

Morphotactics: An Overview of Positional Constraints and Repairs (Chapter for the *Handbook of Distributed Morphology*)*

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Abstract: Consider the kinship relations denoted by ‘sister-in-law’, featuring a morphologically complex item involving derivational processes. Pluralization of such nouns, occurring externally, should yield ‘sister-in-laws’, but an extremely frequent variant is ‘sisters-in-law’. This displaced, internalized inflection involves a morphotactic rearrangement, based on the specific well-formedness principles governing morphology within the word domain. Now consider the putatively substandard Spanish plural imperative *sienten-se-n* ‘Sit down!’ (with an agreement morpheme *-n* outside the clitic *se*). Are these the result of a morphological displacement?

Authors such as Kayne (2010) have answered ‘no’, and treated *sienten-se-n* as the result of an alternative syntactic derivation, arguing that syntax should be the sole engine of this kind of structural re-combinatoriality. But in Arregi and Nevins (2018), we caution against the overzealous wielding of Occam’s Razor. Spanish displaced plural morphology, and certain phenomena like it, are cases of dialect microvariation.

The guiding research heuristic of the present chapter is that the closer one gets to PF, the more one finds dialect microvariation. Cases of displaced morphology in Basque auxiliaries, Cypriot Greek past tense marking, and infinitival particles in varieties of West Germanic can be built into a theory of morphotactic constraints and repairs. In many of these cases, the underlying syntax of these varieties is largely uniform, but dialect-specific positional constraints, such as Non-Initiality within a structural domain, guide a host of repairs that are post-syntactic, after a syntactic composition that does not vary as widely, is complete. In this way, an architecture of word-formation known as Distributed Morphology is composed of discrete components, each with its own burden of labor and its mechanisms for doing so. Morphosyntactic variation in space and time can be more easily localized once specific submodules are isolated and identified.

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1 Introduction

Morphotactics refers literally to the question of which morphemes can ‘touch’ or abut each other. But like phonotactics governs the fact that *tk* is not a licit sequence of consonants to end a syllable, there is often no problem with such sequences across syllables (or distinct words). Thus the study of morphotactics inherently is restricted to a particular *domain*. Typically, one thinks of this domain as the word – but as readers of this volume will know, even defining the relevant domain of a word, whether morphosyntactically or prosodically, requires detailed specification of what is intended. With this goal in mind, we adopt the following definitions of *M-word* and $X^{0\max}$ (adapted from

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Arregi and Nevins 2012; see also Embick and Noyer 2001 and the introductory chapter to the present volume):

- (1) An *morphological word* (*M-word*) is an X^0 not dominated by an X^0 .
- (2) A *maximal 0-projection* (X^{0max}) of a terminal t is an X^0 headed by t not dominated by an X^0 headed by t .

In other words, a X^{0max} is a (possibly complex) head that is the maximal 0-level projection of a terminal, and an M-word is a X^{0max} that is not part of a larger complex head. In our discussion of morphotactics, although in many cases it may be implicitly understood that the relevant domain is the M-word, in fact the specific morphotactic restrictions at hand sometimes correspond to domains not coextensive with the M-Word, such as X^{0max} or even larger (phrasal) domains.

Within this chapter, we focus on four main case studies, in which a particular morpheme or set of morphemes have what we call *morphotactic constraints* on its placement. These morphotactic constraints hold at the postsyntactic level of morphological form, which is by hypothesis a component of the grammar that enters into the computation after the syntactic computation puts together many of the leaves of the tree via operations such as Merge, Head Movement, and Cliticization. While not strictly output-oriented (as further processes of phonological exponence even later than Morphological Form itself may obscure or alter what happens), most of the morphotactics we discuss are surface-observable, once the relevant domain is delimited. We focus in particular on *positional* morphotactic constraints, which have been discussed within DM, as well as in other literature (e.g. Hyman and Mchombo (1992), Ryan (2019)), usually with the entire M-Word as the relevant domain. In the case studies we examine, this domain can be the M-Word, or it can be the maximal (0-level) projection of a particular head, as elaborated below:

- (3) Basque (Arregi and Nevins 2012;); non-initiality of the T morpheme within the T^{0max} projection (section 2)
- (4) Spanish (Harris and Halle 2005, Arregi and Nevins 2018); non-initiality of the Agr morpheme within the clitic cluster (section 3)
- (5) Cypriot Greek (Pavlou 2018): Initiality of the *-e-* augment within the M-Word (section 4)
- (6) German infinitival *zu* as second-to-last (Salzmann 2019a): Non-finality of the morpheme *zu* within the Verbal Cluster (sections 5 and 6)

The morphotactic constraints and repairs we discuss involve displaced inflection, where the notion of ‘displaced’ means, in a linear position not expected given the syntactic or semantic structure. We assume, within the DM model (developed explicitly in our book *Morphotactics*) that linearization is a post-syntactic operation that adds linear relations to the syntactic tree, but it does not remove hierarchical relations. In other words, Linearization is not a ‘flattening’ operation (see Arregi and Nevins 2012:323: ”The Linearization algorithm adds precedence relations that result in the tree [in (189)] which therefore encodes both the hierarchical relations and the precedence relations”).

Now, in all approaches that admit the notion of morphotactic constraints, there is an implicit notion of repair. Thus, in Hyman and Mchombo (1992) well-known ‘CARP’ template for Bantu verbal extensions (the causative, applicative, reciprocal, and passive), morphotactic constraints will determine that in some cases, the ordering of these suffixes must include the pairwise (and

transitive) orderings $C > A > R > P$, where $>$ means ‘comes linearly before’, even when these orderings are not faithful to what one would expect from the Mirror Principle (Baker 1985, Rice 2000), which states that the linear order of suffixes is inversely ordered with respect to their semantic scope. Thus, in the following example of Causativized Applicatives, presented in Zukoff (2022), the expected linear order of affixes based on the semantics is $A > C$, but the surface order is $C > A$:¹

- (7) aná á- ná- lím -its- -il -idw- á makásu
 children AGR- PST- cultivate -CAUS -APPL -PASS -FV hoes
 ‘the children were made to cultivate with hoes’

Nonetheless, when this structure is passivized, as shown above, only the Causee can be promoted to subject. This suggests that syntactically, the causee is higher than the applicative argument. It is only post-syntactically that they are rearranged linearly.

In monostratal theories, the repairs are generated directly as alternate candidates that are evaluated with respect to morphotactic wellformedness (in counterpart to violation of some kind of faithfulness to a purely semantically-determined morpheme order). In our own approach to DM developed in Arregi and Nevins 2012, there is a strict separation between the constraints themselves and the repairs that can be enacted in order to satisfy them. (In fact, we have distinguished between Triggering and Blocking repairs in our earlier work). One reason for modeling things in this way has been the intuition that, especially in microcomparison between dialects and varieties of the same language, while the morphotactic constraint itself is held constant, the suite of repairs can vary widely among such languages. Holding to the ‘tiger and stripes’ metaphor we adopted from Kiparsky (1973)², we maintain a division between constraints (constant, with variables that may be imposed in specific subversions of the constraint) and repairs (which may be present or absent in a given dialect), instead of freely intermixing the variation among these two within, say, a single ranking.

Within the Y-model architecture of grammar adopted herein (largely reflecting the Distributed Morphology model found throughout this handbook overall) the ‘semantic scope’ effects, whereby the Reciprocal of an Applicative (e.g. ‘to pray for each other’) require the reciprocal to come after the applicative, do not involve a direct mapping between semantics and morphology, but rather are a consequence of the order in which morphemes compose in the syntax: if a Reciprocal merges first with a verb, and then an Applicative on top of that, then the semantic component will receive and interpret that accordingly. If then, the whole complex undergoes successive-cyclic head movement, then one expects a mirror principle syntactically, under default linearization. Finally, under a Y-model of grammar, MS – the ‘level’ of morphological structure will be the locus of morphotactically-specific positional constraints. In this chapter, we focus on edge-related posi-

¹In all examples, we follow the Leipzig Glossing Rules (<https://www.eva.mpg.de/lingua/resources/glossing-rules.php>), and use the following abbreviations: 1, 2, 3 (first, second, and third person), ABS(olutive), AGR(eement), APPL(icative), AUG (past tense augment), CAUS(ative), CL(itic), CPST (past tense complementizer), DAT(ive), ERG(ative), FV (final vowel), GER(und), IMP(erative), IMPF (imperfective), INF(itive), L (L-morpheme), PASS(ive), PFV (perfective), PL(ural), PRS(esent), PST (past), PTCP (participle), REFL(exive), SG (singular). The glosses in some of the examples from the cited literature have been adapted to follow a uniform pattern throughout the chapter.

