Patterns of allomorphy in Benabena: The case for multiple inheritance

Berthold Crysmann

CNRS, Laboratoire de linguistique formelle

crysmann@linguist.univ-paris-diderot.fr

Abstract

I discuss recurrent allomorphic splits in Benabena verb morphology, and argue, following Young (1964), that both motivated and unmotivated splits permeate the system in highly systematic ways. I conclude that this phenomenon necessitates generalisations about allomorphy across heterogeneous rules of exponence and show that multiple inheritance type hierarchies over rules, as proposed in Crysmann & Bonami (2016), readily provide the expressive means to capture the generalisations, offering two simultaneous views on the relatedness of rules, i.e. in terms of allomorphic conditions, or in terms of expression. Conversely, I argue that once such an abstraction is in place, mapping of morphosyntactic features to morphomic features becomes unnecessary. If morphomic features can be limited to lexical properties, this will provide for a more transparent interface between syntax and morphology.

Keywords: Allomorphy, morphomic splits, realisational morphology.

Résumé

Je discute des variantes allomorphiques récurrentes dans la morphologie du verbe Benabena, et j'argumente, suivant en cela Young (1964), que celles-ci, qu'elles soient motivées et non, structurent le système de manière très systématique. J'en conclus que ce phénomène nécessite des généralisations sur l'allomorphie au moyen de règles d'exponence hétérogènes, et je montre que les hiérarchies de types à héritage multiple, comme celles que proposent Crysmann et Bonami (2016), fournissent les moyens explicites pour saisir les généralisations sur les règles, en offrant deux vues simultanées des relations entre règles : en termes de conditions sur les allomorphies, ou en termes d'expression. Inversement, je soutiens qu'une fois qu'une telle abstraction est posée, il n'est pas nécessaire de traduire les traits morphosyntaxiques en traits morphomiques. Si ces derniers peuvent être limités aux propriétés lexicales, cela fournira une interface plus transparente entre la syntaxe et la morphologie.

Mots-clefs : Allomorphie, clivages morphomiques, morphologie réalisationnelle.

1. Introduction

In this article, I shall investigate patterns of allomorphic variation in Benabena, a Trans-New Guinea

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language spoken in Papua-New Guinea, and conclude, following Young (1964), that the language's verbal morphology is heavily characterised by three systematic allomorphic processes, which contrast with the otherwise agglutinative nature of the system. I shall argue in particular that a unified analysis of these splits can be given directly in terms of morphosyntactic properties, once rules of exponence are organised in multiple inheritance hierarchies, enabling us to capture generalisations about allomorphic splits across different rules of exponence.

The paper is organised as follows: in section 2, I shall present the basic morphological system of primary verbs in Benabena (section 2.1) and lay out the three different systematic splits we can observe (section 2.2). In section 2.3, I shall discuss the phonological vs. morphological status of the alternation pattern, and I shall explore, in section 2.4 the implication of the Benabena data for current realisational approaches to inflectional morphology. In section 3, I shall provide a brief introduction into the formal framework, namely Information-based Morphology (Crysmann & Bonami, 2016), and finally give a formal analysis of the data in section 4.

2. Data

2.1. Basic facts about Benabena verb inflection

Primary verbs in Benabena (Young, 1964) take both prefixal and suffixal markers. Any primary verb minimally inflects for subject agreement (person and number), tense (present/past/future) and mood (indicative/volitional/imperative), but may take further optional inflectional markers, according to the template given in (1) due to Young (1970)[1].

(1)

ACT	NEG	OBJ	HAB	STEM	TNS	SUB	DU	EMPH	Q/R	MOOD
-4	-3	-2	-1	0	1	2	3	4	5	6

Below, I reproduce two examples from Young (1964) showing an almost[2] fully expanded suffixal template (2) and a fully expanded prefixal template (3).

(2)

me-	na-	ha	-l	-i	-na	-fi	-he
NEG	1.SG.OBJ	hit	FUT	3SG.SUB	EMPH	Q	VOL

'he will not hit me?'

(3)

aʔ-	me-	no-	na-	h	-a	-be
ACT	NEG	HAB	1.SG.OBJ	hit	3SG.SUB	IND

[1] Throughout this paper, I shall use the Leipzig glossing rules, with the following additions: ACT = actualiser, INT = intensive, VOL = volitive, Q = question, R = reason, EMPH = emphatic.

[2] The only suffixal marker not being instantiated is the dual.

‘he is actually not hitting me’

Among the obligatory inflectional dimensions, Benabena distinguishes three persons and three numbers (SG, DU, PL) for subject agreement, three tenses (PRS, PST, FUT), and three moods (IND, VOL, IMP), although I shall mainly focus on the indicative here.

	Class A: *ho/he/ha* ‘hit’			Class B: *bu/bi* ‘go’			Class C: *fi* ‘pierce’		
	PRS	PST	FUT	PRS	PST	FUT	PRS	PST	FUT
SG									
1	ho-**be**	ho-**ʔoh-u-be**	ha-**l-u-be**	b-**u-be**	bu-**ʔoh-u-be**	bi-**l-u-be**	f-**u-be**	fi-**ʔoh-u-be**	fi-**l-u-be**
2	h-**a-ne**	ho-**ʔah-a-ne**	ha-**l-a-ne**	b-**a-ne**	bu-**ʔah-a-ne**	bi-**l-a-ne**	fi-**ne**	fi-**ʔah-a-ne**	fi-**l-a-ne**
3	h-**a-be**	ho-**ʔeh-i-be**	ha-**l-i-be**	b-**i-be**	bu-**ʔeh-i-be**	bi-**l-i-be**	fi-**be**	fi-**ʔeh-i-be**	fi-**l-i-be**
DU									
1	ho-**ʔi-be**	ho-**ʔoh-u-ʔi-be**	ha-**l-u-ʔi-be**	b-**u-ʔi-be**	bu-**ʔoh-u-ʔi-be**	bi-**l-u-ʔi-be**	f-**u-ʔi-be**	fi-**ʔoh-u-ʔi-be**	fi-**l-u-ʔi-be**
2	h-**a-ʔi-be**	he-**ʔeh-a-ʔi-be**	ha-**l-a-ʔi-be**	b-**a-ʔi-be**	bi-**ʔeh-a-ʔi-be**	bi-**l-a-ʔi-be**	fi-**ʔi-be**	fi-**ʔeh-a-ʔi-be**	fi-**l-a-ʔi-be**
3	h-**a-ʔi-be**	he-**ʔeh-a-ʔi-be**	ha-**l-a-ʔi-be**	b-**a-ʔi-be**	bi-**ʔeh-a-ʔi-be**	bi-**l-a-ʔi-be**	fi-**ʔi-be**	fi-**ʔeh-a-ʔi-be**	fi-**l-a-ʔi-be**
PL									
1	ho-**ne**	ho-**ʔoh-u-ne**	ha-**l-u-ne**	b-**u-ne**	bu-**ʔoh-u-ne**	bi-**l-u-ne**	f-**u-ne**	fi-**ʔoh-u-ne**	fi-**l-u-ne**
2	h-**a-be**	he-**ʔeh-a-be**	ha-**l-a-be**	b-**a-be**	bi-**ʔeh-a-be**	bi-**l-a-be**	fi-**be**	fi-**ʔeh-a-be**	fi-**l-a-be**
3	h-**a-be**	he-**ʔeh-a-be**	ha-**l-a-be**	b-**a-be**	bi-**ʔeh-a-be**	bi-**l-a-be**	fi-**be**	fi-**ʔeh-a-be**	fi-**l-a-be**

Table 1. Benabena verb inflection (indicative mood be/ne)

A casual glance at the paradigms in Table 1 will reveal that it is quite straightforward in the general case to arrive at a consensual segmentation of exponents and that it is equally straightforward to determine their primary function. E.g. it is quite easy to determine a constant future marker (*l*), or else an equally constant exponent for dual (*ʔi*). In subsequent paradigms, these constant markers will be greyed out.

Besides these constant markers, we find some alternating markers: e.g. the past marker displays some alternation in vowel quality, while generally conforming to a *ʔVh* pattern. Contrasting the indicative paradigm in Table 1 with volitional *he* (cf. example (2)), one can further identify *be/ne* as the sole exponents of indicative mood. At least when focusing on past and future tense, the markers *u/a/i* can be identified with subject agreement, since the alternation they display remains constant across different tenses, moods and stem classes.

As indicated by bold face, the markers whose primary function can be established essentially exhaust all affixal markers, leaving only the stem.

However, despite this neat segmentability, it becomes equally apparent that we are confronted with massive allomorphy that permeates the system: in essence, we observe alternation of the vowel quality of the past marker (*-ʔoh/-ʔah/-ʔeh*), alternation of the indicative marker (*-be/-ne*), as well as alternation of the stem shape. The latter can be observed to occur both within a particular tense, as illustrated by past *ho/he* and *bu/bi*, or between tenses, as witnessed by the contrast of constant future *ha* or *bi* vs. alternating past *ho/he* or *bu/bi*.

Another straightforward observation pertains to the fact that alternations within each paradigm are governed by person/number distinctions, although we do find some syncretisms.

Furthermore, while we do observe that alternations affect markers across different primary functions, it is equally easy to see that not all of these alternations follow the same syncretism patterns: in fact, the non-overlap between patterns of syncretism actually ensures that all singular cells are properly distinguished.

2.2. Patterns of allomorphy

According to Young (1964), Benabena verb morphology witnesses three systematic allomorphic patterns: an opposition between first and non-first person, an opposition between first person or singular (monofocal) and non-first/non-singular (polyfocal), and finally an opposition that singles out 2SG/1PL in contrast to a default form. All of these patterns affect more than one class of exponents, i.e. they show a certain degree of systematicity.

