

Kartvelian and the Pieces of Inflection:

Constituency versus Morphemes

(First Draft)

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1 Introduction

In this paper I want to discuss the classical Distributed Morphology (DM) analysis of Georgian verbal inflection in Halle & Marantz (1993), taking into account additional data from another South Caucasian language, the Pazar dialect of Laz. I will show that the analysis they proposed fails to treat systematic properties shared by the languages as genuine phenomena, but instead relies on arbitrary and highly specific rules. As a contrast to the DM analysis I present an alternative analysis in a Nanosyntax based framework and show how constituency based realization can derive the data without any manipulation of the structure. I will then go on and argue that a core assumption that DM makes about the morphological realization of syntactic structure – namely the idea that morpho-syntactic features are bundled into morphemes that constitute the locus of vocabulary insertion – necessitates inelegant restructuring with powerful instruments.

I begin the paper with a very short overview of DM. After that I will give a short recap of the proposed analysis of Georgian with a focus on the realization of agreement for plurality, pointing out a systematic constraint on co-occurrence of two suffix types that is treated as accidental in Halle & Marantz (1993). I will then introduce the corresponding data in Pazar Laz and show that the same constraint is valid there as well. After that I will attempt a number of DM analyses that follow Halle & Marantz (1993) and show what kind of restructuring is necessary to derive the affix distribution we find.

After an interim conclusion about the analysis of Georgian and Pazar Laz in DM terms, I will then lay out the basic assumptions of Nanosyntax, followed by the analyses carried out in that framework, showing that the idea of constituency that features in Nanosyntax makes the same phenomena that are derived by arbitrary restructuring in DM a simple property of the structure itself.

I will then end with a final section that discusses the basic different assumptions of DM and Nanosyntax in terms of the locus of realization and will argue that the DM account by its nature treats apparent mismatches between

syntax and morphology as arbitrary restructuring, whereas a Nanosyntax account restraints these cases to constituency.

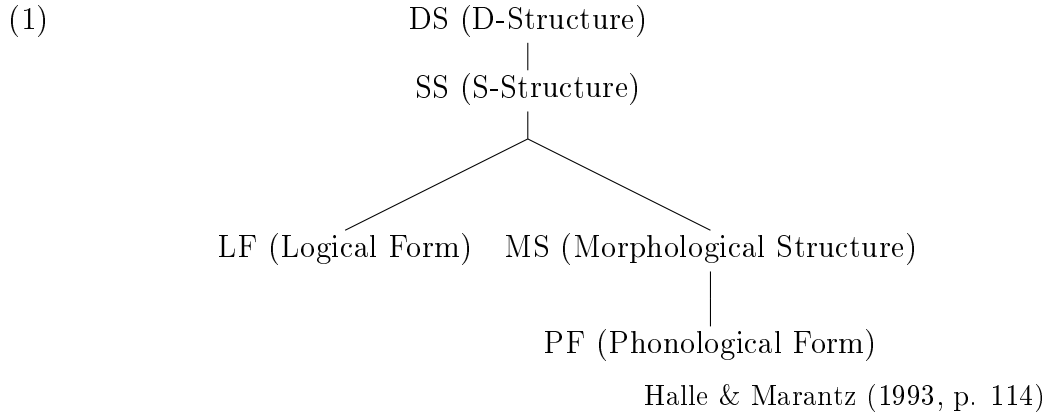
2 Distributed Morphology

In this section I will outline the basic assumptions and tools of DM. I will largely follow the ideas presented in Halle & Marantz (1993) but will occasionally make reference to DM as it is outlined in various younger overview articles; as such this should not deviate to far from what might be considered a standard perspective on DM.

2.1 Structure

DM assumes (inflectional) morphology to be, broadly speaking, the module that creates phonological structures from syntactic structures. The implementation of this idea in the classic Y-model of grammar entails two basic assumptions, namely *Syntactic Hierarchical Structure All the Way Down* and *Late Insertion*.

The first of these, *Syntactic Hierarchical Structure All the Way Down*, is implemented in terms of a level of representation – Morphological Structure (MS) – that follows the S-Structure (SS) and precedes the Phonological Form (PF) (Halle & Marantz, 1993, p. 114). MS takes the syntactic structure of SS as its input and adds certain morphological heads, e.g. AGR nodes. On this structure, based on the one derived by syntax proper, a set of morphological operations applies (see section 2.3). The structure created this way is still based on morpho-syntactic features which are combined into terminal nodes called *morphemes* in DM. This is part of the second assumption, *Late Insertion*, which suggests that syntax operates purely on abstract morpho-syntactic features. These are realized by phonological material after the syntactic structure was constructed. In that sense morphology is the component that supplies an abstract tree structure with phonological material. For DM inflectional morphology is thus located as in (1):



Later versions of DM no longer assume a level of representation specific to morphology; instead the relevant operations are considered “PF readjustment processes” (Embick & Noyer, 2007, p. 304). This is an adaptation to general Minimalist principles which question the existence of specific levels of representation as formal objects/parts of the language faculty (Hornstein *et al.*, 2006, p. 20ff), inflectional morphology, however, remains located at the same relative point/time in a derivation.

2.2 Vocabulary Insertion

In the DM perspective the terminal nodes structured by syntax (and to a limited extent morphology, see 2.3) are realized by phonological material, so called *Vocabulary Items* (VI).¹ These are roughly the equivalent of what is traditionally considered to be a morpheme. In order to systematically explain the fact that languages often exhibit syncretisms – i.e. two forms with different morpho-syntactic specification being phonologically identical – VI are said to be *underspecified*, i.e. they do not necessarily realize all features within a terminal node (called *morpheme* in DM). Instead every VI that is a *subset* of the morpho-syntactic features within such a morpheme, is a candidate for insertion. For every morpheme the most specific VI – i.e. the VI that realizes the most features – is inserted.² This is the so called *Subset*

¹I will only talk about functional heads here, leaving out lexical items or *roots*.

²Accounts may vary with respect to their exact definition of specificity in cases where two VIs realize the same number of features, yet have different specifications. I will leave aside this aspect here.

Principle.

2.3 MS Operations

In order to face apparent mismatches between syntax and morphology, we saw that DM employs underspecification. Since mismatches are not always reducible to underspecification within a given feature bundle (morpheme), DM employs certain structure changing operations on MS.

A number of these have been proposed in various analyses, and approaches vary from examples such as Halle & Marantz (1993) which distinguishes *merger* from *fusion* to approaches that reduce all these operations to VI insertion and its properties (Trommer, 2006).

Here I will give a brief overview of four operations that might be considered standard DM inventory, and which will be relevant to the later discussion, both for my proposals for a DM analysis of Pazar Laz as well as for the analysis of Georgian in Halle & Marantz (1993).