²The original quote was “Changes in phonological systems may reveal ordinarily hidden structure, as a tiger lurking on the edge of a jungle, his stripes blending in with the background, becomes visible the moment he begins to move.”, though we contend it applies to changes across morphological systems of closely related varieties as well.

tional constraints, whose diachronic origins may be varied – being morphologization or grammaticalization of prosodic, phonological, or reanalysis of other grammatical tendencies, but whose synchronic statement is squarely postsyntactic, specifically given dialect microvariation where the overall syntax seems to be constant across varieties. Thus, in the Spanish varieties considered, there are a number of idiolectal and dialect-specific constraints on the structural description of the mesoclisal-generating rule. Similarly, the repairs in Basque dialects to Noninitiality of T, explored below, seem to be postsyntactic variations on a constant syntactic theme. Continuing onwards, the syntax of adverb incorporation and augment placement across Cypriot Greek and Standard Mainland Greek (SMG) is by hypothesis uniform, but the former variety contains a morphotactically-specific constraint and repair. Finally, in the West Germanic varieties we examine, infinitival markers such as German *zu* and Dutch *te* show microvariation as to whether Initiality constraints or Penfinality constraints determine their ultimate placement, distinct from a presumably uniform placement expected from the selecting verbs. This specific pattern of microvariation — one that assumes an underlying uniform syntax for, say, both varieties of Cypriot Greek and SMG, but a specifically post-syntactic set of differences related to well-formedness at the M-Word level, finds a natural home within analyses like Distributed Morphology, as they specifically parcel out different phenomena to different levels of the grammar, instead of, say, attempting to account for all such phenomena within syntax (or within nanosyntax; Starke (2009) — particularly if they relate to linear order, given the hypothesis central to most versions of Minimalist syntax that there is no linear order present within the narrow syntax (see, e.g. Chomsky 2016:p.19 “Linear order, then, should not enter into the syntactic-semantic computation. Rather, it is imposed by externalization”).

2 Positional constraints and repairs

In order to focus on positional morphotactic constraints and repairs within this handbook chapter, we have chosen to highlight four representative case studies. We briefly review two cases from our own prior work, and then discuss two more recent cases from the literature, drawing out the parallels with the framework established. These four case studies have in common that they either require or prohibit a particular morpheme to be placed at the edge of a specifically delimited domain. This can be either the Left-Edge or the Right-Edge, thus yielding an Initiality constraint, a Non-Initiality constraint, a Finality constraint, or a Non-Finality constraint. We also focus on the repairs, which include doubling, displacement, morphological epenthesis, or most drastically, obliteration (i.e. total postsyntactic deletion, in the sense of Arregi and Nevins (2012); see also the chapter on Impoverishment by Keine & Müller, this volume) of the offending morpheme itself.

2.1 Noninitiality and mesoclisal in Spanish clitic clusters

We start here with the most canonical case of morphotactic reordering in the literature from the last two decades: the phenomenon of ‘mesoclisal’ found in Spanish imperatives, in which agreement inflection appears displaced or doubled to the right of enclitics. This has been commented most canonically in Harris and Halle 2005, but in fact has been part of the DM literature since the famous ‘second’ article, Halle and Marantz (1994), and commented on in earlier, ‘proto-DM’ work such as Minkoff (1993). As they actually form one of the most powerful arguments for post-syntactic reordering, they have aroused many responses from Occam’s-Razor wielding proponents of ‘syntax-only’ accounts (e.g. Kayne (2010), Manzini and Savoia (2011)) of morphological

form.³ Readers who are interested in this specific debate – about whether Spanish mesoclisism can indeed be handled (insightfully) via ‘syntax alone’, or whether a factorization of the explananda in terms of ‘two modules’ is preferable – should take a look at Arregi and Nevins (2018).

As analyzed in work by Harris and Halle 2005 and Arregi and Nevins 2018 under what we have called the *Generalized Reduplication* framework, the plural morpheme *-n*, found in Spanish imperatives verbs before enclitics within the prescriptive or standardized variety, as in (8a), also has variants in which this morpheme is displaced past the enclitic, as in (8b), and even doubled in both its ‘original’ location as well as its displaced location (8c).

- (8) a. Siénte -n -se!
 sit.IMP -PL -CL.REFL
 ‘Sit down! (imperative plural)’
 b. Siénte -se -n!
 sit.IMP -CL.REFL -PL
 c. Siénte -n -se -n!
 sit.IMP -PL -CL.REFL -PL

The variation between displacement and doubling observed above is argued to be the result of a suite of repair operations, enacted in the post-syntactic component in order to satisfy a morpho-tactic constraint, in this case, requiring that the Agr morpheme *-n* be non-initial within the clitic cluster (which is all material after the verb stem in this case).

- (9) *Mesoclisism as a second-position effect*
-n is a second position clitic within the post-stem clitic domain. Displacement or doubling of *-n* occurs in order to put a clitic to its left.

The repair operations are achieved by metathesis and doubling-creating operations inspired by phonological reduplication, but which in this case work upon a linearized string of morphemes within an M-Word.

- (10) *Partial reduplication in the GR formalism:*
 a. Repeat all material inside $[[\dots]]$:
 $[[A B]] \rightarrow ABAB$
 b. Delete the material after $>$ in the second copy:
 $[[A > B]] \rightarrow ABAB \rightarrow ABA$
 c. Delete the material before $<$ in the first copy:
 $[[A < B]] \rightarrow ABAB \rightarrow BAB$

- (11) *Metathesis in the GR formalism*
 $[[A > < B]] \rightarrow ABAB \rightarrow BA$

³Agreement doubling has provoked some of the most polarized viewpoints on the responsibility of syntax vs morphology for word-form: at the opposite extreme from the fully syntactic view of Spanish *-n* doubling by Kayne, Harris (2009) places such cases within a Wunderkammer of ‘Exuberant Exponence’, in which morphology is entirely autonomous in its well-formedness concerns, with syntax having no say in the matter.

This formalism was first developed by Harris and Halle 2005, who note the relation between these operations and Embick and Noyer’s (2001) mechanism of Local Dislocation, explicitly stating that GR can be considered a formal implementation of Local Dislocation (see also Bezrukov 2022). In Arregi & Nevins (2012: Chapter 5) we provided an analysis for the Lithuanian case of Local Dislocation in terms of GR (in fact based on Doubling evidence), and also did so for Adger’s (2006) analysis of Local Dislocation in Old Irish. At present, we do not envision an extension of the GR formalism to non-linear-based displacements such as Lowering in Embick & Noyer (2001). Other cases of potential dislocation that might be considered in terms of GR include negation in Finno-Ugric (Georgieva et al. 2021), which, although a second-to-last-position effect (and hence potentially a case of Non-finality), it is one without microvariation, which makes the constraint-repair framework hard to test.

Returning to Spanish, although it may be clear how metathesis, e.g. inversion of the linear order of *-n* and *se*, will yield non-initiality of the former, why does doubling have a repair effect as well? This depends on the specific statement of the morphotactic constraint, which turns out to be existentially satisfied:

- (12) *Noninitiality* Not all instances of *-n* are initial in a clitic cluster.

This constraint is active throughout the postsyntactic component, and automatically triggers mesoclisism whenever it is violated. In particular, it triggers the Plural Mesoclisism rule, which we formulated as follows:⁴

- (13) *Plural Mesoclisism*

- a. Structural description: $[_{Cl} Agr_{Cl} D_{Cl}]$, where Agr_{Cl} is $[-participant, -singular]$
- b. Structural change:
 - i. Insert $[[$ to the immediate left of Agr_{Cl} and $]]$ to the immediate right of D_{Cl} .
 - ii. Insert $><$ (displacement) or $>$ (doubling) to the immediate right of Agr_{Cl} .

Within the typology of morphotactic displacements by Clem et al. (2020), this can be classified as ‘greedy’ (as opposed to ‘altruistic’), as the morpheme *-n* moves in order to satisfy its own positional constraint. As pointed out by Ryan (2019) about cases of morphotactic doubling in general, as they involve vacuous repetition (at a distance) of the very same morpheme, they are unlike other cases of multiple exponence involving redundant specification of a feature but ones expressed using distinct morphemes for each instance of the feature. Secondly, these are distinct from phonological reduplication, as the vacuous repetitions of the same affix in cases of morphotactic doubling almost never surface adjacent to each other cross-linguistically, which is unlike reduplication, where contiguity of the doubled sequences is the norm.

Of further interest is the fact that when two clitics follow, non-initiality could in principle be satisfied by displacement past only one of them. However, observe the examples below:

⁴See Arregi and Nevins (2018) for further discussion of the domain ‘Cl’ as formulated in (13). Note also that the Agr morpheme (whose exponent is plural *-n*) is $[-participant]$, i.e. third person, even though it agrees with a second person imperative subject. This relies on our own postsyntactic account of the more general syncretism between second and third person plural in Spanish, which we discuss at length in Arregi and Nevins 2018.