2.2.1. Monofocal (1/SG) vs. polyfocal

	Class A: *ho/he/ha*		Class B: *bu/bi*		Class C: *fi*	
	HAB	PST	HAB	PST	HAB	PST
SG						
1	**no**-ho-be	**ho**-ʔoh-u-be	**no**-b-u-be	**bu**-ʔoh-u-be	**no**-f-u-be	fi-ʔoh-u-be
2	**no**-h-a-ne	**ho**-ʔah-a-ne	**no**-b-a-ne	**bu**-ʔah-a-ne	**no**-fi-ne	fi-ʔah-a-ne
3	**no**-h-a-be	**ho**-ʔeh-i-be	**no**-b-i-be	**bu**-ʔeh-i-be	**no**-fi-be	fi-ʔeh-i-be
DU						
1	**no**-ho-ʔi-be	**ho**-ʔoh-u-ʔi-be	**no**-b-u-ʔi-be	**bu**-ʔoh-u-ʔi-be	**no**-f-u-ʔi-be	fi-ʔoh-u-ʔi-be
2	***ne***-h-a-ʔi-be	***he***-ʔeh-a-ʔi-be	***ne***-b-a-ʔi-be	***bi***-ʔeh-a-ʔi-be	***ne***-fi-ʔi-be	fi-ʔeh-a-ʔi-be
3	***ne***-h-a-ʔi-be	***he***-ʔeh-a-ʔi-be	***ne***-b-a-ʔi-be	***bi***-ʔeh-a-ʔi-be	***ne***-fi-ʔi-be	fi-ʔeh-a-ʔi-be
PL						
1	**no**-ho-ne	**ho**-ʔoh-u-ne	**no**-b-u-ne	**bu**-ʔoh-u-ne	**no**-f-u-ne	fi-ʔoh-u-ne
2	***ne***-h-a-be	***he***-ʔeh-a-be	***ne***-b-a-be	***bi***-ʔeh-a-be	***ne***-fi-be	fi-ʔeh-a-be

3	*ne*-h-a-be	*he*-ʔeh-a-be	*ne*-b-a-be	*bi*-ʔeh-a-be	*ne*-fi-be	fi-ʔeh-a-be

Table 2. Benabena verb inflection: Monofocal/polyfocal split

The first split we are going to consider singles out non-first non-singular as the marked case, cf. Table 2. The pattern can most easily be observed with past stem alternation in Class A and B: we find, in Class B, an alternation between marked *bi* and unmarked **bu**, or in Class A, the equivalent alternation between marked *he* vs. unmarked **ho**[3].

This split is by no means restricted to stem allomorphy: it is equally attested for prefixal operative marker *no/ne* (glossed as habitual in Table 2). As can be easily verified by comparing Tables 1 and 2, the habitual is modeled on the present by means of prefixation of *no/ne*. Thus, in classes A and B, the alternation of the operative (=habitual) marker targets the same person/number combinations as does the alternation of the past stem. In class C, which does not display any stem alternation in the past, as illustrated by the verb *fi*, we still observe the relevant split with the operative marker used in the habitual.

Young (1964) cites the imperative as another instance of this split. Although the imperative paradigm is quite sparsely populated (2nd person only), we observe that the singular form follows a different pattern compared to plural/dual.

	Class A: *ho/he/ha*			Class B: *bu/bi*			Class C: *fi*		
	SIMPLE	INT	CAUS	SIMPLE	INT	CAUS	SIMPLE	INT	CAUS
SG	**ho**-bo	**ho-ʔoh-u**-bo	—	**bu**-bo	**bu-ʔoh-u**-bo	—	fi-bo	fi-**ʔoh-u**-bo	—
DU	*ha*-liyo	*he-ʔeh-i*-liyo	*he*-ʔi-no	*bi*-liyo	*bi-ʔeh-i*-liyo	*bi*-ʔi-no	fi-liyo	fi-*ʔeh-i*-liyo	fi-ʔi-no
PL	*ha*-lo	*he-ʔeh-i*-lo	*he*-no	*bi*-lo	*bi-ʔeh-i*-lo	*bi*-no	fi-lo	fi-ʔeh-i-lo	fi-no

Table 3. Benabena verb inflection: splits in the imperative

In the simple imperative, second singular uses the basic (=past) stem, whereas plural and dual use the future stem, as illustrated by the paradigm in Table 3.

The intensive imperative equally aligns with the monofocal/polyfocal split: while the stem is the basic (past) stem throughout, it displays the same alternation as it does in the past, cf. Table 2. By contrast, the post-stem affix shows some segmental similarity to the past marker *ʔVh*, although the

[3] From here on, I shall represent instances of the unmarked value of a split by bold face, those of the marked value by italics, and leave exceptions to regular. Irrelevant markers will be greyed out.

following vowel for subject agreement is different from the one we find for the corresponding cells in the past indicative paradigm. Still the vocalisation treats (marked) non-singular forms different from second singular.

The so-called *causative*, another imperative form, finally aligns with this pattern as well, displaying a gap in the second singular.

Owing to the sparsity of the imperative paradigms, in particular the absence of any first person non-singular forms, it is impossible to distinguish the monofocal/polyfocal split from a mere singular/non-singular split. However, it is clear that the split observed here does align with the split observed in more populated paradigms.

2.2.2. Ego (1) vs. non-ego

	Class A: *ho/he/ha*			Class B: *bu/bi*		
	PRS	PST	FUT	PRS	PST	FUT
SG						
1	ho-be	ho-**ʔoh**-**u**-be	ha-l-**u**-be	b-**u**-be	bu-**ʔoh**-**u**-be	bi-l-**u**-be
2	h-*a*-ne	ho-ʔah-*a*-ne	ha-l-*a*-ne	b-*a*-ne	bu-ʔah-*a*-ne	bi-l-*a*-ne
3	h-*a*-be	ho-*ʔeh*-i-be	ha-l-i-be	b-i-be	bu-*ʔeh*-i-be	bi-l-i-be
DU						
1	ho-ʔi-be	ho-**ʔoh**-**u**-ʔi-be	ha-l-**u**-ʔi-be	b-**u**-ʔi-be	bu-**ʔoh**-**u**-ʔi-be	bi-l-**u**-ʔi-be
2	h-*a*-ʔi-be	he-*ʔeh*-*a*-ʔi-be	ha-l-*a*-ʔi-be	b-*a*-ʔi-be	bi-*ʔeh*-*a*-ʔi-be	bi-l-*a*-ʔi-be
3	h-*a*-ʔi-be	he-*ʔeh*-*a*-ʔi-be	ha-l-*a*-ʔi-be	b-*a*-ʔi-be	bi-*ʔeh*-*a*-ʔi-be	bi-l-*a*-ʔi-be
PL						
1	ho-ne	ho-**ʔoh**-**u**-ne	ha-l-**u**-ne	b-**u**-ne	bu-**ʔoh**-**u**-ne	bi-l-**u**-ne
2	h-*a*-be	he-*ʔeh*-*a*-be	ha-l-*a*-be	b-*a*-be	bi-*ʔeh*-*a*-be	bi-l-*a*-be
3	h-*a*-be	he-*ʔeh*-*a*-be	ha-l-*a*-be	b-*a*-be	bi-*ʔeh*-*a*-be	bi-l-*a*-be

Table 4. Benabena verb inflection: Ego/Non-ego split

The second motivated split targets primarily first person as opposed to all others. This pattern is witnessed by the subject agreement markers (-**u**/-*a*) and the vowel alternation in the past marker (-**ʔoh**/-*ʔeh*).

In the non-singular, we observe the basic binary opposition relating to first person, whereas in the singular there is an additional split that singles out the third person for subject agreement (-i) or the second person for past tense (-ʔah).

Although the pattern is slightly obscured by these two exceptions, it is clear that the two exceptions do not affect the same cells, such that the syncretisms of tense and agreement exponents between the non-first singular and non-first non-singular are actually observable.

	Class A: *ho/he/ha*		Class B: *bu/bi*		Class C: *fi*	
	PRS	PST	PRS	PST	PRS	PST
SG						
1	**ho**-be	ho-ʔoh-**u**-be	b-**u**-be	bu-ʔoh-**u**-be	**f**-**u**-be	fi-ʔoh-**u**-be
2	*h*-*a*-ne	ho-ʔah-*a*-ne	b-*a*-ne	bu-ʔah-*a*-ne	*fi*-ne	fi-ʔah-*a*-ne
3	*h*-*a*-be	ho-ʔeh-**i**-be	b-**i**-be	bu-ʔeh-**i**-be	*fi*-be	fi-ʔeh-**i**-be
DU						
1	**ho**-ʔi-be	ho-ʔoh-**u**-ʔi-be	b-**u**-ʔi-be	bu-ʔoh-**u**-ʔi-be	**f**-**u**-ʔi-be	fi-ʔoh-**u**-ʔi-be
2	*h*-*a*-ʔi-be	he-ʔeh-*a*-ʔi-be	b-*a*-ʔi-be	bi-ʔeh-*a*-ʔi-be	*fi*-ʔi-be	fi-ʔeh-*a*-ʔi-be e
3	*h*-*a*-ʔi-be	he-ʔeh-*a*-ʔi-be	b-*a*-ʔi-be	bi-ʔeh-*a*-ʔi-be	*fi*-ʔi-be	fi-ʔeh-*a*-ʔi-be
PL						
1	**ho**-ne	ho-ʔoh-**u**-ne	b-**u**-ne	bu-ʔoh-**u**-ne	**f**-**u**-ne	fi-ʔoh-**u**-ne
2	*h*-*a*-be	he-ʔeh-*a*-be	b-*a*-be	bi-ʔeh-*a*-be o	*fi*-be	fi-ʔeh-*a*-be
3	*h*-*a*-be	he-ʔeh-*a*-be	b-*a*-be	bi-ʔeh-*a*-be	*fi*-be	fi-ʔeh-*a*-be

Table 5. Benabena verb inflection: stem clipping/retention

The basic ego/non-ego split can also be observed with present stem alternation: in Class A, first person shows preservation of the stem-final vowel and suppression of the person/number marker, while second and third person undergo stem clipping. In Class C, the pattern is reversed, witnessing stem clipping for first person, and stem preservation as well as suppression of person/number marking in the other cells. Class B, by contrast, appears neutral in this respect showing stem clipping throughout the present tense paradigm.