2.3.1 Impoverishment

A rule of Impoverishment is a device for the extension of an exponent's (a VI's) domain (Halle, 1997, p. 131) into the domain of a more specific VI. If two VIs α and β compete for insertion into a morpheme, the more specific VI α is inserted. A rule of Impoverishment bleeds this by deleting a feature from the morpheme that is specific to α , making β the most specific VI to form a subset of the morpheme's feature.

To exemplify: A terminal node M contains the features $[+a +b -c]$. The two competing VIs are $\alpha [+a +b]$ and $\beta [+b]$. To bleed insertion of α into M one might postulate an impoverishment rule (2):

$$(2) \quad [+a] \longrightarrow \emptyset / [+b -c]$$

Only β is compatible with $-$ i.e. a subset of $-$ the features in $M [+b -c]$, resulting in its insertion into M .³

³Impoverishment is a very powerful device if interpreted in this unconstrained way;

2.3.2 Merger & Fusion

In its simplest sense *Fusion* “takes two heads and makes one of them” Bank *et al.* (2012, p. 22), i.e. it takes two morphemes, combines them and thus enables a single vocabulary item to realize a subset of the features of both heads.

In Halle & Marantz (1993, p. 116) the picture is more complicated: Fusion is restricted to two terminal nodes that are “sisters under a single category node”. Morphological *Merger* on the other hand is an instrument that can create such sisterhood: It trades a hierarchical relationship for a linear one: It joins a head with the head of its complement phrase. This in turn allows Fusion to take place, i.e. to create a single terminal node from the two sister nodes.

These instruments in various forms can be used to derive second position effects such as Latin *-que* ‘and’ (Harley & Noyer, 1999, p. 6) and the derivation of Portmanteaus, where one VI expresses features of more than one terminal node.

2.3.3 Fission

Fission is the counter operation to *Fusion*. It is used to account for cases in which “a single morpheme may correspond to more than one Vocabulary Item” (Harley & Noyer, 1999, p. 6). That is to say it modifies the hierarchical structure by splitting one morpheme into two morphemes, e.g. a morpheme $M [+a -b]$ into $M'_1 [+a]$ $M'_2 [-b]$.

2.3.4 Readjustment

Unlike the aforementioned operations, *Readjustment Rules* apply after the insertion of VIs. They do, consequently, not modify morpho-syntactic features and structure, but phonological information. They usually are assumed to operate freely; according to Halle & Marantz (1993, p. 129) they “have

there have, however, been proposals for more restrained versions of Impoverishment, such as the hierarchy implementing approach in Keine (2010).

the form of phonological rules and apply to morphemes after Vocabulary insertion”. One example of an application of this type of rule would be the English ablaut, as in (Halle & Marantz, 1993, ex. (10) d, p. 129):

- (3) $V \longrightarrow [+back \ +round] / W_U$
 where WVU = sell, tell

2.4 DM, Structure and Other Theories

Evidently then DM assumes a relatively complex structure, based on two fundamental relationships: On the one hand there is a symmetric, astructural relationship of features within a certain morpheme (see, however, fn 3.2) and structural c-command relations in a binary syntactic structure that holds between feature bundles.

With Merger, Fusion and Fission DM allows for much modification of the syntactic structure. If put to an extreme DM could construct a structure as assumed by theories that do not assume any hierarchical structure between feature bundles, e.g. Paradigm Function Morphology (Stump, 2001). It could also construct a structure that fissions all feature bundles until there is a one-to-one correspondence between terminal nodes and morpho-syntactic features, as is the case in a theory like Nanosyntax.

In the remaining paper then I want to critically examine what “job the structure gets done” in DM, arguing in a comparison to Nanosyntax that the structure approach in DM obstructs analysis instead of having an explanatory function.

3 Georgian and the Pieces of Inflection

In section I will introduce the morphological data from Georgian that is discussed in the classical paper Halle & Marantz (1993), namely the verbal inflection for tense, person and number in transitive constructions. I will highlight and discuss those aspects of the paradigm that are interesting to a

morphological theory. In the second part I will outline the analysis Halle & Marantz (1993) propose and show that they treat the interesting aspects of the paradigm as results of two rules that are highly specific and arbitrary.

In the next section then I will show that the same properties are systematically present in Laz as well as in Georgian, albeit with different outcome. As such the treatment of these properties as outcomes of arbitrary deletion rules is at best a re-statement of the facts but not an explanation.

3.1 Introducing the Data

The Georgian data under discussion are the morphological items⁴ that realize tense and index arguments.⁵

The paradigm⁶ in Table 1 exhibits a number of interesting phenomena. The first one concerns the prefixes, as these appear to be sensitive to features of both the subject and the object: The occurrences of the prefixes that occur with local (i.e. first and second person) objects – namely ‘*m-*’ 1 SG, ‘*gv-*’ 1 PL, and ‘*g-*’ 2 – is independent of the subject’s properties, the prefix ‘*v-*’, however, is used only when the subject is first person and the object is third person. Neither of these conditions is sufficient on its own as the cases of 1>2⁷ (where ‘*g-*’ is used but ‘*v-*’ is ungrammatical) and 2/3>3 (where no prefix or a zero prefix is used) show.

The second notable phenomenon are the interesting properties of plural marking.⁸ Only one of the prefixes, ‘*gv-*’ – in paradigmatic opposition to ‘*m-*’ –, is sensitive to plurality. With respect to the suffixes ‘*-t*’ and ‘*-en*’ clearly make

⁴Since in DM the term “morpheme” is used to refer to terminal nodes at MS, I will use the term “morphological item” to refer to the classical concept of a morpheme whenever I am discussing linguistic data, but not a formal analysis.

⁵Under discussion in Halle & Marantz (1993) are cases with two arguments. Anderson (1992) also discusses cases, where a third argument may be indexed; these are not treated in this discussion. Cases where only one argument is indexed – i.e. intransitives – form a trivial subset of the cases under discussion here and will therefore be skipped as well. The same is true for the data from Pazar Laz to be discussed later.

⁶Note that for DM a paradigm does not have any status of cognitive/linguistic reality. Instead it is merely a notational convenience.

⁷I will use the schema X>Y to denote “Subject:X, Object:Y”.

⁸Note that third person plural objects never trigger any morphology that is different from third person singular objects.

Object	Subject					
	1Sg	1Pl	2Sg	2Pl	3Sg	3Pl
1Sg	—	—	m- \emptyset	m- \emptyset -t	m- -s	m- -en
1Pl	—	—	gv- \emptyset	gv- \emptyset -t	gv- -s	gv- -en
2Sg	g- \emptyset	g- \emptyset -t	—	—	g- -s	g- -en
2Pl	g- \emptyset -t	g- \emptyset -t	—	—	g- -t ¹	g- -en
3Sg	v- \emptyset	v- \emptyset -t	(h-) ⁵ - \emptyset	(h-)- \emptyset -t	-s	-en
3Pl	v- \emptyset ⁴	v- \emptyset -t	(h-)- \emptyset	(h-)- \emptyset -t	-s ²	-en ³

Table 1: Georgian Verbal Agreement, Present Tense (based on Vogt, 1971, p. 85f)

¹ According to Vogt (1971) there is an alternative form ‘g- -s’. He analyzes ‘t’ as ‘-st’->‘-t’. Aronson (1990, p. 170, rule 4) only mentions ‘g- -t’.