(14) *Attested variants in clusters with more than one pronominal clitic*

- a. *Enclisis, with in-situ -n*
Vénda -n -me -lo.
sell.IMP -PL -CL.1SG -CL.3SG.MASC
'Sell it to me! (imperative plural)'
- b. *Mesoclisís with no in-situ -n*
vénda-me-n-lo, vénda-me-lo-n, vénda-me-n-lo-n.
- c. *Mesoclisís with in-situ -n*
vénda-n-me-n-lo, vénda-n-me-lo-n, vénda-n-me-n-lo-n.

These examples show the alternations between displacement and doubling, but they also show that displacement can either stop between the two clitics, or go all the way to the end. This is thus a phenomenon that exhibits cyclicity: after landing in between the first two clitics, re-evaluation of the constraint in terms of the new domain may trigger another cycle of displacement. See Arregi and Nevins 2018:659–670 for our specific analysis of these cyclic effects, and section 3 below for our analysis of a similar pattern in Cypriot Greek.

Of further interest is the fact that mesoclisís of this sort (i.e., migration of the suffix *-n* across the clitic) cannot occur when the intervening clitic is plural – even when there would be no phonological problem with the putative output, such as **vénda-nos-lo-n* 'Sell (pl.) us it!' (cf. nondisplaced *vénda-n-nos-lo*). This restriction holds across all dialects of Spanish with mesoclisís. In Arregi and Nevins (2018), we suggested that this restriction on the structural description of the rule could be implemented in two distinct ways. The first could be in terms of the featural specification [–singular] itself, such that an encoding on the rule would limit displacement across clitics with this feature. The second, based on an analysis of Spanish clitic structure in more detail, could be a limitation across internally-branching clitics, on the hypothesis that plural clitics such as 1pl *no-s* are bimorphemic (with *-s* marking plural number). A surprising outcome of this 'ambiguity' in the way in which the plural restriction is encoded across speakers is that the latter of these has consequences for restrictions on displacement across clitics outside of the plural itself. Specifically, on the hypothesis that 3rd person clitics encoding gender such as *l-o* and *l-a* are also branching and bimorphemic (with *-o* and *-a* realizing masculine and feminine gender, respectively), then for only those speakers who have implemented the plural restriction in this latter way, displacement will not be able to occur across 3rd person clitics bearing gender. Indeed, this point of variation is attested, as mesoclisís in examples such as *vénda-lo-n* 'Sell (pl.) it!' is grammatical only in some varieties (cf. nondisplaced *vénda-n-lo*). In other words, while the number restriction extensionally holds for all dialects, it has two intensional formalizations, and only one of these will automatically lead to the gender restriction as well, as a result of which 3rd person clitics (which show gender contrasts) cannot be crossed for some speakers/varieties.

This in turn raises a recurring theme within the study of morphotactics: surface morphotactic constraints may in many cases have two intensionally distinct, but extensionally equivalent encodings within the grammar. Only on more complex configurations, or even in orthogonal configurations, can they be distinguished. Thus, as we will see with the placement of Dutch infinitival *te*, some speakers have an Initiality-requiring constraint, while others have a Penfinality-requiring constraint. These will have the same output when there is only one verb accompanying the particle, but when there is more than one, these will diverge.

2.2 Noninitiality in Basque auxiliaries

We now turn to noninitiality in the Basque auxiliary as extensively charted in Arregi and Nevins (2012). This case of non-initiality is within the T^0 domain, headed by the T auxiliary itself, which has a non-initiality requirement, though with a variety of repairs, including displacement and doubling, but also epenthesis of a dummy, ‘L-morpheme’. These can all be considered altruistic repairs in the sense of Clem et al. (2020) above. Interestingly, the Basque cases also exhibit another property, namely the timing of these repair operations with respect to Vocabulary Insertion. In Basque, it is clear that displacement occurs before VI, because it has effects on the allomorphic properties of the affected morphemes. (In Spanish above, it may be before VI, but also could be after – one cannot tell, because there is no relevant allomorphy, and the form would be the same.)

Given the wide variety of morphemes placed within the Basque M-Word due to argument doubling and agreement, the morpheme preceding T is typically an absolutive clitic. An absolutive clitic in first position is shown below, where no morphotactic repairs as such take place (note that T shows agreement with the absolutive):⁵

- (15) Ni-k seu- \emptyset ikus-i s -atxu -t.
 I-ERG you.SG-ABS see-PFV **CL.ABS.2SG** -T:PRS.2SG -CL.ERG.1SG
 ‘I have seen you.’ Ondarru (Arregi and Nevins 2012:277)

However, in cases when there is no absolutive morpheme (say, because 3rd person absolutive arguments do not generate clitic doubling), the first position is filled by an epenthetic *L-morpheme*,⁶ which has no syntactic or semantic identity, and is purely morphotactic in nature, in order to supply something to the left edge of the T morpheme.

- (16) Neu-k bakarrik eda-n *d* -o -t au- \emptyset ardau-au- \emptyset ?
 I-ERG only drink-PFV **L** -T:PRS.3SG -CL.ERG.1SG this-ABS.SG wine-this-ABS.SG
 ‘Only I have drunk this wine?’ Zamudio (Gaminde 2000:57)

Another possible repair is ergative Metathesis, which displaces the ergative clitic, which should otherwise follow T linearly to the right, instead to first position:

- (17) Baña seoser- \emptyset ai-ttu *n* -eb -an, e?
 but something-ABS hear-PFV **CL.ERG.1SG** -T:PST.3SG -CPST huh
 ‘But I heard something, huh?’ Lekeitio (Hualde et al. 1994:220)

This displacement, handled for three different dialects in Arregi and Nevins 2012:274–339, is formalized below. (In the notation below, T^{0max} constitutes a domain smaller than the M-Word, for reasons having to do with modal particles in Basque, which are outside of the domain of second-position effects, but still part of the morphological word; see Arregi and Nevins 2012:Sec 5.7.3).⁷

⁵For ease of exposition, we represent Basque finite auxiliaries in full sentences in italics. Although we illustrate the Basque generalizations with data from specific dialects, the phenomena described occur in all dialects, except otherwise noted.

⁶*L* in *L-morpheme* stands for *left* or *linearization-related*. This morpheme has several allomorphs, including *d*- as in (16). See Arregi and Nevins 2012:56, 286–287 for details.

⁷Ergative Metathesis (and Doubling; see below) can displace the ergative clitic to the left of T even if other morphemes intervene (e.g. a dative clitic, as in the examples in (19–21)). This justifies the inclusion of the variable *X* (18). This variable is also involved in stating dialect-particular conditions imposed on the structural description of the rule, the details of which can be found in Arregi and Nevins 2012:281–283.

(18) *Ergative Metathesis*

- a. Structural description: $[_{T^{0max}} T_{Past} X Cl_{Erg}]$
- b. Structural change:
 - i. Insert $[[$ to the immediate left of T, and $]]$ to the immediate right of Cl_{Erg} .
 - ii. Insert $\rangle\langle$ to the immediate left of Cl_{Erg} .

Again, it is important to emphasize that the operations above apply before Vocabulary Insertion, as this correctly predicts the different allomorphs such as first singular *-t* in (16) vs. *n-* in (17).

In addition, akin to the cases reviewed in Spanish above, which show a close relation between displacement and doubling as a result of the GR formalism, one can find alternations between ergative Metathesis and Doubling in some dialects, including Alboniga (de Yrizar 1992:Vol. 1, 470) (see Arregi & Nevins (2012) for evidence that the allomorphs *s-* and *-su* are different, and that this is an important fact that determines where the operation applies – before VI):

(19) **s** -eun -tz -an
CL.ERG.2SG -T:PST.3SG -CL.DAT.3SG -CPST

(20) **s** -eu -sku -**su** -n
CL.ERG.2SG -T:PST.3SG -CL.DAT.1PL -CL.ERG.2SG -CPST

Finally, it is not only the ergative clitic that can be recruited for this purpose; a dative clitic can as well in some dialects, as shown below for the Oñati variety:

(21) Har-ek ne-ri sagarr-a emu-n
he-ERG me-DAT apple-ABS.SG give-PFV
n -o -**sta** - \emptyset -n.
CL.DAT.1SG -T:PST.3.SG -CL.DAT.1SG -CL.ERG.3SG -CPST
'He gave me the apple.'