The stem clipping/rentention pattern is actually mirrored by the presence vs. absence of the person/number markers: whenever the stem is clipped, we find an overt person/number agreement marker, whenever it is preserved, the subject agreement marker is suppressed, accordingly[4].

Comparing the two patterns, it is clear that first person plays a pivotal role, so it makes sense to collapse the two, regarding monofocal/polyfocal alternation as a more restricted case of ego/non-ego alternation yielding a split that singles out not only marked non-first person, but cumulates it with

[4] There are essentially two ways to address this complementary distribution, one morphophonological, the other purely morphological. Under the morphophonological view, vowel retention on one of the formatives would be morphologically conditioned, whereas the suppression on the other would be relegated to phonology, having deletion apply in order to avoid hiatus. The morphological perspective, by contrast, capitalises on the fact that the ultimately deciding condition is morphological in nature, deriving both effects directly. I do not have any strong opinions here, but sake of simplicity, I shall settle with a morphological approach.

marked (non-singular) number.

2.2.3. Morphomic splits (2SG/1PL vs. default)

The third alternation described by Young (1964) involves, inter alia, the indicative mood marker. In contrast to the first two alternations, this split is more morphomic in nature, opposing the unnatural class of second singular and first plural, marked by -ne, to all other cells, marked by -be. Nevertheless, even this split generalises to other markers, namely the emphatic marker -na/-ta and the question marker -fi/-pi. These two markers are found in the vicinity of the mood marker.

Alongside alternating markers, we also find invariant ones in this domain, including the volitive mood marker *-he*, which contrasts with the indicative, and the "reason" marker *-gi*, which contrasts with the question marker.

The morphotactics of these markers are partly illustrated in example (2) above. The mood markers, indicative -be/-ne and volitive -he stand in complementary distribution, sharing the same position (6). Question (-fi/-hi) and reason (-gi) markers are mutually exclusive as well, yet both immediately precede the volitive marker, warranting an assignment to position 5. The emphatic marker -na/-ta is optional and surfaces in position 4, i.e. before the question/reason markers but following the agreement marker (including the dual).

2.3. Phonology

A somewhat salient property of the two systematic splits is that the alternation of shapes also seems to display some systematicity on the phonological level[5]: e.g. a common pattern for the monofocal/polyfocal split is to use a back vowel for the unmarked value, and the corresponding front vowel for the marked one (non-first non-singular). This is the case for two of the stem classes in the past, e.g. **ho**/*he* and **bu**/*bi*, for the habitual marker **no-**/*ne-*, and the intensive imperative marker **ʔoh**/*ʔeh*. However, despite the recurrence of the pattern, there is a good number of exceptions: first, amongst past stems, class C is exceptional in that a constant stem shape is used. Second, in the simple imperative, we do find stem alternation, but it does not follow the back/front pattern except in class B: instead, the marked value uses the "future stem" in class A, while the default value selects the "past stem". Class C is constant, again. Third, in the causative imperative the split is attested by a gap in the paradigm, so there is no back/front alternation in any strict sense, even if the attested cells do follow the pattern of the intensive imperative.

With the ego/non-ego split, the initially neat-looking picture becomes even more questionable: while for the past marker (**ʔoh**/*ʔeh*/ʔah), we do find a back/front pattern, with an exceptional low vowel

[5]Benabena features a system of five vowels: in addition to the peripheral vowels [i] ([HIGH +, LOW –, BACK –], [u] ([HIGH +, LOW –, BACK +]) and [a] ([HIGH –, LOW +]), we find two mid vowels, [e] ([HIGH –, LOW –, BACK –]) and [o] ([HIGH –, LOW –, BACK +]).

in the 2nd singular, the agreement marker rather displays an alternation between a back vowel for the default first person value, vs. a low vowel */a/* for the marked value (albeit with one exception). The exceptional value in the third singular, by contrast instantiates the back/front pattern, but does so only in a single cell. As a net effect of the different exceptional cells in the singular, we do find that fronting and lowering cooccur, cf. the past forms in Table 4, but this pattern does not generalise to non-singular cells. Thus, while the singular cells look like vowel harmony, the dual and plural cells are systematically disharmonic. Finally, present tense stem vowel clipping/retention is entirely disconnected from any process like fronting: among the stem classes that do undergo back/front alternation, one is subject to selective clipping, whereas the other displays clipping throughout. Worse, class C, which is exempt from back/front alternation nevertheless features stem retention, and it even does so with vowel qualities that are systematically clipped in class B.

So the analytical problem we are confronted with is as follows: how can we capture what looks like a systematic phonological relation between allomorphs despite the abundance of exceptions, and especially how can we do that in terms of phonological generalisations that are both surface-true and surface apparent?

One way to make sense of the phonological systematicity is to establish how Benabena organises underspecification of vowel qualities. Under this perspective, two generalisations will surface: first, whenever there is an alternation in vowel quality, the default value will be realised by a back vowel, with the marked values being realised by a front or low vowel. Second, underspecification of Benabena vowel qualities seems to involve two patterns: one involving the peripheral values of the vocalic triangle ([u], [a], [i]), and a lowered variant ([o], [a], [e]). While the latter set does have an underspecified description in most phonological feature geometries (e.g. [HIGH –]), the first one does not. I shall therefore make use of logical negation to represent peripheral, i.e. non-mid vowels as a class[6]. Which phonological pattern will be chosen, however, will ultimately be determined by morphology. To my mind, this will strike a good balance between doing justice to the observable phonologically motivated patterns without relegating exceptions and purely morphologically determined alternations to overly abstract assumptions about underlying representations.

2.4. Discussion

The fact that allomorphic patterns in Benabena are recurrent and can be found across different syntagmatic classes may pose some problems for classical approaches to realisational morphology, such as A-morphous Morphology (= AM; Anderson, 1992) or classical Paradigm Function Morphology (= PFM1; Stump, 2001). While these approaches are of course capable of deriving the correct surface

[6]An alternative to a feature description of vowels could be given by a representation of elements (Kaye, Lowenstamm & Vergnaud, 1985) that treats peripheral vowels as singleton sets ({i}, {u}, {a}), and mid-vowels as sets of cardinality 2, e.g. {i,a} = [e], {u,a} = [o]. For reasons of readability, I shall stick with a featural representation here.

forms, the fact that rules are organised into rule blocks makes it difficult to capture the generalisation that monofocal/polyfocal allomorphy affects exponents in different syntagmatic classes, and the same seems to hold for the other two splits[7].

An interesting alternative may be provided by morphomic features. As originally introduced by Aronoff (1994), the notion *morphome* refers to patterns of morphological realisation that are not reducible to systematic factors outside morphology, like e.g. syntax, semantics or phonology, but constitute arbitrary properties that are entirely internal to morphology (see Luís & Bermúdez-Otero, 2016, for a recent overview). Coarsely speaking, morphomic properties can be sub-divided as to whether the systematic, yet arbitrary patterns are specific to particular lexical classes, or not. In terms of the typology of morphological features proposed by Corbett & Baerman (2006), key examples of the former type are inflection class features and stem indexing features, which also play a central role in the organisation of stem spaces (Maiden, 2005; Montermini & Bonami, 2013) and heteroclisis (Stump, 2006; Bonami & Crysmann, 2018). Deponency (Baerman, Corbett, Brown & Hippisley, 2007; Corbett, 2007) may also be considered as a phenomenon on the lexical side of morphomics. What these phenomena have in common is that they all require an interface to the lexicon, which may need to be cast in featural terms, a conclusion that has been made e.g. in Corbett & Baerman (2006). The second type of evidence for morphomic organisation, syncretic index features in the typology of Corbett & Baerman (2006) comes from unmotivated patterns of syncretism (Baerman, Brown & Corbett, 2005), i.e. systematic patterns that follow neither a natural class divide, nor are amenable to an analysis in terms of Panini's principle.

More recently, morphomic features have been explored as an analytic device for such morphomic splits. Two formal approaches have been proposed within the context of inferential-realisational theories: Bonami & Boyé (2008) argue that regular syncretism in Nepali is morphomic and propose to enrich the morphosyntactic property set with morphomic features cast in terms of the rows and columns of the paradigm. Under their perspective, morphomic features are derived from morphosyntactic ones by means of feature cooccurrence restrictions (FCR). Stump (2016: ch. 8), by contrast, pursues a different route and uses property mappings that replace morphosyntactic features with morphomic ones.

Stump (2016) discusses two splits in Hua (Haiman, 1980), a language related to Benabena. Compared to Benabena, Hua has a much richer set of mood markers, and the split observed there follows the same unmotivated pattern as we have seen in section 2.2.3, which singles out second singular and first plural from all other cells. Furthermore, Stump (2016) addresses the neutralisation of 2nd/3rd person distinctions in the dual and plural, a split which is almost identical to the monofocal/polyfocal split of Young (1964).

