand, in all the unambiguous verbs of the class *a/je* High tone falls on the syllable preceding the TV *je* (e.g. in ˈtes-á-ti~ˈtéʃ-e:-mo 'to carve~we carve'). Now given that the prosodic patterns of both ˈor-á-ti~ˈór-e:-mo 'to plough~we plough' and ˈsláti~ˈʃáɾ̂e:mo 'to send~we send' is compatible with the unambiguous cases of the *a/je* class but not with those of the *a/e* class, we can assign them to the *a/je* class. As announced in the previous subsection, the *a/je* class will grow further to include 3 classes which are now classified as separate TV classes. We will return to a more sophisticated analysis of the exponents of TVs in §4.

2.2 OVERVIEWING SECONDARY16:00 IMPERFECTIVISERS IN BCMS

In this subsection, we overview the secondary imprefectivisers (SIs) in BCMS. We begin the overview with the two most productive suffixes, iva~uje (accounting for 16% of derived imperfective verbs in our database) and ava~ava (13% of derived imperfectives), illustrated in Tables 4 and 5, respectively. Beside being by far the most frequent SIs in our database, iva~uje and ava~ava are the only SIs in BCMS that combine with perfective verbs from at least five different TV classes. More precisely, ava~ava is attested with 8 TV classes in our database, while iva~uje is attested with 5 TV classes.

The remaining SIs attested in BCMS are much less frequent and productive. Moreover, all of them pose analytical problems of exponence because they involve not only concatenative segmental material and the occasional palatalising feature, but also a change of the quantity or quality of the root vowel. The goal of the following overview is to show what

Table 4: Secondary ʌʊa-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'upload'	a/a	u-tʃit-a-ti	u-tʃit-a-mo	u-tʃit-ʌʊ-a-ti	u-tʃit-ʌʊ-a-mo
'acknowledge'	i/i	u-ʊaʒ-i-ti	u-ʊaʒ-i-mo	u-ʊaʒ-ʌʊ-a-ti	u-vaʒ-ʌv-a-mo
'carve out'	a/je	is-tes-a-ti	is-teʃ-e-mo	is-tes-ʌʊ-a-ti	is-tes-ʌʊ-a-mo
'submit'	nu/ne	pod-ʊrg-nu-ti	pod-ʊrg-ne-mo	pod-ʊrg-ʌʊ-a-ti	pod-ʊrg-ʌʊ-a-mo
'survive'	(j)e/i	pre-ʒiʊ-(j)e-ti	pre-ʒiʊ-i-mo	pre-ʒiʊʎ-ʌʊ-a-ti	pre-ʒiʊʎ-ʌʊ-a-mo
'save'	∅/e	spas-∅-ti	spas-e-mo	spas-ʌʊ-a-ti	spas-ʌʊ-a-mo
'go west'	∅/ne	tsr-∅-tɕi (/tsk-∅-ti/)	tsrk-ne-mo	tsrk-ʌʊ-a-ti	tsrk-ʌʊ-a-mo
'keep'	a/i	za-drʒ-a-ti	za-drʒ-i-mo	za-drʒ-ʌʊ-a-ti	za-drʒ-ʌʊ-a-mo

Table 5: Secondary iʊa-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'examine'	a/a	is-pit-a-ti	is-pit-a-mo	is-pit-iʊ-a-ti	is-pit-u-je-mo
'strengthen'	i/i	o-snaʒ-i-ti	o-snaʒ-i-mo	o-snɑʒ-iʊ-a-ti	o-snaʒ-u-je-mo
'copy'	a/je	pre-pis-a-ti	pre-piʃ-e-mo	pre-pis-iʊ-a-ti	pre-pis-u-je-mo
'wink'	nu/ne	na-mig-nu-ti	na-mig-ne-mo	na-mig-iʊ-a-ti	na-mig-u-je-mo
'deserve'	(j)e/i	za-vr(ij)ed-(j)e-ti	za-vr(ij)ed-i-mo	za-vredz̩-iʊ-a-ti	za-vredz̩-u-je-mo

kind of SIs are encountered but also, when patterns seem to target the same environment, to distinguish between major and minor patterns.

Since lengthening of a vowel from the root/base is part of the exponent of some of the SIs, from now on vowel length will be marked in our examples. Note that all present-tense forms have a long TV, which is a consequence of the present-tense morpheme, not in focus here. Moreover, while the High tone will not be targeted by our analysis, we will mark it (using the IPA diacritic, e.g., tá) in a selection of cases, especially when it is useful to show that examples grouped together also have the same prosodic pattern.

One important feature shared by all the less frequent SIs is that, just like iʊa~uje and ʌʊa~ʌʊa, they all belong to the TV classes *a/a* and *a/je*.

We start from patterns which belong to the TV class *a/a*, which are far more frequent in our sample. The most common pattern within this heterogenous class of SIs is the one traditionally analysed as the sufix *-ja* which also causes lengthening of the preceding root vowel as well as apophony of [o] to [a] (where applicable). This pattern is illustrated in Table 6. For completeness, in Table 7 we also present a similar minor pattern targeting the same TV classes. While o~a apophony is exceptionless in this class as well, in these few examples there is no lengthening (and some of them even display shortening).[6]

Before moving on, a brief remark is in order concerning the palatalising element, an issue which is also relevant for the common SIs iʊa~uje and ʌʊa~ʌʊa and which we have glossed over so far. As can be read off the overview in Tables 6 and 7, the TV classes targeted by the *ja*-pattern are those having a front vowel as the exponent of the theme vowel, so that the palatalising element can be analysed as the preservation of the original theme vowel. So, e.g., [za-miːʃʎ-a-ti] would have the underlying representation /za-misl-i-a-ti/, with the preservation of the original theme vowel, rather than /za-misl-ja-ti/ with the palatalising element coming from the suffix.[7] We will return to the palatalising

[6] Although restricted to a handful of items, this is still a SI pattern and not a collection of exceptions to vowel lengthening, as attested both by the 'active' shortening and by the fixed prosodic pattern (High tone on the syllable preceding the TV). As we will argue below, this minor pattern is a 'weaker' version of the major pattern.

[7] An additional argument for such an analysis comes from the fact that the same type of consonant mutation occurs within the paradigm of the perfective verb. In the passive participle, preceding the suffix -en, the

Table 6: Secondary ja-imperfectivisations with vowel lengthening and o~a apophony (major pattern)

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'imagine'	i/i	za-misl-i-ti	za-misl-iː-mo	za-miːʃʎ-á-ti	za-míːʃʎ-aː-mo
'collect'	i/i	pri-kup-i-ti	pri-kup-iː-mo	pri-kuːpʎ-á-ti	pri-kúːpʎ-aː-mo
'place'	i/i	s-m(j)est-i-ti	s-m(j)est-iː-mo	s-m(j)eːʃt-á-ti	s-m(j)éːʃt-aː-mo
'notice'	i/i	o-paz-i-ti	o-paz-iː-mo	o-paːʒ-á-ti	o-páːʒ-aː-mo
'overlook'	(j)e/i	pre-ʋid-(j)e-ti	pre-ʋid-iː-mo	pre-ʋiːdz̩-á-ti	pre-víːdz̩-aː-mo
'repeat'	i/i	po-noʋ-i-ti	po-noʋ-iː-mo	po-naːʋʎ-á-ti	po-náːʋʎ-aː-mo
'ring out'	i/i	od-zʋon-i-ti	od-zʋon-iː-mo	od-zʋaːɲ-á-ti	od-zváːɲ-aː-mo
'happen'	i/i	do-god-i-ti	do-god-iː-mo	do-gaːdz̩-á-ti	do-gáːdz̩-aː-mo
'forgive'	i/i	o-prost-i-ti	o-prost-iː-mo	o-praːʃt-á-ti	o-práːʃt-aː-mo

Table 7: Secondary ja-imperfectivisations lacking vowel lengthening (minor pattern)

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'lean'	i/i	na-slon-í-ti	na-slón-iː-mo	na-sláɲ-a-ti	na-sláɲ-aː-mo
'recover'	i/i	o-po-ráv-i-ti	o-po-ráʋ-iː-mo	o-po-ráʋʎ-a-ti	o-po-ráʋʎ-aː-mo
'leave'	i/i	o-stáʋ-i-ti	o-stáʋ-iː-mo	o-stáʋʎ-a-ti	o-stáʋʎ-aː-mo
'return'	i/i	ʋraːt-í-ti	ʋráːt-iː-mo	ʋrátɕ-a-ti	ʋrátɕ-aː-mo

feature in §5, but the upshot of this preliminary discussion is that the affix itself may be better described as the theme vowel *a/a*, not including a palatalising element, but including an additional mora (plus the vocalic feature responsible for apophony).