Oñati (Rezac 2008:710)

Although we cannot go into it here, in Arregi and Nevins (2012), we also provide evidence for not only non-initiality, but peninitiality too: a plural morpheme linearized to the left of T is displaced further to the right, to guarantee that T is not too far from the left edge (that is, in second position, or peninitial).

These two cases, by now well established in the literature, demonstrate that morphotactic repairs can take place with a variety of repairs, and with timing squarely located in the post-syntactic component. Of particular interest is also the fact that microvariation between dialects exhibits this heterogeneity of repairs as responses to the same constraint. We now turn to a less canonical case study, exhibiting a morphotactic constraint *for* initiality.

3 Initiality and the expression of prefixal tense in Cypriot Greek

A morphotactic constraint requiring Initiality for a particular morpheme occurs with the past tense augment in Cypriot Greek (CG), as shown in Pavlou 2017, 2018. The CG augment provides another case study in Generalized Reduplication and its interaction with linear morphotactic constraints, contrasting in interesting ways with imperative mesoclysis in Spanish and ergative displacement in Basque. While it bears some of what we take to be the hallmarks of Generalized Reduplication, such as an alternation between displacement and copying, it is triggered by a linear

initiality constraint. That is, unlike plural *-n* in Spanish or T in Basque finite auxiliaries, the past tense augment in CG is morphotactically conditioned to be the leftmost element within the verbal complex, which triggers its displacement (or copying) over elements within such a complex that are otherwise syntactically determined to precede it.

In CG, all past tense forms of consonant-initial roots bear the so-called prefixal augment *e-*:

- (22) a. **é-** psi -n -es
 AUG- cook -IMPF -PST.2SG
 ‘you(sg) were cooking’ Pavlou 2018:61
- b. **e-** psí -n -amen
 AUG- cook -IMPF -PST.1PL
 ‘We were cooking’ Pavlou 2018:61
- (23) a. **e-** fíli -s -es
 AUG- kiss -PFV -PST.2SG
 ‘you(sg) kissed’ Pavlou 2018:61
- b. **e-** filí -s -amen
 AUG- kiss -PFV -PST.1PL
 ‘we kissed’ Pavlou 2018:61

Following Pavlou 2017, 2018, we take the restriction to consonant-initial roots to be a consequence of phonologically conditioned allomorphy, that is, all past tense verbal forms have an augment, whose allomorphs include vocalic *e-* before a consonant and \emptyset - before a vowel.

In CG, the past tense augment always precedes all other material in the verbal form. This includes not only the root, as illustrated above, but also certain elements that can be prefixed to the root, such as a variety of elements with adverbial meanings:

- (24) a. **e- para-** psi -s -a
 AUG- over- cook -PFV -PST.1SG
 ‘I overcooked’ Pavlou 2018:69
- b. **e- ksana-** psi -s -a
 AUG- again- cook -PFV -PST.1SG
 ‘I cooked again’ Pavlou 2018:71

As shown by Pavlou, a copy of the augment must precede the incorporated adverb, but an additional copy may be present sandwiched between the adverb and the verbal root:

- (25) a. ***ksana-** (e-) psi -s -a
 again- AUG- cook -PFV -PST.1SG
 ‘I cooked again’ Pavlou 2018:71
- b. **e- ksana-** (e-) psi -s -a
 AUG- again- AUG- cook -PFV -PST.1SG
 ‘I cooked again’ Pavlou 2018:71

A verb may incorporate more than one adverb, and in that case, a separate copy of the augment optionally appears after each adverb. As in single-adverb examples, the word-initial copy of the augment is obligatory. Thus, the example in (26a) with a single word-initial augment has all the variants in (26b), but ones that do not start with the augment (26c) are ungrammatical.

- (26) a. e- ksana- para- psi -s -es
 AUG- again- over- cook -pfv -PST.2SG
 ‘you(sg) overcooked it again’ Pavlou 2018:87
- b. i. e-ksana-e-para-psi-s-es
 ii. e-ksana-para-e-psi-s-es
 iii. e-ksana-e-para-e-psi-s-es Pavlou 2018:87–88
- c. *ksana-e-para-e-psi-s-es Pavlou 2018:88

This contrasts with the placement of the augment in Standard Modern Greek (SMG), in which the augment obligatorily follows incorporated adverbs:

- (27) a. para- e- psi -s -a
 over- AUG- cook -PFV -PST.1SG
 ‘I overcooked’
- b. ksana- e- psi -s -a
 again- AUG- cook -PFV -PST.1SG
 ‘I cooked again’
- c. ksana- para- e- psi -s -es
 again- over- AUG- cook -PFV -PST.2SG
 ‘you(sg) overcooked it again’ SMG

A second difference between the two dialects is that in SMG, the augment only appears in shorter verb forms in order to supply a locus for antepenultimate stress (i.a. Kaisse 1982, Spyropoulos and Revithiadou 2009, van Oostendorp 2012, Giannoula 2020). In the (obligatorily) augmented forms in (27), the verb stem following the augment is bisyllabic, and stems with three or more syllables are augmentless. Following Giannoula 2020, we assume that this is an additional contextual restriction on the allomorphic exponent *e-* in SMG (but crucially, not in CG) to the effect that it can only be inserted at the left edge of a minimal (i.e. disyllabic) prosodic word. The CG augment is not constrained in this way, as illustrated by the forms in (22b) and (23).

In agreement with Pavlou, we take this particular array of possible positions of the augment in CG to represent a paradigmatic case of Generalized Reduplication, reminiscent in many ways of the other case studies discussed above: (i) the alternation of single versus multiple copies of the augment is easily accommodated by the formalism; (ii) the obligatoriness of the word-initial copy is strongly suggestive of a linear morphotactic constraint, but (iii) hard to implement in terms of Mirror-Principle-obeying syntactic operations, as revealed by the fact that the augment can surface in different positions within the word. In particular, we follow Pavlou in adopting an account in which the augment’s syntactic position is below the incorporated adverbs in both SMG and CG, and thus expected to be linearized after them. The augment does indeed surface in this position in SMG, but in CG a postsyntactic *initiality* constraint on the augment obligatorily displaces (or copies) it to the left of incorporated adverbs. We present Pavlou’s analysis below, after discussion of the syntax of incorporated adverbs and the past tense augment in both SMG and CG.

The SMG pattern, in which the augment follows incorporated adverbs (27), is itself interesting from a Mirror-Principle perspective, and calls for an analysis in which this order is not a direct reflection of the underlying syntactic positions these elements are generated in. More specifically, the incorporated adverbs typically express categories such as Aktionsart that are generated hierarchically lower than T (Rivero 1992, Alexiadou 1997). Nevertheless, the adverbs precede – and

are therefore farther from the root than – the tense-related augment, which contravenes Mirror-Principle expectations. We account for this fact in terms of syntactic movement: Incorporated adverbs are generated in a position below T, but move to the specifier of a projection above TP, which we label here as VMP (Verb-Modifier Projection; on examples with multiple adverbs, see below). For an alternative way of dealing with this Mirror Principle violation that does not rely on movement of the adverbs to a high position, see Giannoula 2020 (based on the formalism for Head Movement proposed in Arregi and Pietraszko 2021), and for a more general discussion of verbal prefixes which may originate lower, see the chapter on derivational morphology by McGinnis & Wood, this volume.