Crucially, Stump (2016) regards Hua splits as morphomic in general, and deploys the mapping

[7]These theories may offer a partial solution in terms of morphophonological rules.

between morphosyntactic properties that characterise so-called content paradigms to morphomic properties that are characteristic of form paradigms, a distinction that forms the core of what Bonami & Stump (2016) have called PFM2.

In essence, what he suggests is to remap the number value of the two exceptional cells of the morphomic pattern (see section 2.2.3) to a morphomic feature C, as shown in (4).

(4) a. { 2 SG } ↦ { 2 C }
b. { 1 PL } ↦ { 1 C }

(5) a. { 3 SG } ↦ { 3 SG }
b. { 3 } ↦ { 2 }

Realisation rules for mood markers are then formulated in terms of an opposition between exponence for C and a default realisation.

He equally suggests to account for the Hua equivalent of the monofocal/polyfocal distinction by means of neutralising the 2nd/3rd person contrast in the plural in favour of 2nd person, by virtue of the property mappings in (5). This neutralisation in the non-singular almost captures the pattern in Benabena, except in the habitual, since here the singular forms are syncretic.

As we have shown above, Benabena witnesses three systematic splits that target different classes of exponents: two nested Paninian splits (ego/non-ego and monofocal/polyfocal) and one morphomic split. Depending on whether we choose FCRs or replacive property mappings, we are confronted with different consequences.

Using an approach in terms of FCRs like Bonami & Boyé (2008) both morphomic features and the morphosyntactic features they derive from are available at the same time. Thus, it would be straightforward to have some rules reference morphomic features, e.g. for the morphomic split observed with the mood marker -be/-ne, yet formulate realisation rules partaking in Paninian splits in terms of morphosyntactic features.

Under a replacive conceptualisation of morphomic features, however, the mapping for the morphomic split (2SG/1PL vs. other) interacts in adverse ways with a feature relevant for the monofocal/polyfocal split, namely number. One possibility is of course to postulate MONOFOCAL as a morphomic feature[8]: while indeed the realisation rules downstream will then be quite easy to state, the mapping itself ends up more complicated in a replacive setting, because morphomic features depending on the same morphosyntactic property have to be introduced simultaneously. If mapping of morphosyntactic properties to morphomic features is necessary, it appears that the FCR approach provides a more flexible solution in case of systems that feature motivated and unmotivated splits targeting the same morphosyntactic properties.

[8] Thanks to one of the anonymous reviewers for the suggestion.

More generally, if these morphomic features only serve the internal purpose to generalise over morphomic patterns, their utility is highly dependent on what analytical devices a formal theory of inflectional morphology provides in order to express generalisations across different rules. Thus, an analysis that can derive the same generalisations about allomorphic splits in Benabena yet without morphomic features should be preferred on Occamian grounds.

In what follows I shall assume that there is essentially one feature space for morphosyntactic properties, shared by syntax and morphology proper. As a working hypothesis, I shall assume that morphomic features in the general case should only be necessary at the interface to the lexicon. I shall show in particular that a theory of inflectional morphology couched in terms of typed feature structures organised into multiple inheritance hierarchies provides for simultaneous views of realisation and alternation, obviating the need for feature mappings. As a consequence, the supposed need for mapping to auxiliary morphomic features may turn out to be just an artifact of the choice of descriptive devices: what counts as evidence for morphomic features in one formal theory, may be completely undermotivated in a theory that already provides the necessary means of abstraction.

In order to do full justice to systematic patterns of allomorphy, as witnessed in Benabena, it appears necessary to group different rules of exponence not only in terms of the properties they express, but also according to their allomorphic properties. Accordingly, I shall argue that multiple inheritance hierarchies of realisational rules, as postulated in Information-based Morphology (Crysmann & Bonami, 2016), just provide the necessary prerequisite to generalise simultaneously over properties of exponence and allomorphic pattern.

3. Information-based Morphology

In this section[9], I shall present the basic architecture of Information-based Morphology (IbM), an inferential-realisational theory of inflection (cf. Stump, 2001) that is couched entirely within typed feature logic, as assumed in HPSG (Pollard & Sag, 1987, 1994). For a general introduction to typed feature structure formalisms as used in morphology, see Bonami & Crysmann (2016). In IbM, realisation rules embody partial generalisations over words, where each rule may pair *m* morphosyntactic properties with *n* morphs that serve to express them. IbM is a morphous theory (Crysmann & Bonami, 2016), i.e. exponents are described as structured morphs, combining descriptions of shape (=phonology) and position class. As a consequence, individual rules can introduce multiple morphs, in different, even discontinuous positions. By means of multiple inheritance hierarchies of rule types, commonalities between rules are abstracted out: in essence, every piece of information can be underspecified, including shape, position, number of exponents, morphosyntactic properties, etc.

[9]This section has been reproduced from Crysmann & Bonami (2017).

In contrast to other realisational theories, such as Paradigm Function Morphology (Stump, 2001) or A-morphous Morphology (Anderson, 1992), IbM does away with concepts such as ordered rule blocks. Moreover, rules in IbM are non-recursive, reflecting the fact that inflectional paradigms in general constitute finite domains. Owing to the absence of rule blocks, IbM embraces a strong notion of Panini's Principle or the Elsewhere Condition which is couched purely in terms of informational content (= subsumption) and therefore applies in a global fashion (see Crysmann, 2017, for details and discussion).

3.1. Inflectional rules as partial abstraction over words

From the viewpoint of inflectional morphology, words can be regarded as associations between a phonological shape (PH) and a morphosyntactic property set (MS), the latter including, of course, lexemic information. This correspondence can be described in a maximally holistic fashion, as shown in Figure 1. Throughout this section, I shall use German (circumfixal) passive/past participle (*ppp*) formation, as witnessed by *ge-setz-t* 'put', for illustration.

$$\begin{bmatrix} \text{PH} & \left\langle \text{gesetzt} \right\rangle \\ \text{MS} & \left\{ \begin{bmatrix}\text{LID} & \textit{setzen}\end{bmatrix}, \begin{bmatrix}\text{TAM} & \textit{ppp}\end{bmatrix} \right\} \end{bmatrix}$$

Figure 1. Holistic word-level association between form (PH) and function (MS)

Since words in inflectional languages typically consist of multiple segmentable parts, realisational models provide means to index position within a word: while in AM and PFM ordered rule blocks perform this function, IbM uses a set of morphs (MPH) in order to explicitly represent exponence. Having both morphosyntactic properties and exponents represented as sets, standard issues in inflectional morphology are straightforwardly captured: cumulative exponence corresponds to the expression of *m* properties by *1* morph, whereas extended (or multiple) exponence corresponds to *1* property being expressed by *n* morphs. Overlapping exponence finally represents the general case of *m* properties being realised by *n* exponents. Figure 2 illustrates the word-level *m:n* correspondence of lexemic and inflectional properties to the multiple morphs that realise it. By means of simple underspecification, i.e. partial description, one can easily abstract out realisation of the past participle property, arriving at a description of circumfixal realisation.

$$\begin{bmatrix} \text{PH} & \langle \text{gesetzt} \rangle \\ \text{MPH} & \left\langle \begin{bmatrix} \text{PH} & \langle \text{ge} \rangle \\ \text{PC} & \textit{-1} \end{bmatrix}, \begin{bmatrix} \text{PH} & \langle \text{setz} \rangle \\ \text{PC} & \textit{0} \end{bmatrix}, \begin{bmatrix} \text{PH} & \langle \text{t} \rangle \\ \text{PC} & \textit{1} \end{bmatrix} \right\rangle \\ \text{MS} & \left\{ \begin{bmatrix} \text{LID} & \textit{setzen} \end{bmatrix}, \begin{bmatrix} \text{TAM} & \textit{ppp} \end{bmatrix} \right\} \end{bmatrix} \qquad \begin{bmatrix} \text{MPH} & \left\langle \begin{bmatrix} \text{PH} & \langle \text{ge} \rangle \\ \text{PC} & \textit{-1} \end{bmatrix}, \begin{bmatrix} \text{PH} & \langle \text{t} \rangle \\ \text{PC} & \textit{1} \end{bmatrix}, \ldots \right\rangle \\ \text{MS} & \left\{ \begin{bmatrix} \text{TAM} & \textit{ppp} \end{bmatrix}, \ldots \right\} \end{bmatrix}$$

Word

Abstraction of circumfixation (1:n)

Figure 2: Structured association of form (MPH) and function (MS)

Direct word-based description, however, does not easily capture situations where the same association between form and content is used more than once in the same word, as is arguably the case for Swahili (Stump, 1993; Crysmann & Bonami, 2016, 2017) or Batsbi (Harris, 2009). By way of introducing a level of R(EALISATION) R(ULES), reuse of resources becomes possible. Rather than expressing the relation between form and function directly on the word level, as suggested by word-based approaches to morphology (Blevins, 2006), IbM assumes that a word's description includes a specification of which rules license the realisation between form and content, as shown in Figure 3.