A further class where the suffix *-ja* is commonly reconstructed (but the palatal element arguably has a different source) is a set of verbs from the TV class ∅/*e* with the root ending in the vowel *i*, illustrated in Table 8. In this case, rather than being the exponent of the original theme vowel, the palatal glide can be analysed as a means of hiatus resolution.

Table 8: Secondary (j)a-imperfectivisations with vowel lengthening from ∅/*e* verbs

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'drink up'	∅/e	is-pi-∅-ti	is-pi-jeː-mo	is-piː-já-ti	is-píː-jaː-mo
'kill'	∅/e	u-bi-∅-ti	u-bi-jeː-mo	u-biː-já-ti	u-bíː-jaː-mo
'wrap'	∅/e	u-ʋi-∅-ti	u-ʋi-jeː-mo	u-ʋiː-já-ti	u-ʋíː-jaː-mo

Curiously, the same class (verbs from the TV class ∅/*e* with a root ending in the vowel [i]) is targeted by a similar pattern, distinct in that instead of the palatal glide, a [ʋ] surfaces preceding the theme vowel. This pattern is illustrated in Table 9.

Two notable aspects of the data in Table 9 deserve an additional comment. First, as noted above, the first two verbs appear to form a minimal pair with those from Table 8, indicating that the difference between these two patterns is underlying. We return to this issue in §4.1, where we argue that the distinction is indeed lexical, but originates on the root, whereas the affix is always the same. Second, the four bottom verbs indicate that, at least in some cases, what gets lengthened is not a root vowel but the original TV.

Moving on to the next SI pattern, besides SIs in which a consonant ([ʋ] or [j]) precedes the theme vowel *a/a*, there is a considerable class where only the TV *a/a* is visible, always accompanied by vowel lengthening and the expected apophony. Such verbs are illustrated in Table 10.

theme vowel turns into a palatalising element. E.g., the passive participle of za-misl-i-ti is [za-miʃʎ-en] (from /za-misl-i-en/).

Table 9: Secondary (ʊ)a-imperfectivisations with vowel lengthening

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'wash'	Ø/e	u-mi-Ø-ti	u-mi-jeː-mo	u-miː-ʊá-ti	u-míː-ʊaː-mo
'hide'	Ø/e	sa-kri-Ø-ti	sa-kri-jeː-mo	sa-kriː-ʊá-ti	sa-kríː-ʊaː-mo
'put shoes on'	Ø/e	ob-u-Ø-ti	ob-u-jeː-mo	ob-uː-ʊá-ti	ob-úː-ʊaː-mo
'rest'	nu/ne	po-tʃi-nu-ti	po-tʃi-neː-mo	po-tʃiː-ʊá-ti	po-tʃíː-ʊaː-mo
'dress'	nu/ne	o-d(j)e-nu-ti	o-d(j)e-neː-mo	o-d(ij)eː-vá-ti	o-d(ij)eː-va-mo
'mature'	(j)e/i	sa-zr-e-ti	sa-zr-iː-mo	sa-zr-(ij)eː-ʊá-ti	sa-zr-(ij)eː-ʊaː-mo
'resist'	(j)e/i	od-dol-(j)e-ti	od-dol-iː-mo	od-dol-(ij)eː-ʊá-ti	od-dol-(ij)eː-ʊaː-mo
'succeed'	(j)e/(ij)e	u-sp-(j)e-ti	u-sp-(ij)eː-mo	u-sp-(ij)eː-ʊá-ti	u-sp-(ije)eː-ʊaː-mo
'supply'	(j)e/(ij)e	s-na-bd-(j)e-ti	s-na-bd-(ij)eː-mo	s-na-bd-(ij)eː-ʊá-ti	s-na-bd-(ij)eː-ʊaː-mo

Table 10: Secondary a-imperfectivisations (with lengthening and apophony)

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'stab'	Ø/e	u-bos-Ø-ti (/u-bod-Ø-ti/)	u-bod-eː-mo	u-baːd-á-ti	u-báːd-aː-mo
'disturb'	Ø/e	o-mes-Ø-ti (/o-met-Ø-ti/)	o-met-e-mo	o-meːt-á-ti	o-méːt-aː-mo
'sit down'	Ø/ne	s(j)es-Ø-ti (/s(j)ed-Ø-ti/)	s(j)ed-ne-mo	s(ij)eːd-á-ti	s(ij)eːd-aː-mo
'look at'	a/a	po-gled-a-ti	po-gled-aː-mo	po-gleːd-á-ti	po-glédːd-aː-mo
'break'	i/i	s-lom-i-ti	s-lom-iː-mo	s-laːm-á-ti	s-láːm-aː-mo
'perform'	i/i	na-stuːp-i-ti	na-stuːp-iː-mo	na-stuːp-á-ti	na-stúːp-aː-mo
'burn up'	(j)e/i	iz-gor-(j)e-ti	iz-gor-iː-mo	iz-gaːr-á-ti	iz-gáːr-aː-mo

As with ja-imperfectivisation, in a-imperfectivisations, we also identified a minor pattern where no lengthening is attested, illustrated in Table 11.[8]

Table 11: Secondary a-imperfectivisations without vowel lengthening (minor pattern)

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'attack'	Ø/ne	na-pas-Ø-ti (/na-pad-Ø-ti/)	na-pad-neː-mo	na-pád-a-ti	na-pád-aː-mo
'sit down'	Ø/ne	s(j)es-Ø-ti (/s(j)ed-Ø-ti/)	s(j)ed-neː-mo	s(j)éd-a-ti	s(j)éd-aː-mo
'capture'	i/i	za-xʊat-i-ti	za-xʊat-iː-mo	za-xʊát-a-ti	za-xʊát-aː-mo

This concludes the discussion of the SI patterns ending in *a/a* which apply to sizable classes of perfective verbs. To sum up, the pattern always contains the TV *a/a* and a vocalic element which turns o into a. In what we termed the major pattern there is also an additional mora which is realised as the lengthening of a vowel from the base. Finally, after certain vowels the pattern also involves the introduction of an additional consonanat, either [ʊ] or [j]. Abstracting over the consonant, we can preliminarily term this SI *a-a/a*, using gray to indicate the presence of an element which is not a full vowel [a] but carries some of its features.

For completeness, there is also evidence of a SI which can be termed *i-a/a*, i.e. a SI which contains (some features of) the vowel [i] in the first position. We list all the pertinent examples in Table 12.

[8] Note that s(j)esti 'sit down' shows up both in Table 10 and Table 11. This is because both secondary imperfectives (or rather both prosodic patterns in the same secondary imperfective) are attested.

Table 12: Secondary *i-a/a*-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'call'	a, e	po-zʊ-a-ti	po-zoʊ-eː-mo	po-ziːʊ-á-ti	po-zíːʊ-aː-mo
'rinse'	a, je	is-pr-a-ti	is-per-eː-mo	is-piːr-á-ti	is-píːr-aː-mo
'found'	ova, uje	o-sn-oʊ-a-ti	o-sn-u-jeː-mo	o-sn-iːʊ-á-ti	o-sn-íːʊ-aː-mo
'chain up'	ova, uje	o-k-oʊ-a-ti	o-k-u-jeː-mo	o-k-iːʊ-á-ti	o-k-íːʊ-aː-mo
'weave'	a/a	u-tk-a-ti	u-tk-aː-mo	u-tk-iː-vá-ti	u-tk-íː-vaː-mo

All the examples in Table 12 require additional comments. The first two roots display unpredictable root allomorphy already in the perfective verb and realise the vowel [i] in the secondary imperfectivisation in the same position in which they realise vowels in the present tense of the perfective verb. The next two examples involve the sequence oʊa~uje, which is currently considered a TV, but is one of the classes which will be removed from this list in our final analysis. In the examples we already parse this sequence as oʊ-a~u-je, as we show that the sequence oʊ survives in the secondary imperfectivisations, where its vowel undergoes apophony. Finally, the last example does not involve apophony because the root is consonantal and does not show any allomorphs which contain vowels. Rather, this example seems to be the isolated illustration of the SI iʊa~iʊa. We include this example in this table because, previewing our analysis in sections 3 and 4, we argue iʊa~iʊa is how *i-a/a* is spelled out when there is no context for apophony.