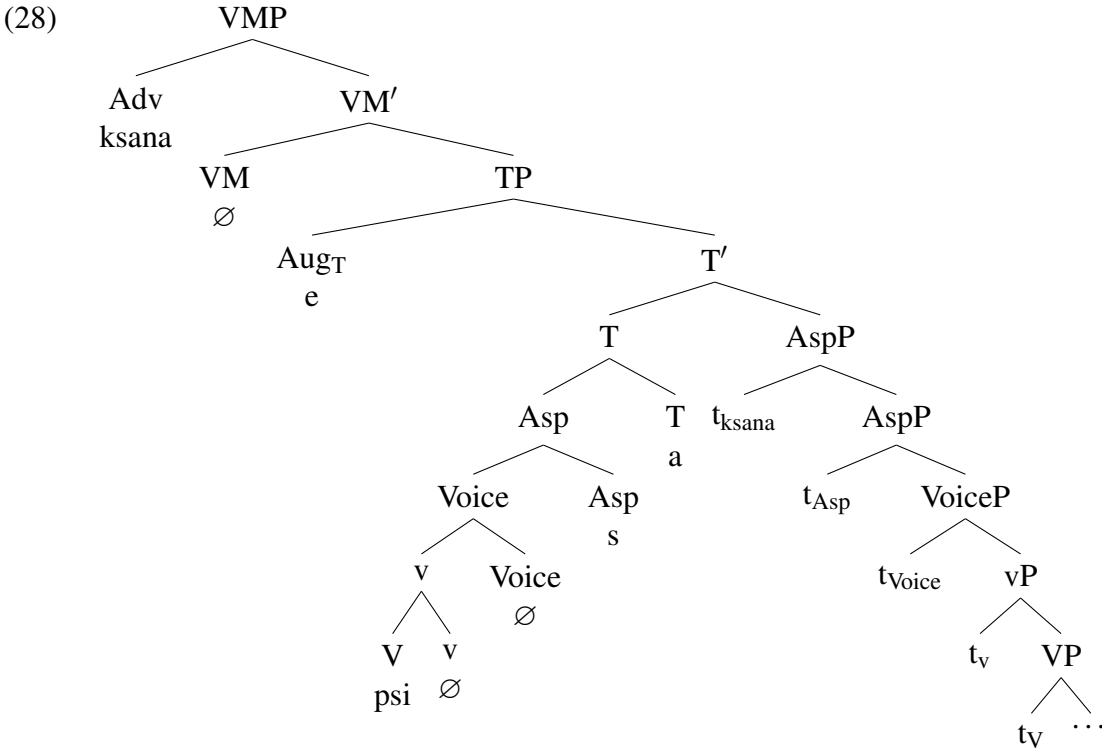
An important property of past tense inflection in Greek is that it displays multiple exponence (on which, see the chapter by Siddiqi, this volume). Alongside the augment *e-* (and its null phonologically-conditioned allomorph), past tense is also expressed suffixally. For instance, *-es* in (22a) and (27c) is specific to second singular past, and *-amen* in (22b) is specific to first plural past.⁸ Like Pavlou, we take the source of this multiple exponence to be syntactic: Suffixal past tense inflection is the realization of T[+past] (to which the verb moves cyclically by Head Movement), and the augment is the realization of a syntactic formative Aug_T generated as the specifier of this head.⁹

Given these hypotheses, the syntactic structure of examples such as (27b) in SMG and (25b) CG is the following¹⁰ – with identical syntax, but different postsyntactic morphotactics:

⁸See Pavlou 2017, 2018 for details on the expression of tense. Pavlou in fact analyzes this suffixal inflection as bimorphemic, with a vocalic exponent of tense (*-e* or *-a*) followed by an exponent of subject person and number agreement (see also Merchant 2015 for a similarly bimorphemic analysis of parallel facts in Standard Modern Greek). For ease of exposition, we represent this suffixal material as fusional, but the details of our analysis of the augment below do not hinge on this matter. For analyses of SMG in which the augment does not realize a dedicated syntactic position, see Spyropoulos and Revithiadou 2009 and Giannoula 2020.

⁹We adopt the hypothesis that there is no special preverbal subject A-position in Greek, following Alexiadou and Anagnostopoulou 1998.

¹⁰We assume the clause structure for Greek proposed in Rivero 1992, as modified in Merchant 2015 and Paparounas (to appear). For ease of exposition, we represent lower copies of head movement as traces and include exponents of each terminal element in (28).



A final relevant property of these verbal forms in the two dialects is that both the augment and incorporated adverbs are part of the same M-word as the inflected verb. Evidence for this is the fact that no element (other than the augment) can intervene between incorporated adverbs and the verb (Alexiadou 1997:181–183). We assume this is due to postsyntactic merger (Marantz 1988, Embick and Noyer 2001, Matushansky 2006, Harizanov 2014, Martinović 2019). First, the augment is lowered from the specifier of T on to the complex head in T. Second, the adverb in the specifier of VMP is lowered onto VM, and the resulting complex head lowers further to T, resulting in the following configuration after linearization:

(29) [T Adv [T Aug_T [T V v Voice Asp T]]]

This accounts for the surface order of morphemes in SMG examples such as (27). It also correctly derives the position of the optional postadverbial augment in cases such as (25b) in CG, but it does not account for its optionality or the obligatory preadverbial occurrence of the augment in this dialect. This is the result of additional morphotactic conditioning on the augment, to which we now turn.

Pavlou proposes that the augment is subject to an Initiality constraint in CG (adapted from Pavlou 2018:80–81):

(30) *Augment Initiality*
 Aug_T must be initial in the M-word.

The linearized structure in (29) violates Augment Initiality, triggering the following Generalized Reduplication rule (adapted from Pavlou 2018:81):

(31) *Augment Externalization*

- a. Structural description: [M-word Adv Aug_T X
- b. Structural change:
 - i. Insert [to the immediate left of Adv, and] to the immediate right of Aug_T.
 - ii. Insert >< (metathesis) or < (doubling) to the immediate left of Aug_T.

As a result of this repair, the augment is placed at the beginning of the word, thus accounting for the obligatoriness of the word-initial copy. The rule is optionally applied as effecting metathesis or doubling, making the postadverbial copy of the augment optional.

As shown by Pavlou, Augment Initiality and its repair apply before Vocabulary Insertion. Evidence for this claim comes from a third allomorph of the augment whose form is *i-*, contextually restricted to certain verbal roots such as *pín* ‘drink’, which has a suppletive form *pkj* in the perfective:

- (32) *i-* *pkj* *-a*
AUG- drink.PFV -PST.1SG
‘I drank’

Pavlou 2018:83

Like the other allomorphs of the augment (*e-* before a consonant, \emptyset - before a vowel), insertion of this exponent is conditioned by properties of a right-adjacent morpheme (the root). More specifically, it can only be inserted when left-adjacent to certain roots including $\sqrt{\text{drink}}$.¹¹ This adjacency requirement emerges in verbal forms prefixed by an adverb, in which an initial copy of the augment is obligatory, and a second copy adjacent to the root is optional, as in the cases discussed above:

- (33) *e-* *ksana-* (*i-*) *pkj* *-a*
AUG- again- AUG- drink.PFV -PST.1SG
‘I drank again’

Pavlou 2018:83

Interestingly, the obligatory initial augment must take its regular *e-* form (**i-ksana-(i)-pkj-a*, Pavlou 2018:84), but the optional root-adjacent copy must be irregular *i-*. This follows from the adjacency requirement on allomorph conditioning, and, more importantly here, from Pavlou’s claim that metathesis/doubling occurs before Vocabulary Insertion. What is metathesized/doubled is the abstract formative Aug_T, not its exponent. If the latter were the case, we would expect both copies of the augment to be *i-*, contrary to fact. The form of this formative must thus be determined after the repair applies.

Finally, consider the multiple-adverb examples illustrated in (26). These forms have up to three copies of the augment: an obligatory word-initial one, and an optional one after each adverb. Given the analysis presented above, these might seem surprising for two reasons. First, the copy of the augment between the two adverbs seems unmotivated, since it is neither word-initial nor adjacent to the root, its expected position before the Initiality repair. Second, the repair rule in (31) is defined to metathesize or double the augment over a single adverb, but the word-initial augment is in fact *two* adverbs away from its hypothesized initial position. As Pavlou shows, cyclic application of the repair (in a way similar to mesoclisism in Spanish) accounts for both properties of these forms,

¹¹That linear adjacency is required follows from standard assumptions on locality of allomorphy (i.a. Embick 2010, Arregi and Nevins 2012). Note also that the phonologically-conditioned allomorphy instantiated by the other two exponents of the other allomorphs is inward-looking, given root-out Vocabulary Insertion (Bobaljik 2000).

as well as for the possible combinations of the three copies of the augment shown in (26). More specifically, we propose that the two adverbs move to specifiers of multiple VMPs above TP in the syntax, and that the postsyntactic operations of Adv-to-VM-to-T merger, Linearization, and Augment Externalization apply cyclically. Thus, after the first pass of merger, Initiality repair applies effecting either metathesis or doubling, resulting in a structure with a copy of the augment before the second (lower) adverb, and an optional copy before the root (for ease of exposition we omit the null heads *v* and Voice in all representations below):

(34) *Externalization: First pass*

$$\begin{array}{l} [\text{T Adv}_2 [\text{T Aug}_T [\text{T V Asp T }]]] \rightarrow \\ [\text{T Aug}_T [\text{T Adv}_2 [\text{T (Aug}_T) [\text{T V T }]]]] \end{array}$$

This derives the possibility of forms with an augment between the two adverbs, such as (26bi) and (26biii). In the next cycle, merger applies again, in this case to the leftmost (higher) adverb. This results in a fresh violation of Initiality, which thus triggers another repair. If the first cycle involves doubling, the second cycle derives the forms with an augment left-adjacent to the root, such as (26bii–26biii):

(35) *Second externalization after initial doubling*

$$\begin{array}{l} [\text{T Adv}_1 [\text{T Aug}_T [\text{T Adv}_2 [\text{T Aug}_T [\text{T V T }]]]] \rightarrow \\ [\text{T Aug}_T [\text{T Adv}_1 [\text{T (Aug}_T) [\text{T Adv}_2 [\text{T Aug}_T [\text{T V T }]]]]] \end{array}$$

If, on the other hand, the first cycle involves metathesis, the second cycle derives the forms with no copy of the augment that is left-adjacent to the root, such as (26a) and (26bi):

(36) *Second externalization after initial metathesis*

$$\begin{array}{l} [\text{T Adv}_1 [\text{T Aug}_T [\text{T Adv}_2 [\text{T V T }]]] \rightarrow \\ [\text{T Aug}_T [\text{T Adv}_1 [\text{T (Aug}_T) [\text{T Adv}_2 [\text{T V T }]]]] \end{array}$$

Thus, the copy of the augment that optionally surfaces between the two adverbs is a derivational residue of the Initiality repair in the first cycle: when it applies, this copy of the augment *is* word initial, but this is later masked by the addition of an additional adverb to the M-word. This early application of the repair to the partially-built M-word also accounts for the apparent long-distance displacement of the word-initial augment: the repair applies to the augment over a single adverb (the higher one), but from its derived position before the lower adverb.