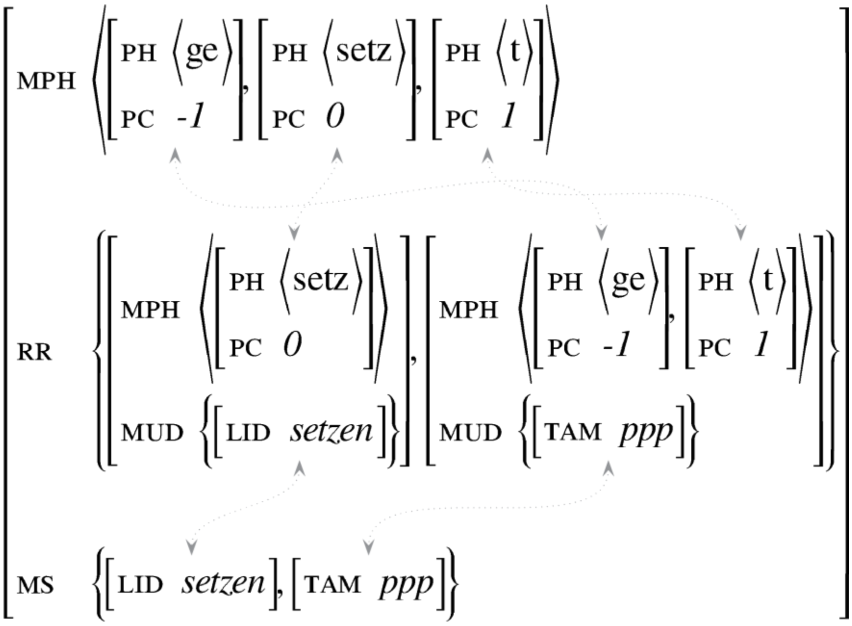

Figure 3. Association of form and function mediated by rule

Realisation rules (members of set RR) pair a set of morphological properties to be expressed, the morphology under discussion (MUD) with a set of morphs that realise them (MPH). A simple principle of morphological well-formedness (Figure 4) ensures that the properties expressed by rules add up to the word's property set and that the rules' MPH lists add up to that of the word, thereby ensuring completeness and coherence without relying on a *1:1* correspondence between form and content.

$$word \rightarrow \begin{bmatrix} \text{MPH} & \boxed{e_1} \circ \ldots \circ \boxed{e_n} \\ \text{RR} & \left\{ \begin{bmatrix} \text{MPH} & \boxed{e_1} \\ \text{MUD} & \boxed{m_1} \\ \text{MS} & \boxed{0} \end{bmatrix}, \ldots, \begin{bmatrix} \text{MPH} & \boxed{e_n} \\ \text{MUD} & \boxed{m_n} \\ \text{MS} & \boxed{0} \end{bmatrix} \right\} \\ \text{MS} & \boxed{m_1} \uplus \ldots \uplus \boxed{m_n} \end{bmatrix}$$

Figure 4. Morphological well-formedness

Realisation rules conceived like this essentially constitute partial abstractions over words, stating that some collection of morphs jointly expresses a collection of morphosyntactic properties. In the example in Figure 3, we find that realisation rules thus conceived implement the *m:n* nature of inflectional morphology at the most basic level: while permitting the representation of classical morphemes as *1:1* correspondences, this is but one option. The circumfixal rule for past participial inflection directly captures the *1:n* nature of extended exponence.

3.2. Levels of abstraction

The fact that IbM, in contrast to PFM or AM, recognises *m:n* relations between form and function at the most basic level of organisation, i.e. realisation rules, means that morphological generalisations can be expressed in a single place, namely simply as abstractions over rules. Rules in IbM are represented as typed feature structures organised in an inheritance hierarchy, such that properties common to leaf types can be abstracted out into more general supertypes[10]. This vertical abstraction is illustrated in Figure 5. Using again German past participles as an example, the commonalities that regular circumfixal *ge-...-t* (as in *gesetzt* 'put') shares with subregular *ge-...-en* (as in *geschrieben* 'written') can be generalised as the properties of a rule supertype from which the more specific leaves inherit. Note that essentially all information except choice of suffixal shape is associated with the supertype. This includes the shared morphotactics of the suffix.

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[10] In contrast to Network Morphology (Corbett & Fraser, 1993; Brown & Hippisley, 2012), which uses default inheritance, IbM is strictly monotonic. As a consequence, multiple inheritance need not be restricted to orthogonal information.

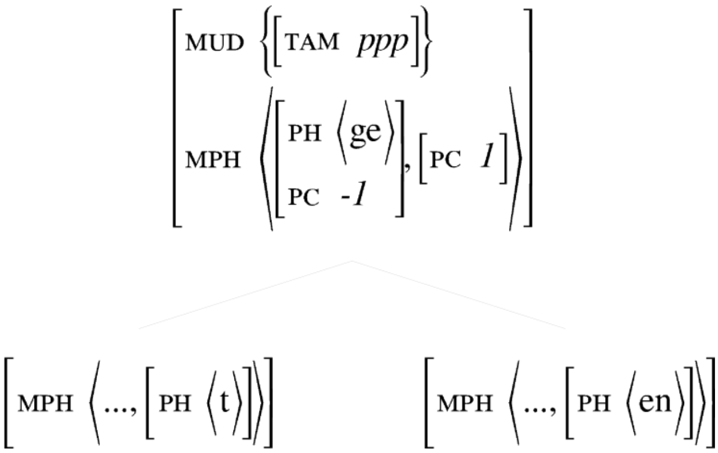

Figure 5. Vertical abstraction by inheritance

In addition to vertical abstraction by means of standard monotonic inheritance hierarchies, IbM draws on Online Type Construction (Koenig & Jurafsky, 1994; Koenig, 1999): using dynamic cross-classification, leaf types from one dimension can be distributed over the leaf types of another dimension. This type of horizontal abstractions permits modelling of systematic alternations, as illustrated once more with German past participle formation:

(6) a. **ge**-setz-**t** 'set/put'
b. über-setz-**t** 'translated'
c. **ge**-schrieb-**en** 'written'
d. über-schrieb-**en** 'overwritten'

In the more complete set of past participle formations shown in (6), we find alternation not only between choice of suffix shape (*-t* vs. *-en*), but also between presence vs. absence of the prefixal part (*ge-*).

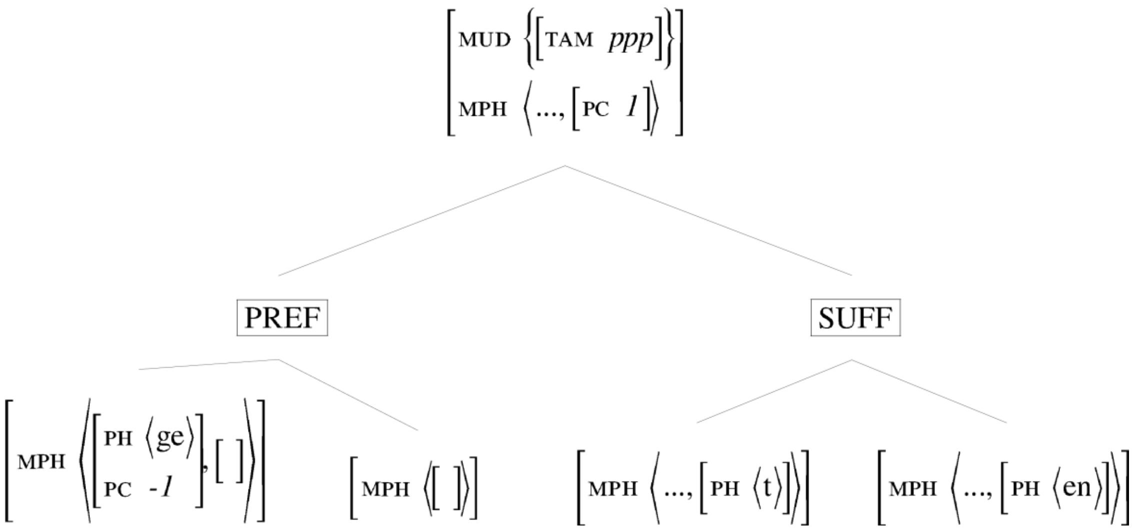

Figure 6: Horizontal abstraction by dynamic cross-classification

Figure 6 shows how Online Type Construction enables us to generalise these patterns in a straightforward way: while the common supertype still captures properties true of all four different realisations, namely the property to be expressed and the fact that it involves at least a suffix, concrete prefixal and suffixal realisation patterns are segregated into dimensions of their own (indicated by PREF and SUFF). Systematic cross-classification (under unification) of types in PREF with those in SUFF yields the set of well-formed rule instances, e.g. distributing the left rule type in PREF over the types in SUFF yields the rules for *ge-setz-t* and *ge-schrieb-en*, whereas distributing the right type in PREF gives us the rules for *über-setz-t* and *über-schrieb-en*, which are characterised by the absence of the participial prefix.

4. Analysis

Having presented the basic workings of the underlying framework, we can now proceed towards an analysis of Benabena patterns of allomorphy. I shall start with ego/non-ego splits, drawing a distinction between marked non-singular vs. an unmarked default. Next, I shall show how monofocal/polyfocal splits can be captured quite straightforwardly by means of embedding a non-singular constraint within the non-first specification, thereby extending the denotation of the default to singular and first person. With the basic outline of the analysis in place, I shall integrate stem clipping/retention as another instance of the ego/non-ego split.

Finally, I will demonstrate that online type construction as used for motivated splits can readily be deployed for unmotivated splits as well: while with Paninian splits we use pre-linking for the marked, non-default value, with unmotivated splits, the pattern is reversed, pre-linking the default form and distributing the exceptions over the alternate exponent.

4.1. Ego/Non-ego

The basic analysis of the ego/non-ego split is given in Figure 7: at the top of the hierarchy of rule types, we distinguish two orthogonal dimensions, one that pairs morphosyntactic properties with partial descriptions of the morphs that express them, and another that captures generalisation on allomorphy.