Having completed the discussion of SIs which end in the TV *a/a*, we can now turn to the few SIs which end in the TV *a/je*. What these SIs have in common with the ones in *a/a* is that the o~a apophony still applies generally and that vowel lengthening is very common. This means that the most common SI in this area is *a-a/je*. This SI is illustrated in Table 13.

Table 13: Secondary *a-a/je*-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'help'	Ø/ne	po-mo-Ø-tɕi (/po-mog-Ø-ti/)	po-mog-neː-mo	po-maːg-á-ti	po-máːʒ-eː-mo
'jump in'	i/i	u-skotʃ-i-ti (/u-skok-i-ti/)	u-skotʃ-iː-mo	u-skaːk-á-ti	u-skáːtʃ-eː-mo
'fly away'	(j)e/i	od-let-(j)e-ti	od-let-iː-mo	od-l(ij)eːt-á-ti	od-l(ij)eːtɕ-eː-mo

As with SIs in *a/a*, those in *a/je* also have variants where they show up preceded by [j] or [ʊ]. These consonants resolve the hiatus between the vowel a (which is either part of the root or a preserved original theme vowel) and the thematic a. The variants in question show up with the 3 roots illustrated by the examples in Table 14.

Table 14: Secondary ʊa/je- and ja/je-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'give'	a/a	d-a-ti	d-aː-mo	d-aː-vá-ti	d-áː-jeː-mo
'admit'	a/a	pri-zn-a-ti	pri-zn-aː-mo	pri-zn-aː-vá-ti	pri-zn-áː-jeː-mo
'stop'	Ø/ne	sta-Ø-ti	sta-neː-mo	sta-já-ti	stá-jeː-mo

Notably, the final verb in Table 14 does not display lengthening of the preceding vowel, in a sense paralleling the exceptional class of SIs in *a/a* presented in Table 7.

Finally, and again in perfect parallelism with the SIs in *a/a*, there is a group of verbs which testify to the existence of SI *i-a/je*. Once again this group only includes verbs

which display allomorphy in the secondary imperfectives.

Table 15: Secondary *i-a/je*-imperfectivisations

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'die'	Ø/e	u-mr(ij)eː-Ø-ti	u-mr-eː-mo	u-mir-a-ti	u-mir-eː-mo
'express'	Ø/e	iz-re-Ø-tɕi (/iz-rek-ti/)	iz-rek-neː-mo	iz-riːts-a-ti	iz-riːtʃ-eː-mo
'mention'	nu/ne	po-me-nu-ti	po-me-neː-mo	po-miɲ-a-ti	po-miɲ-eː-mo
'bow'	nu/ne	sa-g-nu-ti	sa-g-neː-mo	sa-giɲ-a-ti	sa-giɲ-eː-mo

Having presented the full inventory of SIs in BCMS, in the following section we turn to their analysis.

3 SECONDARY IMPERFECTIVISERS AS SEQUENCES OF TVS

In this section we present our general analysis of SIs in BCMS in terms of sequences of TVs. The general idea is not novel for Slavic, since various accounts of SIs as reduplications/sequences of TVs have been proposed for Russian (see e.g. Coats 1974, Feinberg 1980 and more recently Enguehard 2017).[9]

As discussed in 2.1.2, verbal derivational suffixes, including SIs, occur left-adjacent to the inflectional endings, i.e. between the root/base that the verb is derived from and the inflection. In this way, they actually fit the rough descriptive definition of theme vowels. This has led many traditional grammarians, but also formal linguists, to draw the line between derivational verbal suffixes and TVs differently, with some items sometimes being seen as theme vowels, and sometimes as suffixes. As we will show, this analytical problem of the boundary between theme vowels and derivational affixes is partially due to the fact that theme vowels indeed show up in different positions within the affix, as is the case in SIs.

Summarising our descriptive findings in the previous section, we can say that SIs consist of sequences of vocalic features, whereby the final segments match the prototypical theme vowels (i.e. those combining with roots). The general schema of SIs is summarised in Table 16.

Table 16: General schema for BCMS imperfectivisers

position 1	position 2
(μ) a	a/a
(μ) i	a/je

The representation in Table 16 covers all the the SIs illustrated above. The moras are between brackets because they they do not play a role in what we termed the minor patterns. The elements in 'position 2' are the familiar theme vowels *a/a* and *a/je*. The elements in 'position 1' have much more variable exponence and therefore require more abstract autosegmental representations.

In a nutshell, Autosegmental phonology (Goldsmith 1976) presents an explicit and hierarchical model of phonological representations, allowing for an explicit analysis of morphological elements which carry pieces of phonological structure but never surface in isolation (e.g., empty moras, templates etc.). For our purposes, in line with, e.g.,

[9]We are not making any claims about Russian here, since the two systems have considerable differences both when it comes to phonology and to morphology. A comparison between Russian and BCMS (and other Slavic) verbal systems is certainly a recommendable direction for further research.

Trommer & Zimmermann (2014), we assume that what gets realised as a vowel has the following elements linked with each other: vocalic features (e.g., [+high], [-back]) linked to a segment (root node, •) linked to a mora (μ) linked to a syllabic slot (σ). In BCMS, the exemplified autosegmental structure would be realised as [i]. Consonants have the same structure but lack a mora, i.e., their root nodes are directly linked to the syllable. This means that the same feature combination without a mora would yield a [j]. In Optimality Theory (Prince & Smolensky 1993), the framework we will assume here, there are no analogous requirements on the side of underlying representations. In other words, any subset of these elements of phonological structure (and any combination of features) is a licit input to grammar, whose task is to turn this input into a grammatical output.

Returning now to our 'position 1' elements of the SIs, we can see that they consist of some vocalic features and typically contain a mora. When these elements get their own root node, they realise as full vowels, which is when the productive SIs ɪva~uje and ava~ava surface. However, they can also get realised on the base provided by the original perfective verb, which is when all the less productive apophony patterns (*a-a/a*, *i-a/a*, *a-a/je* and *i-a/je*) surface.

Our task is now to establish the exact representation of these elements and the grammar which leads to their exponence pattern. First we need to clarify whether there is any evidence for the proposed position-1 elements outside the domain of SIs. Second, we need to specify the exact featural content of the position-1 element μ, a, which produces a specific apophony pattern (it only targets the vowel o, turning it to a). Finally, we need to account for the hiatus resolving element ʊ and the back vowel in the SIs ava~ava and ɪva~uje.

The answer to the first question is straightforward: looking at their surface realisations, these two elements are the two most common TVs in BCMS, realised as [a] and [i], which together account for a vast majority of all verbs in BCMS (see Table 3). As we will further argue in §6, SIs result from the realisation of two (or effectively, counting also the theme vowel of the base – three) adjacent theme vowels. The first position gets filled in by the two most common verbalisers; in general ([a] and [i]).

In order to answer the second question, pertaining to apophony, we need further insight into the feature set and the markedness of vowels in BCMS. In Table 17, we show the assumed minimal feature set which identifies all BCMS vowels.

Table 17: Vowel features in BCMS

	high	low	back
i	+	-	-
e	-	-	-
a	-	+	+
o	-	-	+
u	+	-	+

The default epenthetic vowel in BCMS is [a]. In an OT analysis of the epenthetic [a] and several related phenomena in BCMS, Simonović (2016) shows that the selection of the epenthetic vowel is determined by the constraint *[-LOW]. Since vowels generally surface faithfully in all positions and long and short versions, *[-LOW] is ranked relatively low and only selects the epenthetic vowel.

Our analysis of the apophony pattern shows that there is a further situation where *[-LOW] gets to decide. Assuming a simple system in which MAX-F assigns violations for all features present in the input but absent from the output (regardless how they are affiliated in the underlying representation), the attested apophony pattern is obtained if we assume the underlying representation of the theme vowel [a] to only contain the feature [+low]. As our overview of the vowels favoured by MAX-F in 18 shows, MAX-F

makes /a/, /e/, /i/ and /u/ surface faithfully under [+low]-affixation. When the base contains the vowel /o/, there is a tie between [a] and [o] (both have one violation: [a] fails to realise the [-low] of the underlying /o/, whereas [o] fails to realise the floating [+low]), which gets resolved by *[-LOW] in favour of [a].