A purely syntactic approach would face significant challenges as there needs to be a separate projection for each instance of the augment, along with dependencies among them. This is a point we already made quite forcefully with respect to Spanish imperative mesoclisism facts in Arregi and Nevins 2018:648-649.

Summarizing, the CG augment is significant in terms of a theory of morphotactic constraints and repairs because 1) it shows a clear *initiality* requirement, thereby adding to the typology of morphotactic constraints; 2) it shows an effect of cyclicity, like Spanish, and thereby an optionality between doubling or further metathesis; 3) it shows allomorphy applying before VI unlike Spanish. The contrast with SMG is also interesting because, although the augment in SMG is not subject to edge-based morphotactics, its distribution is constrained by an edge-based *prosodic* constraint (see discussion under (27)) that is absent in CG. This suggests a possible common diachronic path that led to similar edge-based tactics applied in different domains. We explored a

similar discussion in Arregi and Nevins (2018) with respect to Spanish *-n* displacement, whereby prosodic considerations such as the stress-to-weight principle may reinforce the extent to which morphotactic displacement of this consonantal morpheme to a final (secondarily) stressed syllable occurs, as part of a larger phenomenon whereby the same process may be influenced by and possibly reanalyzed across modules.

This mediation, at the morphological level, after the derivational steps of narrow syntax and before processes such as prosodification that occur on the road to PF during spellout, is well-suited to capture edge-based morphotactics with a variety of repairs, including most importantly the phenomenon of doubling as a variant of metathesis. Finding doubled copies of the same element — importantly, with the potential for divergent surface allomorphs, due to contextual conditioning — with one on the edge of the M-Word and one in intermediate positions is not something one expects in narrow syntax nor within squarely phonological reduplication. As such, the distributed, multimodular architecture of DM, in which morphotactic repairs are situated within a derivational path that can generate ‘opaque’ effects, is at least within current linguistic theorizing, the most explanatorily adequate model that deals with the full range of such phenomena.

4 Noninitiality in German verbal clusters

The placement of the German infinitival particle *zu* ‘to’ (and dialectal variants) in verbal clusters is another case of surface morpheme order that has some of the hallmark properties of postsyntactic displacement, but it also displays certain properties contrasting with the placement of other elements discussed in this chapter that illustrate the sort of variation expected under a morphotactic account. First, unlike other phenomena discussed here, *zu* is almost never doubled (but see section 5). Second, and more revealingly, while the CG augment involves *externalization* due to a *left-edge-related* requirement, the surface placement of German *zu* is the result of *internalization* due to a *right-edge-related* requirement (in particular, nonfinality). Relatedly, *zu* displays *second-to-last* position effects, contrasting with the second-position effects we have described for Spanish plural agreement and Basque T. The analysis presented below, adapted from Salzmann 2019a, capitalizes on these properties.

Suffixal nonfinite verbal inflection in German is phrasal, that is, given a phrasal domain *D*, it suffixes to the last verb in *D*, which may or may not be the head of *D*. As shown by Salzmann (2019a), this is best illustrated in clusters of three or more verbs, in which the relevant generalization is that inflection selected by the highest verb in the cluster occurs on the *rightmost* verb in the complement of the selecting verb. As is well-known, verbal clusters in German (and other West Germanic languages) display quite a bit of optionality with respect to linear order, subject to a great deal of dialectal variation, as amply documented and analyzed in the literature (i.a. Haegeman and van Riemsdijk 1986, Koopman and Szabolcsi 2000, Haider 2003, Williams 2004, Wurmbrand 2004, Barbiers 2005, Bader and Schmid 2009, Salzmann 2013, Abels 2016, Wurmbrand 2017, Salzmann 2019b). For instance, in a cluster of three verbs V1, V2, and V3, where V1 is the highest verb, the linear order of V2 and V3 can be either V3-V2 or V2-V3:¹²

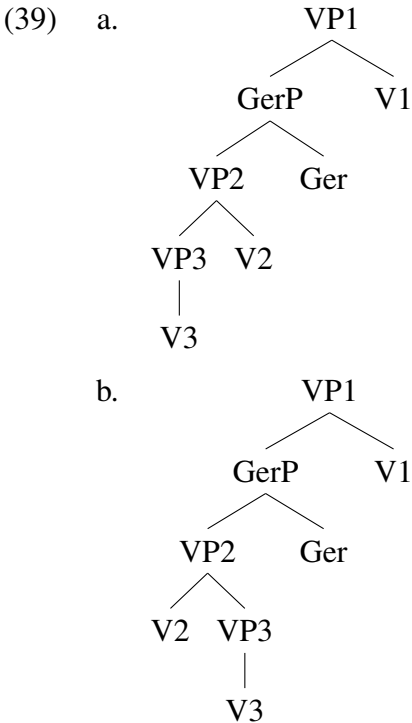
¹²For ease of exposition, and following standard practice in the literature on Germanic verbal clusters, we use the notation ‘V1, V2, V3, ...’ to refer to the hierarchical position of a verb in a cluster, with V1 being the highest, followed by V2, and so on. Furthermore, the different orders the clusters appear in are referred to by sequences of numbers (e.g. ‘132’ refers to the order in which the highest verb is followed by the lowest one, which is followed by the intermediate one). We similarly subscript verbs in examples to reflect this hierarchical order.

- (37) *I... 32-GER*
 a weʌd₁ =s ne: [gə-mãx₃ khün₂-ʌ]
 he will.3SG₁ =it not [GE-do.INF₃ can₂-GER]
 ‘He won’t be able to do it.’ Steinach (Höle 2006:72, apud Salzmann 2019a:12)

- (38) *I... 23-GER*
 ə wyəd₁ =s fʊnd [læs₂ max₃-ə]
 he will.3SG₁ =it indeed [let.INF₂ do₃-GER]
 ‘He’ll have it done.’ Kleinschmalkalden (Steube 1995:432, apud Salzmann 2019a:12)

In the varieties illustrated above, the highest verb in these clusters is a modal auxiliary that selects for gerundive suffixal inflection. If this suffix attached to the head of the complement of the auxiliary, we would expect it to invariably occur on V2 (*khün-* and *læs* respectively in the examples above), contrary to fact. The gerund suffix invariably occurs on the rightmost verb in the cluster, which happens to be V2 in the 132 order (37), but is V3 in the 123 order (38). See Salzmann 2019a:11–12 and references cited there for further illustration of this property of nonfinite inflection in German.

Following Salzmann 2019a, we assume that this suffixal inflection is the realization of a functional head, which in the case of the gerund we label ‘Ger’. This functional head is selected by V1 in the cluster, and in turn takes the rest of the verbal cluster as a complement to its left:¹³



¹³Although V1 is generated in a position that would be linearized adjacent to the other verbs in the cluster, it surfaces further to their left in the matrix sentence examples above, as it is a finite verb that must surface in second position. For simplicity, we assume that variation in the order of V2 and V3 is due to linearization in either a complement-head or head-complement order. See references cited above for different ways of deriving the internal linear order of verbal clusters. Our account of the placement of inflection (as well as Salzmann’s, which ours is based on) is compatible with any of these analytical options.

Since the exponent of Ger does not necessarily surface as a suffix to the verbal head of its complement (i.e. V2), this is a Mirror Principle violation, and thus affixation cannot be the result of syntactic head movement. Rather, the suffix attaches to the immediately preceding M-word (V2 or V3) after Vocabulary Insertion, by a form of Local Dislocation (Embick and Noyer 2001).