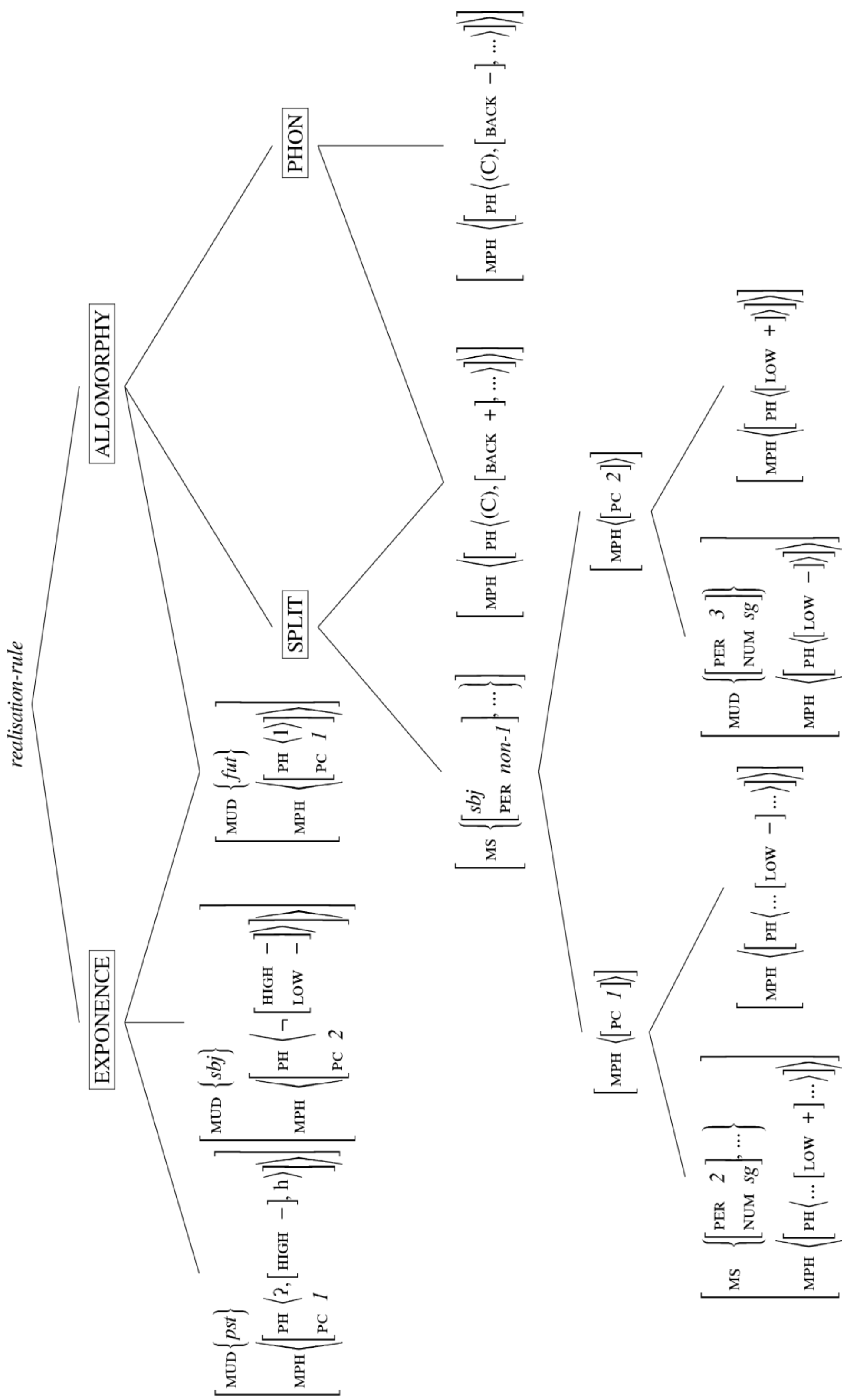

Figure 7. Ego/non-ego split

Actual rule instances in IbM are inferred by systematically intersecting leaf types from one dimension with those in the other. Thus, while the types in the two dimensions capture the generalisations, the inferable rules will contain all and only the licit combinations.

Starting with the EXPONENCE dimension on the left, we find three types: the left-most type describes realisation of *pst* tense, signalled by a morph *ʔVh* in stem-adjacent position 1, where the vowel quality is restricted to non-high (i.e. /e/, /o/, /a/). Likewise, the exponent for subject agreement is restricted to a non-mid vowel in position 2. The third rule type corresponds to non-alternating future marking, expressed by a constant morph *-l* equally in position 1. Since this type does not partake in any allomorphic alternation, it is already pre-linked to the ALLOMORPHY dimension.

In the ALLOMORPHY dimension on the right, we find two sub-dimensions, one (SPLIT) that specifies the morphological properties of the split, and another one (PHON) that provides constraints capturing phonological alternations.

In the PHON dimension, there are two subtypes modelling the back/front alternation. The SPLIT dimension, again, has two types, one that represents the marked allomorphic class (*non-1*), and another one, linked to both SPLIT and PHON that captures the phonology of the default, restricting alternating vowels to be back. The non-back constraint in the PHON dimension will be intersected, under unification, with all subtypes of the *non-1* constraint in the SPLIT DIMENSION.

Thus, while non-back vowel realisation in a way represents a default for subtypes of the *non-1* constraint (a marked value), back vowel realisation serves as the ultimate default for unmarked values.

Subtypes of the non-first allomorphy type may narrow down the vowel quality for different syntagmatic classes: e.g. for position 1, which holds past markers, we find the general non-first realisation as a non-low vowel, as well as the exceptional low vowel for the second singular. Similarly, morphs in position class 2 (subject agreement) are restricted to a low vowel as the more general realisation of non-first person, with an exceptional non-low vowel for third person singular.

The exact vowel qualities for each rule instance are ultimately derived by unification: intersection of the [BACK –] constraint with non-first allomorphs will restrict vowel qualities to a front vowel or /a/, while intersection with the constraints on past tense or subject exponence will further discriminate between high and mid vowels.

Similarly, intersection of the past tense and subject agreement types from the EXPONENCE dimension with the back vowel default in the ALLOMORPHY dimension will equally fix the vowel quality to /o/ for the [HIGH –] past tense exponents, and to /u/ for the non-mid agreement marker.

Application of Panini's principle finally decides on the usage conditions of the default variants: since the allomorphic conditions of the default back realisation are underspecified, rules derived from this type are only ever used, if no more specific rules exist. Thus, for rules that have a non-first allomorphic variant, the default evaluates to first person.

4.2. Monofocal/polyfocal split

The second systematic split in Benabena allomorphy, namely between first or singular vs. non-first non-singular, is approached in a highly similar fashion: like with ego/non-ego splits, I again single out the marked number value (non-singular) and combine it with the marked person value already singled out by the ego/non-ego split. Thus, we keep the top-level types in the ALLOMORPHY dimension, and embed a new subtype for non-singular allomorphy under the type for non-first allomorphy.

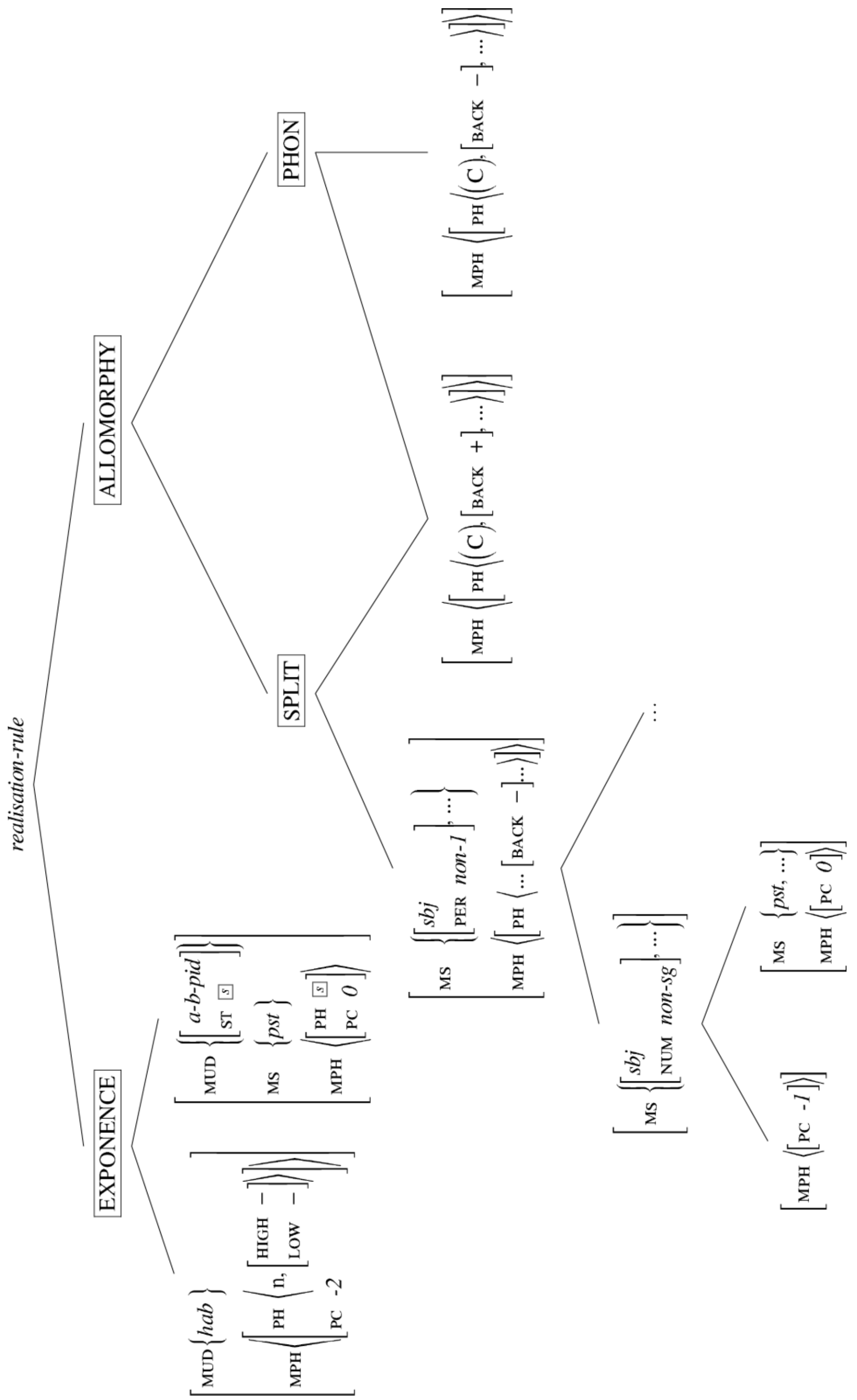

Figure 8. Monofocal/polyfocal split

A sample type hierarchy is shown in Figure 8: starting with the ALLOMORPHY dimension, we still find the same two top-level types from the ego/non-ego split, pairing backness of vowels with a distinction between non-back vowel quality for marked non-first, as opposed to back vowels in the elsewhere case. What is new now, is that we have a nested markedness constraint for non-singular, embedded under the constraint for marked non-first agreement, thus jointly singling out polyfocal values by way of accumulating, via inheritance, two constraints for marked values. The subtypes of this constraint provide descriptions of the rules that partake in the monofocal/polyfocal alternation, characterised in terms of syntagmatic class for the habitual, as well as an additionally conditioning factor for stems, such as *pst*.