Table 18: Results of apophony by [+low]

input	favoured by MAX-F
i + [+low]	i
e + [+low]	e
a + [+low]	a
o + [+low]	tie between o and a
u + [+low]	u

In order to illustrate our OT analysis of the apophony pattern, we take the first two examples from Table 10. The interaction of IDENT and *[-LOW] leads to o~a apophony (the tableau in 19), but /e/ remains unmodified (the tableau in 20). We also added the constraint MAX-μ, which militates against deleting input moras.

Table 19: OT tableau for *ubadati* 'stab.IPFV.INF'

u+bod + $^{\mu[+low]}$ + a + ti	MAX-μ	MAX-F	*[-LOW]
a. ubodati	*!	*	***
b. ubo:dati		*	***!
☞ c. uba:dati		*	**
d. ube:dati		**!	***
e. ubi:dati		**!*	***
f. ubu:dati		**!	***

Table 20: OT tableau for *ometati* 'disturb.IPFV.INF'

o+met + $^{\mu[+low]}$ + a + ti	MAX-μ	MAX-F	*[-LOW]
a. ometati	*!	**	***
b. omo:tati		**!	***
c. oma:tati		**!	**
☞ d. ome:tati		*	***
e. omi:tati		**!*	***
f. omu:tati		**!	***

Note that in the input to the tableaux above we represented the first part of the SI morpheme as μ[+low] whereas we represented the second part as /a/. This is a representational shortcut for saying that whenever there is a root node available for its realisation alone, [+low] will realise as [a], but whenever it has to realise on a root-internal long vowel, it will behave in the way just described. We will return to the issue of the realisational space for the SI in §4 and §6.

Finally, the question regarding the hiatus resolving element [ʊ] and the back vowel in the SIs avа~ava and iva~uje requires an even broader consideration of hiatus-resolving consonants in BCMS. We address this issue in the following section.

4 AUTOSEGMENTAL HIAUTUS RESOLVERS: FLOATING [V] AND [J] AND THEIR VOCALIC COUNTERPARTS

In this section we take up the broader issue of hiatus-resolving [ʋ]- and [j]-insertion in BCMS in order to propose the correct analysis of the consonant [ʋ] which shows up in SIs. Note that the palatal element which is traditionally reconstructed as part of the SI -ja is rarely hiatus-resolving (see the examples in Tables 6 and 7). We will turn to this palatal element in §5.

4.1 HIATUS RESOLVING IN BCMS: EPENTHESIS VS FLOATING SEGMENTS

Before turning to cases of hiatus resolution, it should be noted that hiatus is generally tolerated in BCMS, which is why we will argue for hiatus-resolving elements which are based on underlying elements. Hiatus is attested in nouns (e.g., ʒaoka 'stinger', ʋeo 'veil' etc.), adjectives (e.g., ʋeseo 'merry', truo 'rotten' etc.) and verbs (e.g., iʃao 'go.PAST.PTCP', uzeo 'take.PAST.PTCP' etc.). It is also not repaired in loanwords, so that, e.g., *Bilbao* is used with unrepaired hiatus, with variation in case forms between [bilbaa] and [bilbaoa] 'Bilbao.GEN.SG', [bilbau] and [bilbaou] 'Bilbao.DAT/LOC.SG', but never with any repair. Marković (2018: p.75–79) argues that the only productive glide formation which can be assumed overall in modern BCMS is that of a palatal glide between vowels if one of them is [i] (e.g. in [taksi-j-a] 'taxi.GEN.SG', [taksi-j-u] 'taxi.DAT/LOC.SG' etc.). However, he also states that "Croatian morphophonology requires the recognition of an intervocalic [j]" which gets inserted at certain boundaries between suffixes and roots, as well as between two suffixes, and which is restricted to specific morphological and lexical categories. Even further away from a productive phonetic or phonological process, but still active in morphology, is the process of [ʋ]-insertion. Interestingly, in illustrating [j]- and [ʋ]-insertion, Marković provides several examples in which [j] and [ʋ] show up in the same phonological *and morphological* context, without providing an account of what determines which of the two gets inserted. In table 21, we show the key examples from Marković (2018).

Table 21: ʋ and j insertion in the same context

PFV.INF	PFV.PRS.1PL	PFV.PASS.PTCP	IPFV.INF	IPFV.PRS.1PL	gloss
u-pi-Ø-ti	u-pi-je̲ː-mo	u-pi-je̲n	u-piː-ja̲-ti	u-piː-ja̲ː-mo	'absorb'
za-bi-Ø-ti	za-bi-je̲ː-mo	za-bi-je̲n	za-biː-ja̲-ti	za-biː-ja̲ː-mo	'stab'
u-mi-Ø-ti	u-mi-ʋ̲e̲ː-mo	u-mi-ʋ̲e̲n	u-miː-ʋ̲a-ti	u-miː-ʋ̲aː-mo	'wash'
za-li-Ø-ti	za-li-je̲ː-mo	za-li-ʋ̲e̲n	za-liː-ʋ̲a-ti	za-liː-ʋ̲aː-mo	'water'

Specifically, all verbs of the theme-vowel class Ø/*e* whose root surfaces with a final [i] have the same paradigm except for the PASS.PTCP form, where, preceding the ending *-en*, we in some cases observe [j] (first two verbs in Table 21) and in others [ʋ] (last two verbs). The same hiatus-resolving consonant then surfaces in the secondary imperfectivisation derived using the SI a-a. Pairs like [u-pi-je̲n] but [u-mi-ʋ̲e̲n] indicate that the distinction is lexical, i.e. that the first two verbs have a different lexical representation from the second two. One plausible implementation is /piʲ/ and /biʲ/ versus /mi/ and /li/.[10]

[10] As pointed out by one of the reviewers, another path would be to assume that there are two different segments, which both surface as [i] but cause different hiatus resolution patterns (see Matushansky (2009) for an analysis of Russian SIs which involves the underlying /ʋ/ and the references therein for a lineage of such analyses in rule-based approaches). As far as we can tell, an analysis along these lines would predict that whatever element causes the formation of the hiatus-resolving [ʋ] in front of [a] and [e] would have the same effect in front of [o]. In the past participle we would then expect *[umiʋo] and *[zaliʋo] rather than the attested [umijo] and [zalijo].

The superscript marks a floating element, which is the notational shortcut for the relevant features which are not attached to a root node. For the sake of clarity, we assume that for [j] these features are [+high] and [-back]. The first generalisation based on the data reviewed so far would be that floating elements surface in cases where they optimise syllable structure, but not otherwise. While this accounts for all the forms of the first two verbs without any further assumptions, the contrast between the present-tense and passive-participle forms in the second two verbs remains unaccounted for (e.g. u-mi-j̲e-mo versus u-mi-ʋ̲en). Since the phonological context is exactly the same, at least one of the two endings needs to have a floating element as well. Since ʋ-insertion is more morphologised, we assume that the PASS.PTCP morpheme has a ʋ-element and is therefore better represented as $^{\upsilon}$*en*. By the same token, the TV should be represented as $^{\upsilon}$*a*. Here, again, for the sake of clarity, we will assume that the floating element consists of the unlinked features [+high] and [+back].

Now since morphemes with a /$^{\upsilon}$/-element also get added to verbs with an underlying /^{j}/-element, this means that there are forms with two floating glides in the underlying representation. A case in point is the PASS.PTCP of verbs ending in /i^{j}/, e.g., upijen 'absorbed', which is underlyingly /upi^{j}+$^{\upsilon}$en/). The palatal glide surfaces in such cases, reflecting a general preference of the system for the palatal glide (also reflected by the fact that there is productive [j]-insertion is some contexts, but no productive [ʋ]-insertion).

For completeness, we note that, while based on the data presented here the glide insertion in the present tense forms of the type without a floating glide (e.g. [u-mi-j̲e-mo] from /u-mi-e-mo/) can be derived phonologically, there is evidence elsewhere in the system that the exponent of the TV also contains a floating glide and should be represented as ^{j}*e*. A case in point is the paradigm of the verb *izuti* 'take shoes off': iz-u-∅-ti, iz-u-j̲e-mo, iz-u-ʋ̲en. While assuming that verbal affixes have floating glides may seem an extravagant solution, it has the virtue of deriving verbal forms like iz-u-j̲e-mo using general phonology, which also allows the hiatus in other words (admittedly all̲ loanwords, e.g., [duel] 'duel', [intervju-e] 'interview-ACC.PL', [su-egzistirati] 'co-exist') and in the PASS.PTCP of the same verb [izuo].