The position of the particle *zu* is very similar to that of the gerund and other suffixal inflections, but with a crucial difference: it surfaces to the immediate *left of the rightmost* verb in the relevant domain. In particular, when selected by V1 in a three-verb cluster, *zu* immediately precedes V2 or V3, whichever happens to be rightmost (*z* is a dialectal variant of *zu*):

- (40) *13zu2*
 dass er si schiint₁ [hürate₃ **z** wele₂]
 that he her seems₁ [marry.INF₃ **to** want.INF₂]
 ‘that he seems to want to marry her’ Swiss German (Salzmann 2019a:9)
- (41) *1...2zu3*
 Er schiint₁ nüüt [wele₂ **z** wüsse₃] dervoo.
 he seems nothing [want.INF₂ **to** know.INF₃] about.it
 ‘He doesn’t seem to be interested in it.’
 Zurich German (Weber 1987:244, apud Salzmann 2019a:10)

Verbal clusters in which *zu* is selected by an item outside the verb cluster follow the same generalization; *z(u)* immediately precedes the last verb in the entire cluster:¹⁴

- (42) *32zu1*
ohne das Buch [lesen₃ gekonnt₂ **zu** haben₁]
without the book [read.INF₃ can.PTCP₂ **to** have.INF₁]
 ‘without having been able to read the book’ Standard German (Salzmann 2019a:5)
- (43) *13zu2*
ohne das Buch [haben₁ lesen₃ **zu** können₂]
without the book [have.INF₁ read.INF₃ **to** can.INF₂]
 ‘without having been able to read the book’ Standard German (Salzmann 2019a:5)
- (44) *1zu2*
fer dam Marco [cheni₁ **z** sägan₂]
for the.DAT Marco [can.INF₁ **to** say.GER₂]
 ‘to be able to tell Marco . . .’
 Bosco Gurin (Comrie and Frauenfelder 1992:1059, apud Salzmann 2019a:9)
- (45) *23zu1*
 d Froid, di [göört₂ singe₃ **z** haa₁]
 the joy you [hear.PTCP₂ sing.INF₃ **to** have.INF₁]
 ‘the joy to have heard you sing’ Swiss German (Salzmann 2019a:9)

If the placement of *z(u)* were determined purely hierarchically, we would expect it to immediately precede the highest verb (V1) in all examples, but this is not the case. The correct generalization is that it immediately precedes the rightmost verb in the cluster, which is not necessarily V1.

¹⁴When the selector of *z(u)* is outside the cluster, it is underlined in the examples below. This selector can be a complementizer (42–44), a noun (45), or an adjective.

The minimally contrasting orders 321 (42) and 132 (43) (from the same dialect) are especially revealing. The clusters only differ with respect to linear order (V1 is either rightmost or leftmost),¹⁵ and $z(u)$ immediately precedes the linearly last verb in the cluster (V1 and V2 respectively), not the highest (V1 in both examples).

To summarize so far, the placement of $z(u)$ is the same as verbal inflection (e.g. the gerund suffix discussed above), except that it “skips” the last word in the domain, as it is realized as a particle immediately preceding this word, not as a suffix to its right. Salzmann (2019a) proposes that $z(u)$ has the same syntax as other nonfinite inflections, but its surface placement involves postsyntactic displacement to the left of the last word in its complement. We adopt this analysis below, but adapted to the specific morphotactic framework assumed here.

The particle $z(u)$ is the exponent of a functional head (here labeled ‘Zed’) that takes a verbal cluster as complement and is initially linearized after it. That is, $z(u)$ involves the same structure as other nonfinite inflections, but unlike them, it is subject to a Nonfinality constraint (46) within ZedP. (Note therefore that the domain of nonfinality is not the M-Word in this case, but a larger constituent). This constraint triggers the Generalized Reduplication rule in (47), which displaces $z(u)$ from its peripheral position:

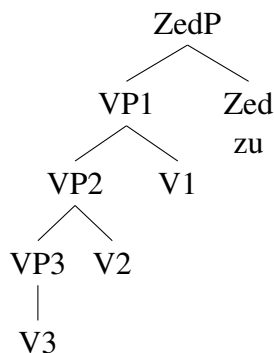
(46) *Zed Nonfinality*
Zed must not be final in ZedP.

(47) *Zed Internalization*

- a. Structural description: $V \text{ Zed }]_{\text{ZedP}}$
- b. Structural change:
 - i. Insert $[[$ to the immediate left of V, and $]]$ to the immediate right of Zed.
 - ii. Insert $\rangle\langle$ to the immediate left of Zed.

Zed Internalization displaces $z(u)$ (the exponent of Zed) to the immediate left of the last verb in the cluster, thus satisfying Nonfinality. The following illustrates the analysis for the clusters in (42–45):

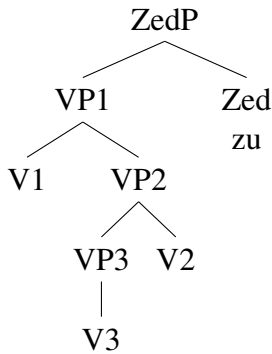
(48) *32zu1*



$[_{\text{ZedP}} V3 V2 V1 \text{ Zed }] \rightarrow [_{\text{ZedP}} V3 V2 \text{ Zed } V1]$

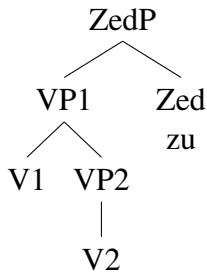
¹⁵They also differ with respect to the inflection on V2. Since this verb is selected by perfect *have* (V1), the expected inflection is participial, as in (42). The infinitival inflection in (43) is an example of the so-called Infinitivus Pro Participio (IPP) effect. See Salzmann 2019a:26–30 and references cited there for discussion.

(49) *13zu2*



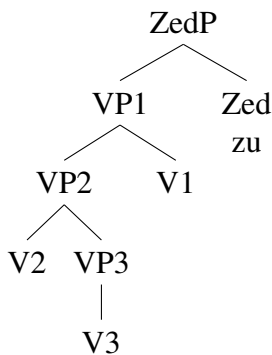
[_{ZedP} V1 V3 V2 Zed] → [_{ZedP} V1 V3 Zed V2]

(50) *1zu2*



[_{ZedP} V1 V2 Zed] → [_{ZedP} V1 Zed V2]

(51) *23zu1*



[_{ZedP} V2 V3 V1 Zed] → [_{ZedP} V2 V3 Zed V1]

Given the extremely flexible and dialectally variable linear order displayed by German verbal clusters, the fact that *z(u)* (almost) invariably surfaces to the immediate left of the final verb in the relevant domain would be puzzling from a purely syntactic point of view. A morphotactic analysis along the lines proposed here and in Salzmann 2019a is based on a modular division of labor that accounts for the dual hierarchical and linear nature of the facts: The syntax defines the domain within which *z(u)* is linearized, and postsyntax is ultimately responsible for its specific linear position within this domain. This is precisely the kind of empirical phenomenon that suggests that natural language structure is organized with distinct components for different aspects of well-formedness – the *distributed* part of Distributed Morphology precisely referring to the fact that syntactic properties such as selection determine the hierarchical order of elements and their external or internal merge position in the syntax, while wholly distinct properties specific to the

morphophonological form of elements determine their linear placement at a subsequent stage of computation. Attempting to shoehorn both the hierarchical and linear properties within one component alone would be akin to attempting to deal with all phonological processes of a language without the lexical vs postlexical distinction by now firmly established as a property of grammar – thereby losing all attendant generalizations about the recurrent differences in the nature of each subcomponent as well as its distribution within dialectal and diachronic variation.

5 Potential evidence for doubling and penfinality in West Germanic

Interestingly, there is evidence of dialectal variation that cannot be fully accounted for by the analysis discussed in the previous section, reported in Schallert 2012, 2020, and briefly discussed in Salzmann 2019a:15. These dialectal options, which we illustrate below, suggest an alternative morphotactic analysis, which is of interest for present purposes because it illustrates other aspects of the framework adopted here. We note, however, that these word-order options are not as robustly attested and as well studied as the others discussed above, hence the analysis sketched below remains tentative.