Hewitt (1995, p. 131f) states that for this form, where ‘g- -s-t’ would be expected, the ‘-s’ is deleted (i.e. the form found is ‘g- -t’). He also states that earlier forms of Georgian did in fact have the form ‘g- -s-t’.

Tschenkéli (1958, p. 354) suggests that the prescriptive norm is to use ‘g- -t’, but that all three forms, ‘g- -s’, ‘g- -t’ and ‘g- -s-t’ can be found across different dialects.

In Halle & Marantz (1993, p.117) the form is ‘g- (-s)-t’.

² Again Vogt (1971) suggests that the form ‘t’ (in his analysis ‘-st’->‘-t’) also exists. I could, however, not find reference to this form in other grammars. Tschenkéli (1958) explicitly states that -t cannot occur here.

³ The alternative form ‘-en-t’ also exists according to Vogt (1971).

⁴ In Vogt (1971) the table on p. 85 suggests the form ‘v- -t’ here, the example that follows the table in (2), however, does not have a suffix ‘-t’. There is no ‘-t’ in Tschenkéli (1958, p. 355) either, nor does Aronson (1990) suggest the existence of such a form. I will assume the ‘-t’ to be a misprint.

⁵ Vogt (1971) states that there is an alternative ‘h-’ in those cases without a prefix. According to Anderson (1992) these are markers for indirect objects only. Halle & Marantz (1993) does not treat ditransitive cases.

reference to plural, with the latter one being a fused marker that is inserted in all present tense contexts with a third person plural subject. ‘-t’ on the other hand has a rather complex distribution: It is used in all cases where plurality is not realized by one of the aforementioned affixes ‘gv-’ or ‘-en’; in that sense it seems to be a classical elsewhere marker. It does not differentiate between subjects and objects, and the cells for 1Pl>2Sg, 1Sg>2Pl and 1Pl>2Pl are all equal. It also never co-occurs with the third person markers ‘-s’ and ‘-en’. The result of this apparent constraint is that the only case

where the plurality of both arguments can be indexed separately is 3Pl>1Pl, where the prefix ‘*gv-*’ realizes the objects plural feature.

The third point worth noting is that in light of modern person decomposition approaches which suggest person to be constructed from the two binary features $[\pm\text{auth}(\text{or})]$ and $[\pm\text{part}(\text{icipant})]$, the only time the prefix makes reference to subject features in addition to object features is ‘*v-*’ versus no prefix (or a zero prefix, depending on the analysis); i.e. if the object is third person the feature that determines the insertion of the correct prefix is whether the subject is $[+\text{auth}]$ (‘*v-*’) or $[-\text{auth}]$ (no/zero prefix). The distribution of those suffixes that realize Tense and the subject features on the other hand can be described easily by making reference only to the other feature proposed: There are only two third person affixes, ‘*-s*’ and ‘*-en*’ (i.e. $[-\text{part}]$) that contrast with ‘ \emptyset ’, i.e. $[\text{part}]$. The exception to this simple description is of course found in the above-mentioned case of 3Sg>2Pl, where no third person subject suffix occurs, but ‘*-t*’ is present.

For a better understanding of the paradigm it is also worth mentioning that the prefixes ‘*g-*’, ‘*m-*’ and ‘*gv-*’, ‘*v-*’ as well as the suffix ‘*-t*’ occur in all tenses, whereas the suffixes ‘ \emptyset ’, ‘*-s*’ and ‘*-en*’ do not occur in past tense. Instead ‘*-di*’, ‘*-da*’ and ‘*-dnen*’ are used, with the same distribution as the respective present tense suffixes.⁹ This motivates the analysis of a zero suffix as indicated in the paradigm.^{10,11}

3.2 Georgian in Halle & Marantz (1993)

For an approach like DM that proposes *Syntactic Hierarchical Structure All the Way Down* one non-trivial property of Georgian verbal agreement is the distribution of the prefixes, since these can be described only by making

⁹Obviously these affixes call for an analysis as $d+X$, this is however not important to the argument here, which focuses on the distributional facts.

¹⁰It proved notoriously difficult to get proper data for the Georgian paradigm from the resources listed in the reference section. I cannot give a definite answer with respect to ‘*-da*’ being present or absent in the 3Sg>2Pl (past tense) cases.

¹¹The data on the zero suffixes is to be taken as a starting point of traditional (descriptive) morphology. Analyses may significantly deviate from the distribution of zero affixes later on.

reference to properties of both the subject and the object. An object marker such as ‘*g-*’ (second person) cannot co-occur with a marker such as ‘*v-*’ that occurs only if the subject is first person. Instead in 1>2 contexts ‘*g-*’ appears, whereas in 1>3 contexts it is ‘*v-*’. ‘*v-*’ on the other hand cannot simply be a third person object marker since it does not occur in 2>3 or 3>3 contexts. To explain the non-cooccurrence of ‘*v-*’ and ‘*g-*’, i.e. for one VI to bleed the appearance of another VI they have to compete for insertion into the same morpheme.

To achieve this, the VIs in (4) are – following the analysis in Nash-Haran (1992)¹² – all said to compete for insertion into a clitic cluster that incorporates all first and second person arguments.

(4) *Clitic Cluster*

- | | | | |
|----|------------------|---|-------|
| a. | [+1], DAT, [+pl] | ↔ | /gv-/ |
| b. | [+1], DAT | ↔ | /m-/ |
| c. | [+2], DAT | ↔ | /g-/ |
| d. | [+1] | ↔ | /v-/ |
| e. | [+2] | ↔ | /∅-/ |

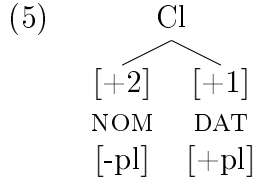
Plural

- | | | | |
|----|-------|---|------|
| f. | [+pl] | ↔ | /-t/ |
|----|-------|---|------|

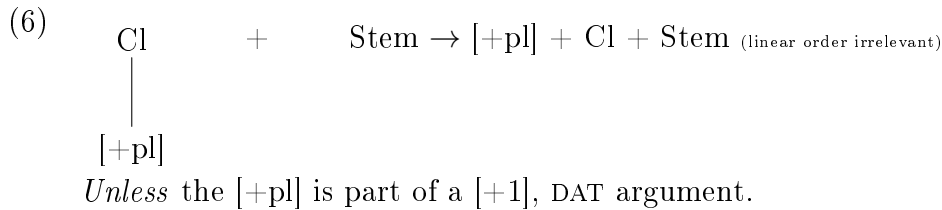
This cluster – syntactically sister to the inflected verb – is fused into a single node like the example in (5).¹³

¹²Nash-Haran (1992) is a French article and my understanding of French is very limited. My impression, however, is that the article’s argument for a clitic cluster analysis is precisely the fact that it cannot be a (syntactic) AGR head, as it makes reference to features of (local) subjects and objects. If this is indeed the argument there is no motivation independent of the morphological facts that are to be explained that would support the clitic cluster analysis.