We can now turn to the OT formalisation for the forms discussed so far. Since the floating segments are features lacking a root node, their realisation requires insertion of a root node, i.e., incurring a violation of the constraint DEP-SEG, which militates against the insertion of additional segments (i.e., root nodes). As shown above, this constraint is violated in order to avoid hiatus, which justifies the relative ranking *HIATUS»DEP-SEG.

The fact that hiatus is generally allowed in BCMS means that BCMS disallows the insertion of new features which make a glide possible. Assuming that a glide requires a feature [+high], this means that the constraint DEP[+HIGH], militating against the insertion of new [+high] features, is ranked above these two constraints, yielding the ranking DEP[+HIGH]»*HIATUS»DEP-SEG. Finally, the low-ranked constraint against labial consonants (and round vowels) is added to the bottom of the ranking to ensure that in cases where both [ʋ] and [j] compete for the realisation in the same inserted root node, the latter gets realised. Since this latter constraint never has the effect of turning an underlying /$^{\upsilon}$/ into a surface [j], we place MAX-F above it. The definitions of the five constraints are provided below.

(2) DEP-[+HIGH]: Assign a violation mark for every [+high] feature in the output that is not present in the input.
*HIATUS: Assign a violation mark for every sequence of adjacent vowels.
DEP-SEG: Assign a violation mark for every output root node that is not present in the input.
MAX-F: Assign a violation mark for every feature that is present in the input, but absent from the output.
*LABIAL/ROUND: Assign a violation mark for every output segment that carries the feature(s) labial/round.

In the tableaux in Tables 22, 23, 24 and 25, we illustrate the evaluation of the INF and PASS.PTCP form of the verbs with and without a final floating /^{j}/-element. The tableau in Table 22 shows that no insertion of root nodes is tolerated unless they help resolve hiatus. The tableau in Table 23 shows that hiatus repair has to be minimal (candidate (a) incurs two violations of DEP-SEG and is therefore excluded) and that when both [ʊ] and [j] are introduced by lexical specifications, [j] surfaces due to the low-ranked constraint against labial consonants. Finally, the tableau in Table 25 shows that the /^{ʊ}/-element can surface in cases where it is the only hiatus-resolving element available.

Table 22: OT tableau for *upiti* 'absorb.PFV.INF'

u+pi^{j} + ∅ + ti	DEP-[+HIGH]	*HIATUS	DEP-SEG	MAX-F	*LABIAL/ROUND
a. upijti			*!		**
☞ b. upiti				**	**
c. jupijti	*!		*		**
d. jupiti	*!		*	**	**

Table 23: OT tableau for *upijen* 'absorb.PASS.PTCP'

u+pi^{j} + ^{u}en	DEP-[+HIGH]	*HIATUS	DEP-SEG	MAX-F	*LABIAL/ROUND
a. upijʊen			**!		***
☞ b. upijen			*	**	**
c. upiʊen			*	**	***!
d. upien		*!		****	**

Table 24: OT tableau for *umiti* 'wash.PFV.INF'

u+mi+ti	DEP-[+HIGH]	*HIATUS	DEP-SEG	MAX-F	*LABIAL/ROUND
☞ a. umiti					**
b. umijti	*!		*		**

Table 25: OT tableau for *umiven* 'wash.PASS.PTCP'

u+mi+^{u}en	DEP-[+HIGH]	*HIATUS	DEP-SEG	MAX-F	*LABIAL/ROUND
☞ a. umiʊen			*		***
b. umijen			*	*!	**
c. umien		*!		**	**

This ranking allows us to analyse the secondary imperfective forms derived from the verbs discussed in the previous section, i.e. from verbs of the theme-vowel class ∅/*e* whose root surfaces with a final [i] or [u]. We add the constraints introduced in the previous section to the tableaux. Since no hiatus is produced in order to satisfy MAX-μ, we rank MAX-μ below *HIATUS. *[-LOW] is not crucially ranked with respect to the other constraints below MAX-F, so we place it in the same stratum with *LABIAL/ROUND for presentational purposes.

The tableaux in Tables 26 and 27 show the evaluations of secondary imperfectives discussed in the previous section.

This concludes our analysis of the vowel-lengthening and apophony patterns. In the following section we will turn to the case of both the position-1 and position-2 element of the SI getting a dedicated root node, which leads to the patterns ʊa~ava and ʊa~uje.

Table 26: OT tableau for *umivati* 'wash.IPFV.INF'

u+mi+$^{\mu[+low]}$+$^{\upsilon}$a+ti	DEP-[+HIGH]	*HIATUS	MAX-μ	DEP-SEG	MAX-F	*LABIAL/ROUND	*[-LOW]
a. umiaʊati		*!		**		***	***
☞ b. umi:ʊati				*	*	***	***
c. umi:jati				*	**!	**	***
d. umiʊati			*!		*	***	***
e. umijati			*!		**	**	***

Table 27: OT tableau for *upijati* 'absorb.IPFV.INF'

u+pi^{j}+$^{\mu[+low]}$+$^{\upsilon}$a+ti	DEP-[+HIGH]	*HIATUS	MAX-μ	DEP-SEG	MAX-F	*LABIAL/ROUND	*[-LOW]
a. upijaʊati				***!		***	***
b. upi:jʊati				**!	*	***	***
c. upi:ʊati				*	***	***!	***
☞ d. upi:jati				*	***	**	***
e. upijʊati			*!	**	*	***	***
f. upiʊati			*!	*	***	***	***
g. upijati			*!	*	***	**	***

4.2 CONCATENATIVE SIS AND FLOATING SEGMENTS IN THE *A/JE* THEME CLASS

In this section, we are addressing the SIs patterns aʊa~aʊa and iʊa~uje, which are realisational variants of the non-concatenative SIs discussed so far in the environment where both parts of the SI get a dedicated root node. We start from aʊa~aʊa, illustrated in the tableau in Table 28. The fact that the root node is now available is marked in the input of the tableau, where the extra root node is marked as •. As will be discussed in §6, the option with additional realisational space is concatenative, transparent and therefore the only productive one in modern BCMS.[11]

Table 28: OT tableau for *crkavati* 'go west.IPFV.INF'

tsrk+•$^{\mu[+low]}$+$^{\upsilon}$a+ti	DEP-[+HIGH]	*HIATUS	MAX-μ	DEP-SEG	MAX-F	*LABIAL/ROUND	*[-LOW]
☞ a. tsrka:ʊati				*		*	*
b. tsrka:ati		*!			**		*
c. tsrkʊa:ti				*	*!	*	*

The same logic can be applied to account for the ʊ-element in the other productive SI in BCMS, iʊa~uje. We assume that the first element of this SI consists of a [+high] feature, a mora and a root node. This elements surfaces as [i] in the infinitive due to the workings of the constraint *LABIAL/ROUND. The evaluation for the infinitive is shown in the tableau in Table 29.

The theme vowel *a/je* has a floating ʊ-element. The reason why the ʊ-element is not realised as a consonant in the present tense is straightforward: floating elements are realised as consonants only in cases where they can repair hiatus, and given the consonant-initial exponent of the TV je, there is no need for its realisation. However, the present-tense allomorph uje is an indication that the floating element gets realised by making the high vowel back, yielding an [u]. In the tableau in Table 30 we present

[11] One aspect of the analysis which we need to leave out due to space limitations is the account of the vowel length on the conacatenatively realised SIs a:ʊa~a:ʊa and i:ʊa~uje. In a nutshell, we assume that this length comes from the original TV of the prefective verb, which contains a mora even in cases where it is realised as null.

Table 29: OT tableau for *prepisivati* 'copy.IPFV.INF'

pre+pis+ •$^{\mu[+high]}$ +$^{\upsilon}$a+ti	DEP-[+HIGH]	*HIATUS	MAX-μ	DEP-SEG	MAX-F	*LABIAL/ROUND	*[-LOW]
a. prepisa:ʊati					*!	***	***
☞ b. prepisi:ʊati						***	****
c. prepisu:ʊati						****!	****

the evaluation for the present-tense allomorph uje. Recall that the floating ʊ-element consists of features [+high] and [+back] and the non-realisation of the [+back] feature is considered a MAX-F violation.