The EXPONENCE dimension provides pairings of morphosyntactic properties with the morphs that express them, specified for position, yet partially underspecified for vowel quality.

When forming rule instances by means of intersection of leaf types from the two dimensions, we obtain of course the two polyfocal rules for the habitual and for the past stem rule, but we will also obtain the intersections of the two exponence types with the default back vowel constraint.

However, compared to the ego/non-ego split what changes is the denotation of the default back vowel variant: as dictated by IbM's version of Panini's principle (Crysmann & Bonami, 2016; Crysmann, 2017), a more general rule is expanded with the complement of the informational difference of that rule and the more specific competitor. Thus, as the allomorphic conditions are tightened, going from non-ego to polyfocal (= non-ego, non-singular), the denotation of the default is automatically relaxed, thereby providing a formal definition of pre-theoretic disjunctive monofocal as just a Paninian default competing with a conjunctively defined polyfocal. In other words, nesting of marked conditions not only gives a succinct representation of the phonological properties of the unmarked values, but it also eschews postulation of disjunctive classes, thereby embracing the monofocal/polyfocal alternation as a member of the family of motivated splits.

Rules of exponence not partaking in the allomorphic alternation, such as e.g. the rule for class C past stem selection can again be incorporated by means of pre-linking to both of the two dimensions.

4.3. The representation of stems in Benabena

One aspect that I have glossed over so far, however, concerns the representation of stems. Primary verbs in Benabena are classified into one of three stem classes, which are characterised, inter alia, by their characteristic vowel alternation pattern (Young, 1970). While class C stems are invariant (except for stem clipping, see below), classes A and B display a front back alternation in the past. Furthermore, these two latter classes differ in the choice of stem vowel for the future stem, and they also differ in their clipping pattern. All stems have a CV shape.

Figure 9 represents commonalities and class-specific properties: building on Bonami & Boyé (2006) and Bonami & Crysmann (2018), I represent class-specific stem alternation in terms of a stem space, represented here by two stem features, where A-ST corresponds to an alternate stem typically found in the future, while ST corresponds to the standard stem, as found in the present and past.

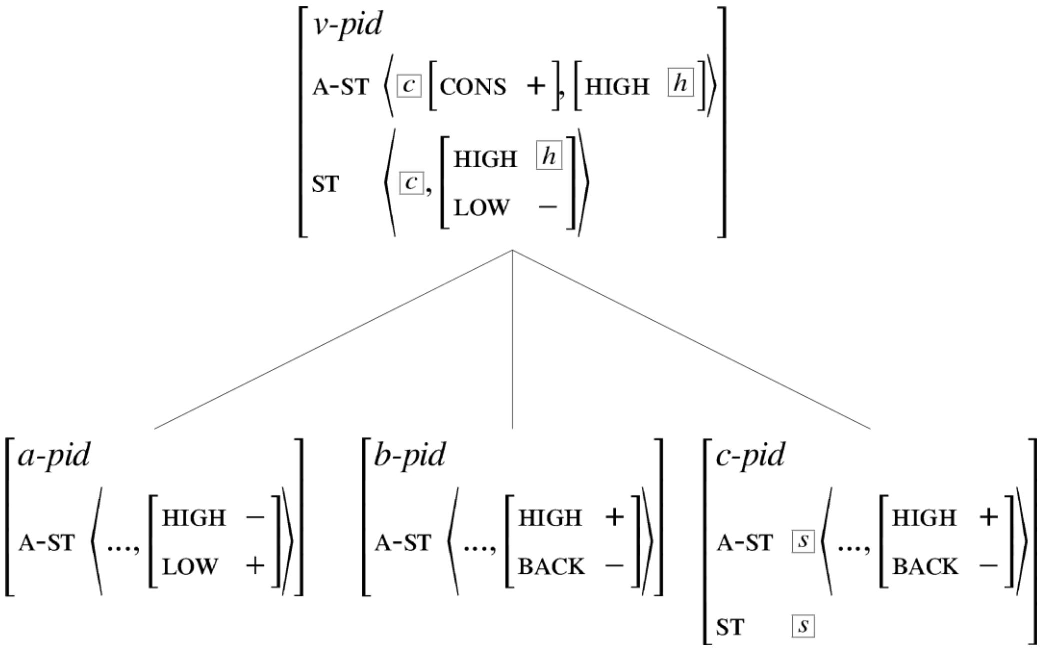

Figure 9. Phonological constraints on Benabena verb stems

In the spirit of Declarative Phonology (Bird, 1995; Bird & Klein, 1994; Walther, 1999), I provide underspecified descriptions of stems, using an SPE-style feature geometry (Chomsky & Halle, 1968). The top of the hierarchy captures properties shared by all stem classes: all stems are made up of a consonant and a vowel, with the consonant being constant across all stem alternants as indicated by the coreference marker *c*, which denotes token-identity in feature logic. Furthermore, present/past stems (ST) are never low ([LOW –]), and the height of the vowel of the present/past stem is systematically related to that of the future stem, hence the re-entrancy *h* for the feature HIGH: with class B and C, all vowels are high, and with class A, vowels are either mid or low.

The subtypes for the individual classes essentially specify the quality of the future stem: a non-high vowel in class A (*ha/ho/he*), a high back vowel in class B *bu/bu/bi* and an invariant high front vowel in class C. Note that for classes A and B, the value of BACK remains crucially underspecified for present/past stems (ST), so these are free to partake in the back/front alternation discussed in the previous section.

With systematic phonological alternation being abstracted out into stem class properties, lexical entries can be defined in quite a concise way, as illustrated in Figure 10. I use standard HPSG feature geometry to represent the lexical predicate, but nothing hinges on that for the purposes of this paper.

See Bonami & Crysmann (2018) for details on the interface between morphology and the lexicon.

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{LOC.CONT.RELS} & \left\langle \begin{bmatrix} \text{PRED} & \textit{hit} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{MORPH} & \begin{bmatrix} \text{MS} & \left\{ \begin{bmatrix} \textit{a-pid} \\ \text{ST} \ \langle \text{h}, \ldots \rangle \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{LOC.CONT.RELS} & \left\langle \begin{bmatrix} \text{PRED} & \textit{go} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{MORPH} & \begin{bmatrix} \text{MS} & \left\{ \begin{bmatrix} \textit{b-pid} \\ \text{ST} \ \langle \text{b}, \ldots \rangle \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{LOC.CONT.RELS} & \left\langle \begin{bmatrix} \text{PRED} & \textit{pierce} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{MORPH} & \begin{bmatrix} \text{MS} & \left\{ \begin{bmatrix} \textit{c-pid} \\ \text{ST} \ \langle \text{f}, \ldots \rangle \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix}$$

Figure 10. Sample lexical entries for *hit, go, pierce*

4.4. More on the ego/non-ego split: Stem clipping

Now that we have seen how the systematic allomorphic splits in Benabena can be captured in a way that generalises from affixal exponents to stems, we are in a position to address a most intricate pattern, namely stem clipping/retention in the present.

What is particularly interesting about this pattern is that it involves a morphological reversal (see Baerman, 2007, for a typological overview): as witnessed by the paradigm in Table 5, whenever Class A witnesses stem retention, class C undergoes stem clipping, and whenever a class C stem is retained, the class A stem for the same cell is clipped. Class B stems undergo clipping in all cells, suggesting that retention is the exceptional property in the present, with clipping being the standard case.

Stem clipping vs. stem retention correlates with the presence vs. absence of the subject agreement marker. Thus, I shall propose that stem selection rules in the present come in two varieties in Benabena: one rule that merely introduces a clipped stem in position 0, and a positional portmanteau rule that introduces a full stem, yet blocks the position for subject agreement as well. Expression of subject agreement is then taken care of by default zero realisation, IbM’s equivalent of the identity function default.