¹³Note that – judging by the analysis proposed – the fused node still has a complex structure and only allows the insertion of an element that realizes one argument’s features as a bundle. For example: In 1Sg>2Sg contexts the features [+1], NOM, [+2] and DAT are present, but ‘*m-*’ cannot be inserted. In 2Sg>1Sg contexts the exact same features are present, albeit structured differently. In this case – unlike 1Sg>2Sg – ‘*g-*’ cannot be inserted, but ‘*m-*’ can. Since the same features are present in both cases, resulting in the



This fused node is then modified by the fission rule in (6). To allow for the prefix ‘*gv-*’ rather than ‘*m-*’ in contexts where the object is first person plural, the fission rule has to include an exception for first person plural objects.¹⁴



The occurrence of ‘*-t*’ then is trivial: Whenever (6) can apply, there will be a [+pl] node. Only ‘*-t*’ competes for insertion. In 3Pl>2Pl cases however this overgenerates, and since Halle & Marantz (1993) does not treat the complementary distribution of ‘*-t*’ and third person subject affixes as a genuine phenomenon, they resort to an impoverishment rule that merely states that the fissioned [+pl] node is deleted, whenever it follows any third person plural Tns-Agr node.

The Tns-Agr node then is treated as rather trivial as well and Halle & Marantz (1993) does not go beyond just stating the distributional facts: If the subject is first or second person, the present affix is zero, if the subject

insertion of a different *vis*, this is not reducible to specificity, but has to be resolved by reference to the fused node’s internal structure.

¹⁴Different approaches to fission as e.g. in Halle (1997) or Harley & Noyer (1999) suggest that when a morpheme marked for fission undergoes vocabulary insertion the remaining features (i.e. those not realized by the inserted *vi*) form a new terminal node, which can again undergo vocabulary insertion. While this would provide a more elegant solution to the fact that [+pl] is fissioned in all cases except for the one, where a *vi* that actually does have [+pl] in its specification is inserted, it would also wrongly predict the insertion of multiple prefixes in cases like 1Sg>2Sg if we were to otherwise keep the above analysis.

is third person it is either ‘-s’ in the singular or ‘-en’ in the plural. One possible analysis without decomposition of person features is the one in (7)¹⁵. Again however this overgenerates: There is no ‘-s’ in 3Sg>2Pl (in Standard Georgian at least, see Table 1, fn. 1) and the analysis in Halle & Marantz (1993) resorts to a readjustment rule that simply deletes the ‘-s’ again.¹⁶

(7) *Tns-Agr Node*

- | | | | |
|----|----------------------|---|-------|
| a. | [-past], [+3], [+pl] | ↔ | /-en/ |
| b. | [-past], [+3] | ↔ | /-s/ |
| c. | [-past] | ↔ | /-∅/ |

3.3 Evaluation

In summary then, Halle & Marantz (1993) do not treat the distributional facts about ‘-t’ and the third person suffixes as a genuine phenomenon. Instead they propose an analysis that overgenerates: It predicts the unattested structures ‘*-en-t’ (3Pl>2Pl) and ‘*-s-t’ (3Sg>2Pl). To repair the analysis they formulate two specific rules that delete the plural feature in the first case (to avoid insertion of ‘-t’ and the third person suffix ‘-s’ in the second case).

Object	Subject					
	1Sg	1Pl	2Sg	2Pl	3Sg	3Pl
1Sg	—	—	m- - \emptyset	m- - \emptyset -t	m- -s	m- -an
1Pl	—	—	m- - \emptyset -t	m- - \emptyset -t	m- -an	m- -an
2Sg	g- - \emptyset	g- - \emptyset -t	—	—	g- -s	g- -an
2Pl	g- - \emptyset -t	g- - \emptyset -t	—	—	g- -an	g- -an
3Sg	v- - \emptyset	v- - \emptyset -t	- \emptyset	- \emptyset -t	-s	-an
3Pl	v- - \emptyset	v- - \emptyset -t	- \emptyset	- \emptyset -t	-s	-an

Table 2: Laz Verbal Agreement, Present Tense

Note: In the past tense only the suffixes (sans ‘-t’) alternate:

‘-s’ \leftrightarrow ‘-u’, ‘-an’ \leftrightarrow ‘-es’, ‘- \emptyset ’ \leftrightarrow ‘-i’. I take these distributional facts as evidence for a real zero suffix expressing present tense, iff the subject is not third person, just like I argued earlier for Georgian.

4 Pazar Laz

4.1 Data

The verbal agreement in Pazar Laz is in many ways similar to the agreement patterns found in Georgian. It does in fact only show two differences:

The first one is the absence of the only plural sensitive prefix in Georgian, ‘*gv-*’ *Object:2Pl*. While Georgian does allow agreement for [+pl] with both arguments if (and only if) ‘*gv-*’ is the prefix form, i.e. when the object is first person plural, this is never the case in Pazar Laz. Instead it shows a general expression of plurality of either argument, irrespective of which argument carries the feature [+plural].¹⁷

¹⁵In contrast to the fused clitic cluster node, here a VI is sensitive to features of both the Tns and the Agr node.

¹⁶It is noteworthy that this rather arbitrary treatment of the cases of 3Sg>2Pl and 3Pl>2Pl concerns precisely those cases that apparently show substantial variation between Georgian dialects. Of course this also the locus of the phenomenon of ungrammatical co-occurrence of some (contentwise disjunct) VIs discussed earlier, which in the perspective of Halle & Marantz (1993) is just a random effect of two arbitrary rules.

While it is beyond the scope of this paper, this clearly calls for a detailed study of Georgian dialects and their respective morphological properties.

¹⁷Note that this is not true for third person objects, which do not trigger agreement for plurality. There is evidence that in Pazar Laz third person objects never trigger agreement

The second difference is the form plural marking takes in the case of 3Sg>2Pl. In Georgian the form used is ‘*g- -t*’ (recall that Halle & Marantz (1993) resort to claiming that the form is ‘*g- -s-t*’ and a rule of readjustment deletes the ‘*-s*’ later); in Pazar Laz, however, the aforementioned symmetry of plural marking is retained and the marker ‘*-en*’ is used. It is worth noting that this can be interpreted as a different way of avoiding a violation of a constraint on co-occurrence of ‘*-t*’ and third person subject markers, just like we saw in Georgian, i.e. while the distribution differs slightly, the fact that third person subject markers and ‘*-t*’ are in complementary distribution remains true in Pazar Laz. The *form* (i.e. the morphological items used) of plural expression in Pazar Laz then depends fully on the person of the subject: It is ‘*-t*’ (independent of tense) whenever the subject is not third person. If the subject is third person it is ‘*-an*’ (‘*-es*’ in past tense).