Table 30: OT tableau for *prepisujemo* 'copy.PRES.1PL'

pre+pis+•$^{\mu[+high]}$+$^{\upsilon}$je+mo	DEP-[+HIGH]	*HIATUS	MAX-μ	DEP-SEG	MAX-F	*LABIAL/ROUND	*[-LOW]
a. prepisiʊjemo				*!		*****	*****
b. prepisijemo					**!	****	*****
☞ c. prepisujemo					*	*****	****
d. prepisajemo					**!	****	****

Note that the presence of the ʊ-element does not predict massive vowel mutation in front of the morphemes that have such an element. As a matter of fact, under the current ranking, no fully specified underlying vowel (i.e., specified for the features [low], [high] and [back]) is predicted to mutate if [+high, +back] gets affixed to it.

Adding the ʊ-element to the TV *a/je* puts us in a position to reduce the number of TV classes from our initial overview in Table 3 from 13 to 10. The former TV class iva/uje, which only hosted secondary imperfectivisations, is now reanalysed into [+high] followed by *a/je* (or, more precisely $^{\upsilon}$a/$^{\upsilon}$je). The other former TV class which straightforwardly falls into the revised *a/je* class is *va/je*, which hosted simplex verbs such as bɅu-ʊa-ti~bɅu-je-mo 'to vomit~we vomit' and secondary imperfectives such as sa-zna-ʊa-ti~sa-zna-je-mo 'to find out~we find out'. Finally, *a/je* can now include the former class *ova/uje*,[12] which included very few simplex verbs, such as k-o-ʊa-ti~k-u-je-mo 'to forge~we forge', one single secondary imperfective, kup-o-ʊa-ti~kup-u-je-mo 'to buy~we buy', as well as many denominal and borrowed verbs, e.g., kamen-o-ʊa-ti~kamen-u-je-mo 'to stone~we stone' and lajk-o-ʊa-ti~lajk-u-je-mo 'to like~we like (on social networks)'. Here again, the u-apophony of the vowel preceding the je-exponent is a further indication that the ʊ-element is present. This u-apophony, which does not influence fully specified vowels, further indicates that the targeted vowel (most probably a theme realizing an uninterpretable nominal feature, or an unvalued category feature) is itself underspecified. We leave out the full analysis due to space limitations.

This concludes our discussion of the elements that SIs consist of. We argued that they consist of TVs, which contain floating and underspecified elements. The TV *i* was argued to consist of the feature [+high] (next to a mora, and a root node). On the other hand, the TV *a* was argued to contain the feature [+low] (next to a mora, and a root node), but also a ʊ-element, which accounts for the hiatus resolving ʊ in the context of this theme. We showed that the ʊ-element consists of vocalic features [+high, +back]. Having discussed the elements which we argue constitute SIs, we can now turn to the elements which are often reconstucted as parts of SI, but actually are not: the palatalising elements preceding SIs.

[12] See Melvold (1990: p.258–267) for a rule-based analysis of *ova*-verbs in Russian, where [ʊ] in *ova* and [u] in *uje* have the same lexical source. This idea was present already in Lightner (1965: p.36–38). Interestingly, Melvold does not explicitly parse *ova*, but Lightner does (the underlying representation of *kujet* 'she forges' is /kou-ō-e-t/.).

5 RESIDUAL ISSUE: RESIDUAL THEME VOWELS AS PALATALISING FEATURES

As mentioned already in §1, the consonants preceding the two productive SIs, ɪva~uje and ava~ava, often undergo palatalisation (the traditional term is iotation), which led authors of traditional analyses to postulate four affixes /ɪva/, /jɪva/, /ava/ and /java/ (see, e.g., Babić 2002: p.526).

In §2 we already discussed a similar case: the tradtional SI ja, illustrated in Tables 6 and 7. This SI only targets bases which in the perfective counterpart have TVs *i/i* and *e/i* (e.g., za-mi:ʃʎ-á-ti 'imagine.IPFV' derived from za-misl-i-ti 'imagine.PFV'). Crucially, the exact same result of palatalisation surfaces within the paradigm of the perfective verb in the passive participle in front of the ending *-en*. E.g., the passive participle of za-misl-i-ti is za-miʃʎ-en, from /za-misl-i-en/, testifying to the ability of the TVs containing front vowels to transform into a palatalising element. This means that in all cases where the traditional SI ja is invoked, its sole purpose is to introduce the palatalising element which was previously deleted. In order to avoid this type of uneconomic derivation, we proposed that the TV of the original perfective verb is always preserved in the secondary imperfective.

In this section we will make the same argument for the productive SIs ɪva~uje and ava~ava, showing that original TVs lose their root nodes, but their features still influence the surface form of the secondary imperfective and are therefore able to cause palatalisation.[13] We start from the cases where the original TVs are *i* and *a*. Table 31 shows a set of *i/i* verbs which derive secondary imperfectives traditionally analysed as featuring the SI java~java. In order to appreciate the data, we need to make a distinction between on the one hand general palatalisation (iotation), which is typically assumed to be caused by a j-element and targets labials, dentals and velars and, on the other hand, velar palatalisation, which is caused by front vowels and only targets velars. Our examples illustrate dentals and velars in the same environment. As the perfective forms show, the sequences /ti/ and /di/ are not palatalised, but /ki/ and /gi/ are. Since velar palatalisation is generalised in verbs, there are no verbs in /kiti/ and /giti/.[14] In the secondary imperfectivisation, all four consonants show up palatalised. Clearly, if the SI is java~java, the palatalisation is fully expected. However, the analysis which assumes the preservation of the original TV allows us derive these examples using the same SI as for the examples in Table 32.

Table 31: Secondary ava-imperfectivisations: original TV *i/i*

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'adapt'	i/i	pri-lagod-i-ti	pri-lagod-i:-mo	pri-lagodʐ̩-a:ʊ-a-ti	pri-lagodʐ̩-a:ʊ-a:-mo
'utilise'	i/i	is-korist-i-ti	is-korist-i:-mo	is-koriʃtɕ-a:ʊ-a-ti	is-koriʃtɕ-a:ʊ-a:-mo
'train'	i/i	ob-utʃ-i-ti /ob-uk-i-ti/	ob-utʃ-i:-mo	ob-utʃ-a:ʊ-a-ti	ob-utʃ-a:ʊ-a:-mo
'multiply'	i/i	u-mnoʒ-i-ti /u-mnog-i-ti/	u-mnoʒ-i:-mo	u-mnoʒ-a:ʊ-a-ti	u-mnoʒ-a:ʊ-a:-mo

As Table 32 shows, the original TV here does not leave any trace (beyond possibly the lengthening of the first vowel of the SI). However, there may be some indication of its survival if we consider the data in Tables 33 and 34.

[13] In the previous section we hinted at the long vowels in a:va~a:va and i:va~uje as potentially lengthened by the moras of the original TV of the perfective verb. The obvious question is why there is a length difference in i:va~uje. One possible answer is that the blocked long vowel in *u:je would have lexical elements of three morphemes: the original TV (contributing a mora), the first TV of the SI (contributing a mora and [+high]) and the second TV of the SI (contributing [+back]).

[14] The only exceptions being verbs from infant-directed speech such as kak-i-ti 'to poo', pajk-i-ti 'to nap', lag-i-ti 'to fib' etc.

Table 32: Secondary ʌʋa-imperfectivisations: original TV *a/a*

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'justify'	a/a	o-praʋd-a-ti	o-praʋd-aː-mo	o-praʋd-aːʋ-a-ti	o-praʋd-aːʋ-aː-mo
'upload'	a/a	u-tʃit-a-ti	u-tʃit-aː-mo	u-tʃit-aːʋ-a-ti	u-tʃit-aːʋ-aː-mo
'portray'	a/a	o-slik-a-ti	o-slik-aː-mo	o-slik-aːʋ-a-ti	o-slik-aːʋ-aː-mo
'inject'	a/a	u-brizg-a-ti	u-brizg-aː-mo	u-brizg-aːʋ-a-ti	u-brizg-aːʋ-aː-mo

Table 33: Secondary iʋa-imperfectivisations: original TV *i/i*

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'reward'	i/i	na-graːd-i-ti	na-graːd-iː-mo	na-gradʑ-iːʋ-a-ti	na-gradʑ-u-jeː-mo
'charge'	i/i	na-plaːt-i-ti	na-plaːt-iː-mo	na-naplatɕ-iːʋ-a-ti	na-platɕ-u-jeː-mo
'order'	i/i	na-ruːtʃ-i-ti /na-ruːk-i-ti/	na-ruːtʃ-iː-mo	na-rutʃ-iːʋ-a-ti	na-rutʃ-u-jeː-mo
'deserve'	i/i	za-sluːʒ-i-ti /za-sluːg-i-ti/	za-sluːʒ-iː-mo	za-sluʒ-iːʋ-a-ti	za-sluʒ-u-jeː-mo