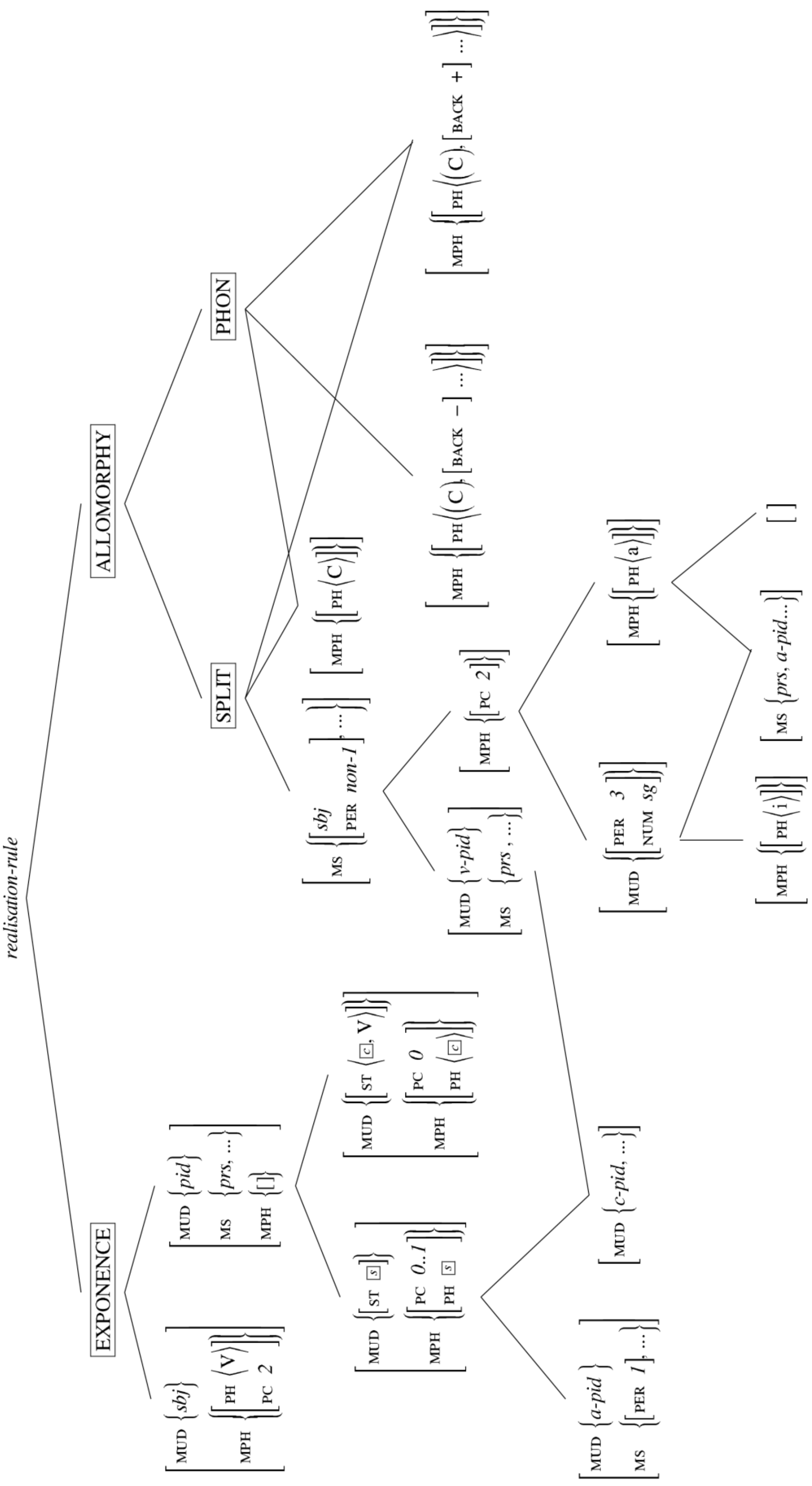

Figure 11. Stem clipping/retention

As depicted in Figure 11, clipping is treated as the default present stem realisation, being unconstrained for any stem class or allomorphic properties. According to Panini's principle, it will serve as a realisation rule in all those cases where there is no more specific rule.

Stem retention, by contrast, constitutes the marked choice in the present. Being exceptional and morphomic in nature, the extension of this positional portmanteau rule type is enumerated (cf. Koenig, 1999, for irregularity and subregularity in Online Type Construction): one subtype describes the exceptional first person cells for class A stems, whereas the other is constrained to class C stems, linked to the marked allomorphic non-first person type.

Owing to its intricate relation to stem clipping and stem retention in the present, the treatment of subject agreement as presented in Figure 7 was modelled on the past and future alone. Closer examination of the paradigm in e.g. Table 4 reveals that, in the present, exponence of third singular subject agreement is exceptional with class A. The marker -a neither corresponds in shape to the third singular marker found in the past or future of any class, including class A, nor to the present in class B, which takes the form -i. The stem does not provide any solution either, since the expected form for this cell would be *he*, not *ha*, given that the non-clipped first person stem suggests that present tense uses the same stem as past, not future. As shown in Figure 11, the exceptional behaviour of the third singular cell is addressed, by specifying an additional rule type restricted to present tense in class A which shares the phonological constraint with the non-ego default.

4.5. Unmotivated morphomic split

Now that we have seen how motivated (Paninian) splits can quite easily be captured using multiple inheritance hierarchies that are abstractions over rules, let us briefly discuss how unmotivated splits can be incorporated. The special twist with unmotivated splits is that they do not involve a natural class, so we cannot easily use underspecification of individual values to pick out all the exceptional forms at once. In the case at hand, we have first plural and second singular pattern together, forming a distributed disjunction. However, the fact that the exact same split occurs with different markers would make it quite unsatisfactory to stipulate the exceptional variant separately for each of the two exceptional cells.

What we need is a way to systematically distribute one constraint over two types. To do this, we can once again use Online Type Construction (Koenig & Jurafsky, 1994): setting up the constraints on expression and allomorphy in two separate dimension, Online Type Construction will systematically intersect, under unification, every leaf type from one dimension with every leaf type from the other. As a result, constraints on expression will be distributed over the two types defining the allomorphic conditions that identify exceptional cells. The standard variants are exempt from this since their types are already pre-linked to a type in the ALLOMORPHY dimension. As always, Panini's principle will ensure that the more general rules can only apply to the complement of the exceptional cells.

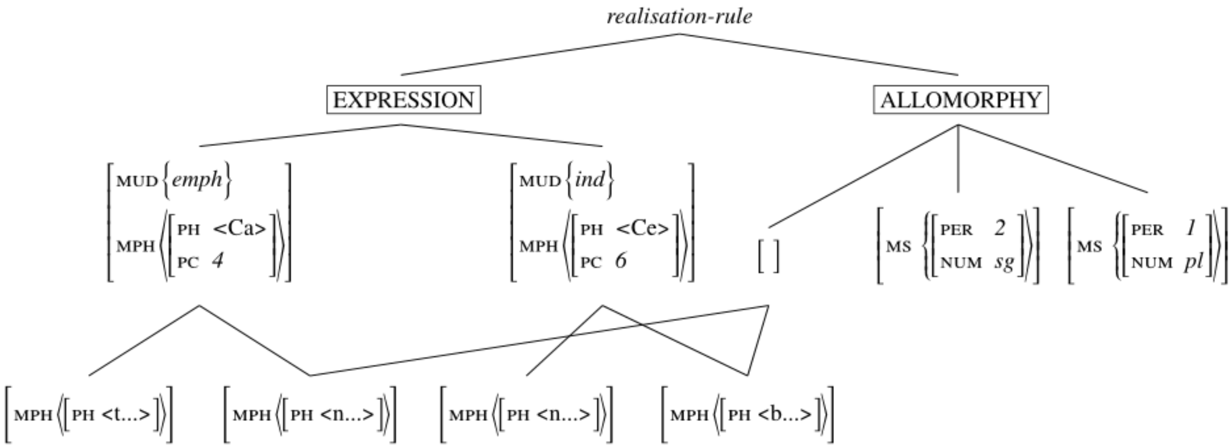

Figure 12. Unmotivated split

The main difference now between natural splits, Paninian splits and unmotivated splits has a direct correspondence in the geometry of the type hierarchies: while natural classes are captured directly by vertical inheritance, the other two types of splits involve cross-classification. Paninian splits will involve pre-linking of the exceptional value, as shown for marked non-ego, or even more marked non-ego/non-singular, whereas fully unmotivated splits display the opposite pattern, having the standard realisation pre-linked, such that the exceptional constraint can be distributed over several disjoint morphosyntactic descriptions.

To summarise, I have shown that morphomic splits in Benabena can be addressed without appeal to morphomic features, once the formalism permits abstraction over properties of rules. In particular, IbM's exclusive reliance on inheritance and cross-classification in typed feature structure hierarchies of realisation rules appears to provide the right analytical device to capture the full range of splits from natural classes, via Paninian splits, to unmotivated classes directly, without any need for remapping of morphosyntactic features.

5. Conclusion

I have discussed recurrent allomorphic splits in Benabena verb morphology, and argued, following Young (1964), that both motivated and unmotivated splits permeate the system in highly systematic ways. I have concluded that this phenomenon necessitates generalisations about allomorphy across heterogeneous rules of exponence. I have shown that multiple inheritance type hierarchies over rules, as proposed in Crysmann & Bonami (2016), readily provide the expressive means to capture the generalisations, offering two simultaneous views on the relatedness of rules, i.e. in terms of allomorphic conditions, or in terms of expression. Furthermore, the current approach derives the seemingly unnatural notion of monofocal, a disjunction of unmarked person (first) and unmarked number (singular) as the default in a Paninian split that results from the accumulation, in a monotonic inheritance hierarchy, of a non-singular marked value with an independently attested marked value for non-first person.

On a more general note, I have argued that mapping of morphosyntactic features to morphomic features is unnecessary once the formalism provides the necessary means to generalise simultaneously over exponence and allomorphy in a cross-cutting multiple inheritance hierarchy of realisational rules. If morphomic features can be limited to lexical properties, this will provide for a more transparent interface between syntax and morphology.

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