4.2 DM Analyses

In this section I will give a number analyses of Pazar Laz’ inflection and compare them to the Georgian analysis in Halle & Marantz (1993).

I will first outline an analysis that assumes the same basic structure of a fused clitic cluster containing features of both first and second person arguments; since I do not have any data that would support a clitic cluster analysis in Pazar Laz, I will later on also shortly outline possible analyses based on two AGR heads (i.e. two ϕ -probes in the syntax).

I will then conclude that all these analyses involve similar problems, namely that the structure assumed by DM and the distinction between possible targets of VI insertion (morphemes) and nodes and in turn the resulting absence of any notion of constituency are an obstacle that requires modifying the assumed structure to an extent that makes the assumption of such an underlying structure absurd.

for plural. Cf. Blix (2012) for details of the ability of arguments to trigger plural agreement in Pazar Laz.

4.2.1 Clitic Cluster Analysis

In this section I will assume the same basic structure of a fused clitic cluster containing features of both first and second person arguments as well as an Agr-head that carries the subject's ϕ -features and that is fused with the Tense head (8).

$$(8) \quad \text{Cl} + \text{Stem} + [\text{Agr}_S + \text{Tns}]$$

The same fission rule that applies in Georgian (6) and splits of [+pl] from the clitic cluster also has to apply to allow for insertion of '-t'. In Pazar Laz however it lacks the exception for first person objects.^{18,19}

$$(9) \quad \begin{array}{c} \text{Cl} \\ | \\ [+pl] \end{array} + \text{Stem} \longrightarrow [+pl] + \text{Cl} + \text{Stem}^{(\text{linear order irrelevant})}$$

One major difference between Georgian and Pazar Laz is the fact that the third person plural suffixes also occur in contexts where the subject is singular, but the object is both local and plural. To accommodate this fact in DM we need another rule fusing the fissioned [+pl] into the Agr-Tns node, iff the subject is third person. This is necessary to account for the fact that '-an' realizes [+pl] in 3>1/2Pl cases.

¹⁸In a concept of fission like the one in Halle & Marantz (1993) the absence of 'gv-' and the change in the fission rule are two unrelated facts. For a concept of fission where items not expressed by the inserted morpheme create a new morpheme however the absence of 'gv-' automatically entails the difference.

¹⁹If there is a restriction on rules modifying MS so that they can only apply once on a given morpheme, this would explain the fact that there is only one VI '-t' in contexts where both subject and object are local (i.e. where the rule splitting of [+pl] could apply twice). Alternatively this could be attributed to phonological restrictions: Since Pazar Laz does not have geminate consonants, the structure '-t-t' may be reduced to '-t'.

$$(10) \quad \begin{array}{c} [\text{Agr}_S + \text{Tns}] + [+pl] \\ | \\ [+3] \end{array} \longrightarrow \begin{array}{c} [\text{Agr}_S + \text{Tns} + [+pl]] \\ | \\ [+3] \end{array}$$

In the structure created by these operations then VIs with the same specification as the Georgian ones are inserted:

- (11) *Clitic Cluster*
- | | | | |
|----|-----------|-------------------|------|
| a. | [+1], DAT | \leftrightarrow | /m-/ |
| b. | [+2], DAT | \leftrightarrow | /g-/ |
| c. | [+1] | \leftrightarrow | /v-/ |
| d. | [+2] | \leftrightarrow | /∅-/ |
- Plural*
- | | | | |
|----|-------|-------------------|------|
| e. | [+pl] | \leftrightarrow | /-t/ |
|----|-------|-------------------|------|
- Agr_S + Tns (+[+pl])*
- | | | | |
|----|----------------------|-------------------|-------|
| f. | [-past], [+3], [+pl] | \leftrightarrow | /-an/ |
| g. | [-past], [+3] | \leftrightarrow | /-s/ |
| h. | [-past], | \leftrightarrow | /-∅/ |

4.2.2 Two AGR Heads

Since I know of little evidence of the prefixes in Pazar Laz having any clitic properties, I will give a number of very brief analyses without a clitic cluster, i.e. with two AGR nodes as the obvious alternative:

$$(12) \quad \text{AGR}_O + \text{Stem} + [\text{AGR}_S + \text{Tns}]$$

In a way similar to the one in the clitic cluster analysis, every DM analysis of Pazar Laz needs some way to get a local object's plural feature on the same

morpheme as the third person subject features, i.e. they need to suppose that a [+pl] feature on the Agr_O node is fissioned²⁰ and then merged/fused with the Agr_S node if the subject is third person. Since this is necessarily similar to the analysis above I will therefore not go into detail here.

With respect to ‘v-’ versus a zero prefix, DM has to make reference to the subject features when realizing AGR_O. There are multiple ways in which this can be accomplished:

Impoverishment feeding ‘v-’

For ‘v-’ to be inserted into the Agr_O node only in 1>3 contexts an impoverishment rule could be proposed that bleeds the insertion of any other prefix in only this context. ‘v-’ would then be the least specified VI (the elsewhere marker), and the impoverishment would thus feed its insertion. This impoverishment rule would necessary take into account both Agr nodes. It could delete the person feature [3] in the Agr_O head iff the AGR_S node is first person, resulting in only [DAT] being present on the node. We would then postulate specifications such as (13):

- (13) Agr_O
- | | | | |
|----|-----------|---|------|
| a. | [+1], DAT | ↔ | /m-/ |
| b. | [+2], DAT | ↔ | /g-/ |
| c. | [+3], DAT | ↔ | /∅-/ |
| d. | DAT | ↔ | /v-/ |

Merge, Fission, Merge

A second possible approach is one, where not the complete Agr_S node is fused with the Tense node. Assuming a decomposition of person features into [±author] and [±participant] a fission rule would first split of the [±auth] feature of Agr_S, then merge/fuse [±auth] and AGR_O. As above the +plural

²⁰We can either assume that the [+PL] feature is fissioned only if the object is local (i.e. construct a morphological explanation for third person arguments not triggering plural agreement) or attribute the absence of plural agreement for third person objects to syntax not supplying one.

feature on AGR_O is fissioned and merged with AGR_S if the subject is third person. In this approach ‘*v-*’ would be the most highly specified VI:

(14) $\text{Agr}_S + \text{Agr}_O$

- | | | | |
|----|-------------------------------------|-------------------|------|
| a. | [[NOM, +auth] [DAT, -part, -auth]] | \leftrightarrow | /v-/ |
| b. | [DAT, +part, -auth] | \leftrightarrow | /g-/ |
| c. | [DAT, +part, +auth] | \leftrightarrow | /m-/ |
| d. | [DAT] | \leftrightarrow | /∅-/ |