Table 34: Secondary iʋa-imperfectivisations: original TV *a/a*

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'examine'	a/a	is-piːt-a-ti	is-piːt-aː-mo	is-pit-iːʋ-a-ti	is-pit-uj-eː-mo
'welcome'	a/a	do-tʃek-a-ti	do-tʃek-aː-mo	do-tʃek-iːʋ-a-ti	do-tʃek-uj-eː-mo
'mock'	a/a	iz-ruːg-a-ti	iz-ruːg-aː-mo	iz-rug-iːʋ-a-ti	iz-rug-uj-eː-mo

The data in Table 33 show the exact same pattern as those in Table 31, with the surviving TVs palatalising the preceding consonant. However, in Table 34, we see that the SI iʋa does not trigger velar palatalisation. Since our analysis of this SI is that it contains the TV *i*, it is all the more urgent to account for this lack of palatalisation. Given space limitations, we can only provide a sketch of an account, leaving the full formalisation to future research. Velar palatalisation is blocked by the feature [+back], present in the TV *a* (as part of its ʋ-element). The original TV in do-tʃek-a-i-ʋa-ti intervenes between the target and the trigger of the palatalisation and makes the target immune to it (just like, say, dentals).[15]

Finally, besides *i/i*, there are two other TV classes whose TV can survive in the form of consonant palatalisation. These are illustrated in Table 35. The conditioning for general palatalisation is straightforward: all TVs which surface with features [+high] and/or [-back] can get preserved in the form of general palatalisation.[16] This is not unexpected given that high and front vowels trigger palatalisation cross-linguistically (Bateman 2011).

This concludes our phonological analysis. We now turn to the syntactic and semantic rationale behind the proposed analysis of SIs.

6 SYNTACTIC AND SEMANTIC CONSEQUENCES

The analysis of SIs as sequences of TVs has significant implications for the ongoing debate about the distinction between derivational suffixes and theme vowels, addressed in §2.

[15] We are grateful to Wayles Browne for pointing this out to us.

[16] Surfacing is a necessary part of our phrasing if we assume that the TV *a* also has the feature [+high] underlyingly. Of course, it may be that palatalisation is blocked by [+low] in this case. It is a question we leave for further research whether the preservation of the TV should refer to the underlying features or the ones surfacing in the perfective verb.

Table 35: Secondary imperfectivisations: preservation of other TVs

gloss	TV (PFV)	PFV.INF	PFV.PRS.1PL	IPFV.INF	IPFV.1PL
'starve'	(j)e/i	iz-gladn-(j)e-ti	iz-gladn-iː-mo	iz-gladɲ-iː-ʋa-ti	iz-gladɲ-u-jeː-mo
'deserve'	(j)e/i	za-vr(ij)eːd-(j)e-ti	za-vr(ij)eːd-iː-mo	za-vredz̩-iː-ʋa-ti	za-vredz̩-u-jeː-mo
'inspire'	nu/ne	na-dax-nu-ti	na-dax-neː-mo	na-dax-ɲ-iː-ʋa-ti	na-dax-ɲ-u-jeː-mo
'worry'	nu/ne	za-bri-nu-ti	za-bri-neː-mo	za-bri-ɲ-aː-ʋa-ti	na-zabri-ɲ-aː-ʋaː-mo
'sour'	nu/ne	pro-kis-nu-ti	pro-kis-neː-mo	pro-kiʃ-ɲ-aː-ʋa-ti	pro-kiʃ-ɲ-aː-ʋaː-mo

We open this section with a brief discussion on where we stand now with respect to this issue. We then tackle the issue of what the necessary elements of SIs are on our analysis, as well as the syntactic and semantic underpinnings of the proposed account. Finally, we briefly (and tentatively) discuss why SIs involve the suffixation of multiple theme vowels and why there are different realisational possibilities for the same combinations of theme vowels.

Theme vowels are suffixes: they get added to a base with the effect of assigning it an inflection class, i.e. providing it with the capacity to take verbal inflection, while also specifying the exact set of inflectional endings that this base can take. This effectively amounts to making it a verb, if we take that a verb can be morphologically defined as any word showing verbal inflection.

In the linguistic tradition, the notion of TVs as distinct from verbalizing suffixes has been introduced to capture the fact that suffixes classified as TVs do not have any additional contributions apart from mediating inflection, while proper verbal affixes do (but see Fábregas 2017). The imperfectivising effect of the traditional TV *iva/uje* is a case in point. Further support for the division came from the fact that morphemes with an additional contribution tend to be phonologically more complex than those that just express an inflectional class. In this perspective, the list of TVs in Table 3 was inconsistent: it included real dummy TVs like *a/a* and *i/i*, but also those traditionally seen as suffixes, such as *iva/uje* and *ova/uje*. At the same time, it excluded other verbal suffixes such as the integration morphemes ira~ira and isa~iʃe or the iterative-semelfactive suffixes ta~tɕe (e.g. in *treptati* 'blink repeatedly') and ka~ka (e.g., in *lupkati* 'knock repeatedly').

The overview of SIs presented in this paper has shown that the systematic effect of secondary imperfectivisation (typically associated with suffix-like items) corresponds to different amounts of phonological material. Compare, for instance, single-theme SIs in Table 36[17] and Table 37 and double-theme SIs in Table 38. We argued that all of these patterns have the same core, two copies of the theme vowel *a/a*, but that the first copy has different levels of phonological strength/realisational space. In Table 36 it is neither affiliated with a mora nor with a root node, in Table 37 it has a mora (which leads to vowel lengthening), whereas in Table 38 it has both a mora and a root node (which leads to its realisation as a separate vowel). This means that the system we have described allows for some flexibility when it comes to the exponence of SIs. The first issue that we will tackle is what are the limits of this flexibility, i.e., what are the necessary elements of SIs in BCMS.

From the empirical picture presented above, it can be generalised that i) all TVs effecting imperfectivisation are added to a base that already has a verbal TV and ii) all the sequences of two or more TVs have a suffix-like behavior (i.e. they do more than mediating inflection). Based on these two generalisations we can state that all cases of secondary imperfectivisation involve reverbalising previously verbalised material, i.e., involve sequences of theme vowels.

Analysing secondary imperfectivisation as stacking theme vowels (i.e., as reverbalis-

[17] The term 'single-theme SIs' refers to the surface realisation, where only a single theme vowel is realised as a full vowel, which leads to the surface pattern in which a single theme vowel has the function of a SI. The first theme vowel which does not surface at all is marked gray.

Table 36: Imperfectivisation by simple theme vowels

gloss	PFV (root-TV-INF)	IPFV (root-TV-TV-TV-INF)
'fall'	pad-Ø-ti (realised as [pasti])	pad-Ø-ᵘa-ᵘa-ti [padati]
'put'	stav-i-ti	stav-i-ᵘa-ᵘa-ti [stavʎati]
'return'	vrat-i-ti	vrat-i-ᵘa-ᵘa-ti [vratɕati]

Table 37: Imperfectivisation by simple theme vowel + vowel lengthening

gloss	PFV (root-TV-INF)	IPFV (root-TV-TV-TV-INF)
'disturb'	o-met-Ø-ti (realised as [omesti])	o-met-Ø-ᵘa-ᵘa-ti [omeːtati]
'relax'	o-pust-i-ti	o-pust-i-ᵘa-ᵘa-ti [opuːʃtati]
'notice'	o-paz-i-ti	o-paz-i-ᵘa-ᵘa-ti [opaːʒati]

ing verbs) raises the questions of the syntactic and semantic underpinnings of such a procedure. Our analysis straightforwardly matches the analysis of imperfective verbs from Arsenijević (2018, 2023), where they are analysed as aspectually unspecified, i.e. unrestricted. Perfectives, on the other hand, involve an aspectual restriction. If verbal TVs simply realise the verbal category, then adding a TV or a sequence of TVs to a base that already has a TV, amounts to reverbalisation. Considering that SIs only select perfective verbs, this amounts to saying that SIs take a verb that is restricted to the perfective interpretation, and derive from it a verb which is not aspectually restricted. This is a verb that is semantically equivalent to the base verb, except that it lacks the aspectual restriction, exactly what it means to be a secondary imperfective (at least in terms of Arsenijević 2018, 2023). The strong tendency for imperfective (i.e. atelic) interpretation of secondary imperfectives emerges via antipresupposition: if there are two verbs with equivalent semantics, except that one is restricted to perfective/telic interpretations, and the other is unrestricted, the use of the latter will infer that perfectivity/telicity was not intended, as under the maxim of quantity it would trigger the realisation of the more specialised variant.