Plural

- | | | | |
|----|-------|-------------------|------|
| e. | [+pl] | \leftrightarrow | /-t/ |
|----|-------|-------------------|------|

Tns (+[+pl], +[-part])

- | | | | |
|----|--------------------|-------------------|-------|
| f. | [-PST, -part, +PL] | \leftrightarrow | /-an/ |
| g. | [-PST, -part] | \leftrightarrow | /-s/ |
| h. | [-PST], | \leftrightarrow | /-∅/ |

5 Interim Conclusions

In the two previous sections Georgian as well as Laz data was shown to be derivable with standard DM assumptions. The assumptions made about the specific structure are relatively limited, i.e. only the core assumption of feature bundles that are the locus of VI insertion, morphemes, was made use of, in line with generally accepted concepts of morpho-syntax, namely a Tense and AGR heads. The exact nature of the inter-relation of these morphemes was largely ignored.

The analyses based on this idea of the relationship between syntactic structure and inflectional morphology all had to face a fundamental problem: The mismatch between the assumed basic building blocks and the structural descriptions necessary to derive the actual distribution of morphological items is vast and as a result all analyses had to manipulate the structure heavily. This was done by moving features from one morpheme

into another (e.g. plural, +author), deleting features (e.g. [+3], plural), or deleting already inserted VIs (e.g. ‘-s’). In fact the result of these assumptions seems to require mechanisms of restructuring that are so powerful that basically *everything goes*.

6 Structure, Morphemes and Constituency

In this section I want to introduce an approach to morphology that uses a structure as could be derived in DM via abundant usage of Fission, namely one in which there are no feature bundles, but a one to one correspondence between terminal nodes and features: *Nanosyntax*. Instead of a concept of morphemes a concept more familiar from syntax proper is used, namely constituency. I will try to show these assumptions about structure and realization allow for a much more elegant analysis of both Laz and Georgian.

In the first subsection I will briefly introduce the basic assumptions of Nanosyntax following Starke (2009, 2011). In the second one I will detail how an approach in the spirit of these assumptions can be used to postulate a single underlying structure based on generally accepted features that can derive both Georgian’s and Laz’ verbal agreement without making any stipulated modification to the underlying structure necessary.

6.1 Nanosyntax - Overview

Nanosyntax is built on three main propositions, namely *Cyclic Overwrite*, the *Superset Principle* and the *Elsewhere Principle*. I will briefly introduce those ideas in this subsection.

In Nanosyntax *Spell Out* occurs post-syntactic (with no lexicon feeding syntax; only single features) and *cyclically bottom-up*.²¹ Syntactic nodes are spelled out by *lexically stored trees* that thus constitute Nanosyntax’s counterpart to DM’s vocabulary items. If a higher node can be spelled out, this *overwrites* any spell out that occurred at a lower node contained by the

²¹It actually is assumed to operate within syntax and after every operation of Merger; we will skip the details here.

higher one. To exemplify: Say there is a syntactic structure $[a[b[c]]]$ generated by syntax, and the lexicon contains the tree structures $[b[c]]$ as well as $[a[b[c]]]$. They will then both spell out the respective trees, but since the bigger one spells out a structure that contains the smaller one later in the cyclic spell out, it overwrites it. This property of Spell Out is called *Cyclic Overwrite*.

The second assumption Nanosyntax utilizes is a theorem²² called the Superset Principle:

- (15) Starke (2009, p. 3)
A lexically stored tree matches a syntactic node iff the lexically stored tree contains the syntactic node.

The third assumption, the *Elsewhere Principle*, is the Nanosyntax implementation of the Panini Principle of competition; informally it is also known as the minimize junk principle:

- (16) Starke (2009, p. 4)
At each cycle, if several lexical items match the root node, the candidate with least unused nodes wins.

In combination with the cyclic realization the Superset and Elsewhere Principles significantly complicate the example derivation used above. In fact we start with the structure $[c]$ only that can be spelled out by both lexically stored trees. The smaller one, $[b[c]]$, wins because there is only one unused node. Then b is merged and the resulting structure is $[b[c]]$. Again both trees can spell out this structure and again the smaller tree wins due to the Elsewhere Principle, overwriting itself. After that a is merged and we get the structure $[a[b[c]]]$; $[b[c]]$ can no longer realize this structure, according to the Superset Principle and thus only now $[a[b[c]]]$ wins.

²²The Superset Principle is actually derived from other assumptions about cyclic insertion, and therefore considered a theorem. Again the details are not under discussion here.

I should, however, point out that I do significantly deviate from standard Nanosyntax in that I do not assume *exponent contiguity*, i.e. I assume that $[a[b[c]]]$ can spell out a tree $[a[c]]$ as a way to account for the \pm feature specifications that I included. Instead I merely require the c-command relations between the features in the realized structures and the lexicalized trees to be the same – i.e. $[a[b[c]]]$ cannot realize $[c[b[a]]]$.

To highlight how this cyclic process determines the actual final spell out of structures let us extend on the above example and assume that after $[a[b[c]]]$ we merge another c , resulting in $[c[a[b[c]]]]$. If there are no additional trees stored in the lexicon, there is no tree that can spell out this structure. Since every other operation of Merger will just add features (i.e. $[c[a[b[c]]]]$ is a subset of any tree produced by further application of Merger), there can by the principles outlined above not be any stored tree that realizes this structure.²³ To allow for realization Starke (2011) suggests that the last tree that could be realized – $[a[b[c]]]$ – moves, creating a structure $[c][a[b[c]]]$, with the result that $[c]$ is a constituent again and can thus be realized by a tree on its own.²⁴

6.2 Georgian and Laz

A formulation of a structure of Georgian/Laz agreement in terms of binary branching and terminal nodes only can easily be accomplished by using the well established²⁵ person features used before in this paper, namely the binary features $[\pm\text{part}]$ and $[\pm\text{auth}]$, as well as a number feature $[\pm\text{PL}(\text{ural})]$.²⁶

If we assume – in line with the concept of layering that figures even in the almost structureless approach in Anderson (1992, p. 94ff) and the fact that internal arguments are embedded deeper/merged earlier than external arguments – that there are two AGR heads with AGR_S (subject agreement) embedding AGR_O , we could postulate a structure such as the one in (17).

²³To put it more formally:

Let the set of lexically stored trees be T .

Let there be a structure b .

Every operation of Merger creates a $b' \supset b$

If there is no tree in the lexicon that matches b , i.e. $\neg \exists x | x \in T, x \supseteq b$

Then we can, by the transitive nature of the superset relation, conclude that:

$\neg \exists x | x \in T, x \supseteq b'$

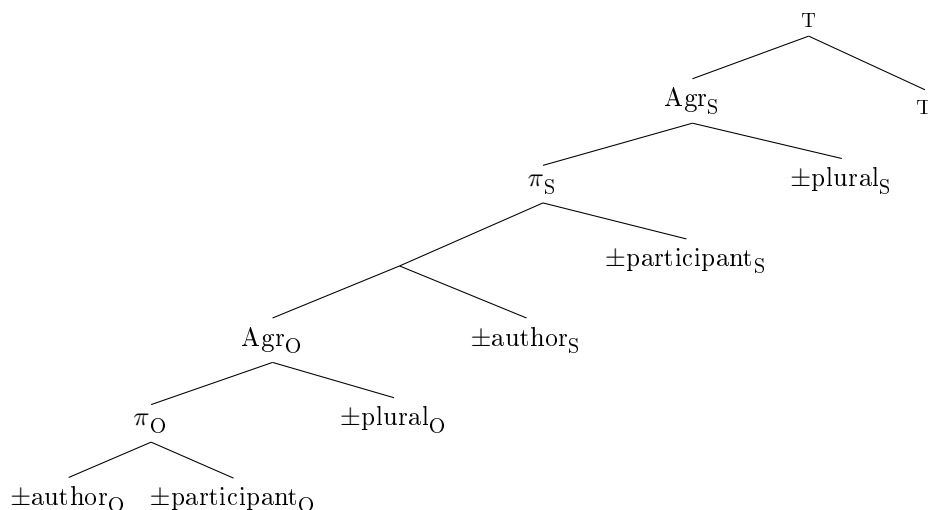
²⁴I will leave out any details of movement (as well as any comments on how this might be used to derive notions of different affix types etc) in the later part.

²⁵Cf. for example Frampton (2002), Nevins (2007, p. 302ff)

²⁶Plurality – or Tense for that matter – may well be a more complex structure, this would, however, be treated simply by matching more complex structures in the stored trees as well. As such this is not relevant for the topic under discussion.

I leave open the extend to which insights of feature geometrical approaches such as Harley & Ritter (2002) can generally be adopted in a Nanosyntax approach.

(17)



6.2.1 Georgian

Recall the phenomena introduced in section 3.1. The first one, the distribution of the prefixes and the fact that at least ‘*v-*’ has to make reference to features of both the subject and the object, is easily explained now: The contrast of ‘*v-*’ versus zero in cases of third person objects is an expected possibility, since the subject’s feature $[\pm\text{auth}]$ and AGR_O form a constituent; we can thus easily account for this by assuming two trees that lexicalize the node created by merging $[\text{AGR}_O]$ and $\pm\text{auth}_S$, namely (18d,e).²⁷ If the object is third person, (18e) can only realize a structure where the subject is first person, i.e. where a $[\text{+auth}]$ feature is present; in that case it overwrites the previously inserted (18d).

This formulation already lays the ground for a systematic account of the realization of plurality. By assuming that both trees that realize third

²⁷A short comment on notation: If a lexicalized tree is specified for both a negative and a positive value, there is no motivation for deciding that one is higher in the structure than the other. Any lexicalized tree with such a feature set will always have at least one “junk feature”.

(18) *Prefixes*

- a. /m-/ \leftrightarrow $[_{AGR_O} [[+auth] +part] -PL]$
- b. /g-/ \leftrightarrow $[_{AGR_O} [[-auth] +part] -PL]$
- c. /gv-/ \leftrightarrow $[_{AGR_O} [[-auth] +part] +PL]$
- d. / \emptyset -/ \leftrightarrow $[_{AGR_O} [[-auth] -part] \pm PL]$
- e. /v-/ \leftrightarrow $[_{\pi_S} [[[-auth] -part] \pm PL] +auth]$

person object features are specified for $[\pm PL]$, we already explained the the syncretism of third person singular and plural objects: There simply are no trees stored in the lexicon that are specified for $[-part]$ and for $[+PL]$ or $[-PL]$ only, with the result that the same realization takes place in all cases where the object is third person, independently of the object being + or – plural.

Recall, however, that we still need to capture a number of things: i) The fact that there is only one case – appearance of ‘gv-’ – where both arguments can mark their plurality independently, ii) the distribution of ‘-t’ and its sensitivity to plurality of local subjects as well as local objects, iii) the complementary distribution of ‘-t’, ‘-en’ and ‘-s’.

(19) *Suffixes*

- a. /-t/ \leftrightarrow $[_{AGR_S} [[[+PL] \pm auth] \pm part] \pm PL]$
- b. /-s/ \leftrightarrow $[_T [[[-auth] -part] -PL] PRS]$
- c. /-en/ \leftrightarrow $[_T [[[[+PL] -auth] -part] +PL] PRS]$
- d. /- \emptyset / \leftrightarrow $[_T [[[\pm auth] +part] -PL] PRS]$

The specifications in (19) take care of all these things: In accordance with the superset principle we can simply assume ‘-t’ to be a kind of elsewhere marker, i.e. to carry all the relevant features. Note that the only other suffixes that includes a +PL feature that is c-commanded by the subject’s features, is ‘-en’, i.e. the other two suffixes are in principle not compatible

with (do not constitute a superset of the features remaining in) a tree with a +PL feature that was not realized by one of the prefixes. ‘-t’ thus realizes all structures of the form $[[+PL] \text{ AGR}_S]$, but is overwritten in *all* cases where ‘-en’ is compatible as well, namely all cases where the subject is third person plural (with 3Pl>2Pl being the only one where the embedded [+PL] is actually not a “junk feature”). Note that ‘-en’ not only wins due to the minimize junk principle, but also realizes a bigger structure $[[([+PL]) \text{ AGR}_S] \text{ T}]$ than ‘-t’ does, i.e. it overwrites it. The same is true for the zero suffix and ‘-s’: If there is no unrealized +PL – i.e. if they form a superset of all the features dominated by T –, they win the competition. For both of them this requires the subject to be singular, since they do not contain any +PL, i.e. if there is a plural subject, they do not constitute a superset of $[[\text{AGR}_S] \text{ T}]$.

It is worth noting that due to the minimize junk principle we would expect ‘-s’ to realize the remaining T, in those cases where ‘-t’ realizes AGR_S and is not overwritten, since it carries the least “junk”; we could solve this problem either by assuming ‘-s’ to actually contain additional features, e.g. to contain future and past tense as well, or by postulating another zero suffix that realizes only tense. The first one seems to be the less stipulative solution; since I lack some data on other tense forms of Georgian, I can not decisively argue for a specific way here; I will, however, discuss the same problem with respect to Laz in section 6.2.2.

I would also like to point out that Nanosyntax does not always give a conclusive answer to the specific contents of lexicalized trees; ‘*m-*’ (18a) for example might just as well be specified for $[-PL]$ with no difference in outcome. The same is true for specifying ‘ \emptyset -’ (18d) for $[-\text{auth}]$. In the same vein one might argue that instead of specifying (18 a,b) for $[-PL]$, all suffixes might carry $[-PL]$, having the exact same result.