The next question is why the SIs described involve the addition of two theme vowels, whereas simplex verbs take a single theme vowel. One promising possibility is that there is a featural distinction between root-selecting verbal heads and category-selecting verbal heads. Root-selecting verbal heads only carry one interpretable verbal category feature (spelled out as a single theme). On the other hand, verbal heads selecting categorised bases carry two category features. One of these features is interpretable and specified for the verbal category, and it categorises the expression as verbal (fully on a par with the root-selecting verbal heads). The other feature is uninterpretable – it is responsible for selecting exclusively categorised bases. It can either be specified for a verbal category, and spelled out as the first part of SIs whenever the base is verbal or unspecified for the exact category, and spelled out when the base is non-verbal (e.g., as the first part of *o-va/u-je*).

Having defined the limits of the exponence of SIs as well as their syntactic and semantic underpinnings, the remaining question is why there is flexibility of exponence, i.e. what allows the surface realisation of certain SIs as simple monosyllabic exponents, others as intermediate ones, still monosyllabic but with additional effects on a vowel of

Table 38: imperfectivisation by theme vowel combinations

gloss	PFV (root-TV-INF)	IPFV (root-TV-TV-TV-INF)
'go west'	tsrk-Ø-ti [tsr-Ø-tɕi]	tsrk-Ø-ᵘa-ᵘa-ti [tsrkavati]
'save'	spas-i-ti	spas-i-ᵘa-ᵘa-ti [spaʃavati]
'solve'	r(ij)eʃ-i-ti	r(ij)eʃ-i-ᵘa-ᵘa-ti [r(j)eʃavati]

Table 39: Single and double-theme-vowel SIs in verbs with the base prat-i-ti 'follow'

gloss	PFV	single-TV IPFV	double-TV IPFV
'escort'	iz-prat-i-ti	iz-prat-i-ᵘa-ᵘa-ti [ispratɕati]	*iz-prat-i-i-ᵘa-ti *[ispratɕiʋati]
'start following on Twitter'	za-prat-i-ti	??za-prat-i-ᵘa-ᵘa-ti ??[zapratɕati]	za-prat-i-i-ᵘa-ti [zapratɕiʋati]

the base (apophony and lengthening), and yet others as complex ones, i.e., sequences two full vowels (with an intervening glide). More historical insight is needed to offer an empirically well supported analysis of the exponent patterns, so we restrict ourselves to offering a brief speculation about its emergence.

We speculate that at an older stage of BCMS, SIs productively had non-concatenative exponence, i.e., patterns where the first part of the complex input is sometimes realised on the base in terms of modifications of the base-final vowel (as illustrated in 37) or not realised at all (as illustrated in 36). This system has been moving in the direction of a more transparent exponence pattern, with concatenative, disyllabic exponents (as illustrated in Table 38), which surface when the SI is entirely realised linearly following the base.[18] The transparent and concatenative exponence pattern is now much more dominant, and only disyllabic exponents are productive as realisations of SIs. This is also recognised by traditional descriptions: e.g., Babić (2002: p.526) states that the only productive SIs are (j)iʋa~(j)uje and (j)aʋa~(j)aʋa. Non-concatenative SIs are only available in already established secondary imperfectives. Evidence for this comes from newly coined verbs.

Consider the examples in Table 39. The verb *ispratiti* is an old, well-established, lexicalised verb meaning 'to escort', and its secondary imperfective is derived through the non-concatenative (minor) pattern, which on the surface looks like a single TV added to the perfective stem. The variant with the concatenatively realised SI i-ᵘa/ᵘje, yielding ??[ispratɕiʋati], is ungrammatical. The fully equivalent, but newly coined verb *zapratiti* 'start following on social networks', shows the opposite pattern. It only derives the secondary imperfective with concatenatively realised sequence i-ᵘa/ᵘje ([zapratɕiʋati], underlying /zaprat-i-i-ᵘa-ti/), and yields ungrammaticality with the non-concatenative pattern (??zapratɕati), despite the fact that an analogous old secondary imperfective ispratɕati 'escort' is available in the lexicon.

A further indication of the reasons behind the current preference for concatenative SIs and the exponence dynamics in present-day BCMS comes from the only exception to the generalisation that concatenative SIs (iʋa~uje and aʋa~aʋa) never co-occur with apophony, a set of verbs with the root /skok/. The most typical behaviour in this class of verbs is illustrated by /pre-skok-i-ti/ [preskotʃiti] 'jump over, skip', which predominantly derives the non-concatenative imperfective [pre-skaːk-a-ti], while also allowing (though much less frequently) what looks like a concatenative secondary imperfectivisation of [pre-skaːk-a-ti]: [pre-skak-iːʋ-a-ti]. Even more exceptionally, /po-skok-i-ti/ [poskotʃiti] 'jump a little bit' only derives the 'double' secondary imperfective [po-skak-iːʋa-ti] 'jump a little bit', but not the intermediate step (??[po-skaːk-a-ti]). We conjecture that the relevant difference, resulting in the blocking of the non-concatenative option in the latter case, is the existence of another verb [po-skaːk-a-ti] 'jump.all', which would be homophonous with it. Rather than undoing the derivation and enforcing the application of a concatenative SI to the perfective verb (which would have yielded ??[poskotʃiːʋati]), an additional application of reverbalisation takes place, and this time it has to use a concatenative exponent (because otherwise it would be surface-vacuous), resulting in

[18] As fully predicted by our analysis, SI-exponence through vowel lengthening and apophony is in complementary distribution with disyllabic exponence. In the WeSoSlav database (Arsenijević et al. to appear), there is only one possible exception, which we discuss below.

[poskakiʋati]. Once this double imperfectivisation pattern became lexicalised for some verbs with the root /skok/, being more transparent than the non-concatenative pattern in [preskaːkati], it started (at least for some speakers) spreading to other prefixed verbs with the same root, leading to forms like [preskakiːʋati].

Such cases indicate that having non-concatenative derivation as the default pattern increases the complexity of the system, where various types of licensing and blocking play a role. In comparison with such a system, the present-day system, where only the concatenative disyllabic exponents are productive imperfectivisers, is more economical. By generalizing the crash-proof strategy of concatenative realisation, the system eliminates the additional evaluation step and thus simplifies the derivation.

7 CONCLUSIONS

Building on Quaglia et al. (2022) and Marković (2018), we propose to reanalyse BCMS imperfectivising suffixes in terms of sequences of theme vowels. The two most frequent traditional SI suffixes, iʋa~uje and aʋa~aʋa, are thus analysed as the TV *i* followed by the TV *a/je*, and as two occurrences of the TV *a*, respectively. To account for the emergence of the intervocalic consonants and for the allomorphy of iʋa~uje, we proposed an autosegmental representation including floating segments. We formulated a phonological analysis couched in OT, which covered the hiatus-resolving behaviour of floating consonants and the encountered apophony patterens in SIs. A further welcome result of the autosegmental representations is that they enabled reducing the number of theme vowel classes in BCMS from 13 to 10. We have shown how the proposed analysis fits well with some recent views of secondary imperfectivisation as reverbalisation, such as Arsenijević (2018). Assuming with Svenonius (2004), Fábregas (2017) and Milosavljević & Arsenijević (2022), among others, that theme vowels are verbalisers, suffixation of a new layer of theme vowels is exactly expected to result in reverbalisation. Besides its reductionist contribution in unifying and reducing the number of verbal suffixes and theme vowels, our analysis thus yields support to a particular analysis of verbal aspect in terms of restriction to perfectivity vs. underspecification, while also rendering expected rather than exceptional the behavior of several BCMS verbs, such as *kovati* 'forge' or *bljuvati* 'puke', which have traditionally been considered unclear cases between root and theme allomorphy.

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ABBREVIATIONS

1	first person	OT	Optimality Theory
ACC	accusative	PASS	passive
BCMS	Bosnian/Croatian/-Montenegrin/Serbian	PFV	perfective
		PL	plural
DAT	dative	PRS	present
GEN	genitive	PTCP	participle
INF	infinitive	SG	singular
IPFV	imperfective	SI	secondary imperfectiviser
LOC	locative	TV	theme vowel

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