6.2.2 Laz

As I outlined before, Laz is very similar to Georgian in terms of agreement morphology. With respect to the present tense affixes it comes down to the absence of ‘*gv-*’ in Laz (i.e. the four paradigm cells where the object is first

person plural) and the marker in the 3Sg>2Pl cell, which is marked by ‘-t’ in Georgian, and ‘-an’ in Laz. The result is a more symmetric paradigm in Laz. Since the data is my own, I also had full access to past marking; consequently I will explain the respective past tense suffixes as well, and introduce the complete paradigm of the past agreement here for the sake of easy comparability (cf. the note below Table 2).

Object	Subject					
	1Sg	1Pl	2Sg	2Pl	3Sg	3Pl
1Sg	—	—	m- -i	m- -i-t	m- -u	m- -es
1Pl	—	—	m- -i-t	m- -i-t	m- -es	m- -es
2Sg	g- -i	g- -i-t	—	—	g- -u	g- -es
2Pl	g- -i-t	g- -i-t	—	—	g- -es	g- -es
3Sg	v- -i	v- -i-t	-i	-i-t	-u	-es
3Pl	v- -i	v- -i-t	-i	-i-t	-u	-es

Table 3: Laz Verbal Agreement, Past Tense

With respect to the prefixes we can start by simply assuming that there is no ‘gv-’, as the prefix distribution is exactly the same, we could leave everything as it is; since we would then have to specify six suffixes for $[-PL]$, I will assume that (20 a,b) carry it instead. Note that they can still realize π_O if the object is plural, thanks to the superset principle.

(20) *Prefixes*

- a. /m-/ \leftrightarrow $[_{AGR_O} [[+auth] +part] -PL]$
- b. /g-/ \leftrightarrow $[_{AGR_O} [[-auth] +part] -PL]$
- c. / \emptyset -/ \leftrightarrow $[_{\pi_S} [[[-auth] -auth] \pm PL] -auth]$
- d. /v-/ \leftrightarrow $[_{\pi_S} [[[-auth] -part] \pm PL] +auth]$

The fact that there is no prefix left that realizes $[+plural]$ (with local objects) allows us to account for the symmetry in the Laz paradigm with

the same mechanism we used for the more limited symmetry (namely that in 1>2 cases which resembles the symmetry Laz shows in all cases with a local object) in the Georgian paradigm, namely specifying the relevant suffixes (21 a,e,f) for a [+plural] embedded by AGR_S, making only them compatible with local plural objects.

The difference in 3Sg>2Pl cell, namely the occurrence of ‘-an’/‘-es’ can be solved by a simple step: In Laz ‘-t’ is specified only for [+part], not for [-part], rendering it incompatible with cases in which the third person is subject. ‘-an’ on the other hand is in addition to its Georgian counterpart also specified for [-plural], rendering it compatible with cases where the subject is third person singular. If the subject is third person singular while the object is simultaneously singular as well, however, both ‘-an’ and ‘-s’ are compatible, but ‘-an’ is less specific; i.e. ‘-s’ wins.

(21) *Suffixes*

- a. /-t/ ↔ [AGR_S [[[+PL] ±auth] +part] ±PL]
- b. /-∅/ ↔ [AGR_S [[±auth] +part] -PL]
- c. /-s/ ↔ [T [[[-auth] -part] -PL] PRS]
- d. /-u/ ↔ [T [[[-auth] -part] -PL] PST]
- e. /-an/ ↔ [T [[[[+PL] -auth] -part] ±PL] PRS]
- f. /-es/ ↔ [T [[[[+PL] -auth] -part] ±PL] PST]
- g. /-∅/ ↔ [T PRS]
- h. /-i/ ↔ [T PST]

With respect to tense we can make a couple of interesting observations:²⁸ The third person subject affixes are all specified for tense, whereas the ones that realize local subject features are not. The fact that ‘-t’ occurs in both past and present tense in combination with the occurrence of an additional

²⁸It is worth noting that there are also complex stem alternations in present tense that are not treated throughout the paper. According to Ömer Faruk Demirok (p.c.) these are linked to the fine structure of vP, i.e. to event structure. As such they should in principle be open to a Nanosyntax account as well.

suffix ‘-i’ that occurs in the past tense (in *all* cases with a local subject, even Sg>Sg ones) forces us to assume that an additional tree realizes only tense information, i.e. there is at least a tree (20 h) that realizes [PST]: ‘-t’ cannot realize a bigger structure, as ‘-i’ never overwrites ‘-t’. Instead it co-occurs with it in all cases where at least one local argument is specified for [+plural] and the subject is not third person. If the alternating zero suffix and ‘-i’, however, do realize only tense information, we need to explain the absence of ‘-t’ in cases of local subjects with singular (or third person) objects, i.e. we are forced to postulate a specific zero affix (21b) that realizes [–plural] local subjects.

Also noteworthy is the derivation of the order of ‘-t’ and the past suffix ‘-i’ (and consequently, albeit invisible, the zero affix in present tense). We can assume – in line with earlier discussions – that AGR_S moves, iff realized by ‘-t’ (without ‘-t’ being overwritten). This allows us to account for the linear order *-i-t*: AGR_S moves in order to allow for constituency of T, since it is exactly the case that ‘-t’ realizes AGR_S (without being overwritten) if [[AGR_S] T] cannot be realized by a lexicalized tree. The result of the movement is [T || AGR_S /-t/], accounting for the linear order; with AGR_S being realized either by ‘-t’ or ‘-∅’.

If, on the other hand, the subject is third person, AGR_S and tense are realized by one lexicalized tree, making no movement necessary.

7 Conclusions

I hope to have shown in the above pages that Nanosyntax allows for a far more principled account of not only Laz and Georgian verbal agreement, but also the small differences between both languages’ verbal inflection. This, it seems to me, is largely attributable to the fact that the DM perspective on the way features are structured is inconsistent. This is evident in the fact that, as mentioned earlier, the apparatus of DM can create both a structure with all features in one morpheme and one where every feature is a morpheme in itself. The idea that structure and “bundling” are two separate things makes structure itself rather superfluous from an inflectional morphology

point of view. If only bundling is concerned, however, a theory striving for explanation should focus on the principles of feature bundling. A theory like Paradigm Function Morphology – for a PFM analysis of Georgian see Stump (2001, p. 69ff) – does exactly that, as there are fundamental principles that restrict the ordering of realization rules (the PFM equivalents to DM’s VIs) into certain blocks. For this PFM needs lists of feature bundles with minimal internal structure. The other end of the spectrum is an approach like the one detailed above, Nanosyntax. Here features are never bundled, instead the structure is fixed and the realization restrained and systematized by the structure itself, i.e. by constituency of terminal features.

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