In some dialects, *zu* selected from outside the cluster can surface to the left of the entire cluster:

- (52) *zu21*
als sich vo mir **z** fahra₂ lo₁
than REFL from me **to** drive₂ let₁
 ‘than let himself be driven home by me’
 Vorarlberg (Schallert 2020:52)

This contrasts with most dialects, in which *zu* appears medially in 21 clusters (see also the pattern 32zu1 in (42)):

- (53) *2zu1*
ohni s Buech kchaufft₂ **z** ha₁
without the book buy.PTCP **to** have.INF₁
 ‘without having bought the book’
 Western Swiss German (Salzmann 2019a:24)

The *zu21* order in (52) is a counterexample to Salzmann’s generalization that *zu* surfaces to the immediate left of the last verb in the cluster, and can therefore not be accounted for by an analysis in which the particle is initially linearized as final and then minimally displaced to the left due to Nonfinality. As with other languages discussed in this chapter, we believe that a key to understanding this variation comes from dialects that have *doubling* in these clusters, with instances of *zu* occurring in both initial and medial position (the selector of *zu* in this case is the matrix verb *brauch* ‘need’):

- (54) *zu2zu1*
 ich brauch merr deß net **zu** gefalle₂ **zu** gelasse₁
 I need me that not **to** please₂ **to** let₁
 ‘I don’t need to put up with that.’
 Frankfurt (Brückner 1988:3651, apud Schallert 2020:52)

This order is also unexpected under our analysis (or Salzmann’s). Although variants with doubling instead of displacement are expected, the two copies of the particle are not in the predicted positions. In the analysis presented in the previous section, *zu* starts as final in the cluster and is then

displaced to the left of the final verb, and thus the predicted order under doubling would be *2zu1zu* rather than the attested *zu2zu1*. Although doubling of *zu* is quite rare, the fact that the attested order is not the one predicted suggests that the analysis is missing something, and points to an account in which the doubling pattern is informative both about the syntactically-determined position of the particle, as well as its morphotactically-imposed position.

The variation between these three orders thus suggests a different analysis that nevertheless relies on the morphotactic framework adopted here. In particular, given the peripheral position of *zu* in the *zu21* pattern, this could actually be taken to be a dialectal variant in which the surface order is faithful to the initial linearization within ZedP. The idea is that, in all dialects, ZedP is linearized in the head-complement order, rather than the reverse order adopted above. Thus, a *zu21* dialect is one in which no morphotactic constraint is imposed on *zu*. On the other hand, dialects with *2zu1*, which seem to be by far the most common, as illustrated throughout the previous section, are further morphotactically conditioned to place *zu* in second-to-last position. Finally, a minor change in the displacement rule that derives *2zu1* results in the doubling *zu2zu1* pattern, in which *zu* surfaces both in its initially-linearized position and in morphotactically compliant second-to-last position.

In addition to a change in the initial linearization of Zed, the present analysis also calls for changes both in the morphotactic constraint and in the Generalized Reduplication rule that effects displacement and doubling. In particular, our Zed Nonfinality constraint is not sufficient to derive a second-to-last effect, since Zed *is* nonfinal when first linearized under the analysis contemplated within this section. What we propose instead is that it results from the interaction of this nonfinality constraint with a *penfinality* constraint that requires Zed to be not too far from the right edge. This constraint is defined below, alongside Zed-Nonfinality, repeated from (46).

(55) *Zed Peninitiality*

At most one M-word may follow Zed within ZedP.

(56) *Zed Nonfinality*

Zed must not be final in ZedP.

Given an initial order in which Zed precedes all verbs in its complement, these two constraints conspire to place Zed as close as possible to the end of the domain (peninitiality), yet not final (nonfinality), that is, in second-to-last position.

Zed Internalization as stated in the previous section (see (47)) also therefore must be modified, as that version is predicated on an initial linearization of Zed to the right of the cluster it takes as its complement. Instead, the rule would be stated as follows under the current proposal:

(57) *Zed Internalization (alternative version)*

a. Structural description: [_{ZedP} Zed X V]

b. Structural change:

i. Insert [to the immediate left of Zed, and] to the immediate left of V.

ii. Insert >< to the immediate right of Zed.

This rule displaces ZedP-initial Zed to the immediate left of the last verb in the cluster, triggered jointly by Zed Penfinality and Zed Nonfinality:

(58) [_{ZedP} Zed V2 V1] → [_{ZedP} V2 Zed V1]

Thus, while *zu21* dialects are not subject to the morphotactic constraints above, *2zu1* dialects are, resulting in the displacement schematized in (58). Finally, the doubling *zu2zu1* pattern is the result of a rule of Zed Internalization that is the same as (57) except that it inserts ‘}’ instead of ‘}⟨’ to the immediate right of Zed. Thus, under this analysis, the alternation between *2zu1* and *zu2zu1* has the same source as the similar variation between displacement and doubling found in Spanish plural agreement, Basque clitics, and the augment in CG.

The proposal that infinitival markers may have a morphotactic pressure to appear in particular linear positions within the verb cluster finds support from Dutch, as studied by Cavarani-Pots (2020). Verbs such as *hoeven* ‘need’ select for an infinitive introduced by *te* ‘to’, as found in the following:

- (59) Hij zal morgen niet [hoeven₁ te gaan₂ voetballen₃]
 He will tomorrow not [need.INF₁ to go.INF₂ play.football.INF₃]
 ‘He won’t need to go play football tomorrow.’ Cavirani-Pots 2020:3

Nonetheless, according to Pots’ questionnaire survey of 459 speakers of Dutch, many speakers allow infinitival *te* to appear in the ‘wrong’ place, as shown below:

- (60) Hij zal morgen niet [te hoeven₁ gaan₂ voetballen₃]
 He will tomorrow not [to need.INF₁ go.INF₂ play.football.INF₃]
 ‘He won’t need to go play football tomorrow.’ Cavirani-Pots 2020:3

Surprisingly, *te* surfaces to the left of the entire cluster, that is, external to the projection of its selector. This is different from the German dialects discussed above, in which *zu* invariably surfaces within the complement of its selector (i.e. ZedP). It appears that in Dutch, the selecting verb comes before *te* according to default linearization, but the latter can be morphotactically placed before the selector, given an Initiality requirement. Interestingly, these data also provide evidence that the morphotactic Initiality requirement on *te* can be satisfied another way, via a more drastic repair: deleting it entirely!

- (61) Hij zal morgen niet [hoeven₁ gaan₂ voetballen₃]
 He will tomorrow not [need.INF₁ go.INF₂ play.football.INF₃]
 ‘He won’t need to go play football tomorrow.’ Cavirani-Pots 2020:3

Finally, there is evidence for an apparent competition between the Initiality requirement on *te* and a Penfinality requirement, again demonstrating its surfacing in the ‘wrong’ place (highly akin now to Salzmann’s examples):

- (62) Koen zal vanwege de winterstop vandaag niet
 Koen will because.of the winter.break today not
 [hoeven₁ gaan₂ te voetballen₃]
 [need.INF₁ go.INF₂ to play.football.INF₃]
 ‘Because of the winter break, Koen won’t have to go and play football today.’
 Cavarani-Pots 2020:47

Given the analysis in which this displacement is due to Generalized Reduplication, it is not surprising that instances doubling can be found, where for example *te* is found in its original source and in its morphotactically-motivated location, as shown below (see Cavarani-Pots (2020) for detailed description of the geographical distribution of these phenomena within Dutch dialects, as well as other doubling patterns, including *te* in both initial and penfinal position):

- (63) Koen zal vanwege de winterstop vandaag niet
 Koen will because.of the winter.break today not
 [hoeven₁ te gaan₂ te voetballen₃]
 [need.INF₁ to go.INF₂ to play.football.INF₃]
 ‘Because of the winter break, Koen won’t have to go and play football today.’

Cavirani-Pots 2020:47

It is worth thinking about all of this microvariation in West Germanic infinitival positional morphotactics. Why, for example, do the same Dutch dialects sometimes have initiality effects and sometime penfinality effects? In fact, this makes sense on the hypothesis that the wellspring of variability is ambiguity within the primary linguistic data (as posed in Nevins (2004) for reduplication variability). Considering that most infinitival markers are witnessed within only a single V cluster (e.g. *te* V1), this pattern is actually ambiguous between positioning of *te* in absolute initial position within the cluster *or* within the penultimate position within the cluster.

6 Looking to other cases of postsyntactic morphotactics

We have explored Initiality, Penitality (Noninitiality), Finality, and Penfinality as morphotactic constraints that motivate postsyntactic repairs, leading to morpheme orders distinct from what would be expected from default linearization as based on the Mirror Principle and semantic scope. There are, however, additional cases of postsyntactic morphotactics in the literature that could be considered. Some of these may involve edge-based positional constraints, of the type we have discussed above (or avoidance of edges to induce nonperipheral cliticization in Udi, e.g. Smith (2014)), and displacement/doubling in the Semitic prefixal conjugation in Hewett (to appear a, b). Others, such as the CARP template from Bantu (Hyman and Mchombo 1992, Myler 2015, Zukoff 2022) appear to involve pairwise morphotactics (such as morpheme X must precede morpheme Y at a morphotactic level). Some of these may be motivated by phonological factors (e.g., if the applicative in Bantu, which has the potential to undergo vowel harmony, is positioned closer to the root, it will potentially maximize application of this process, whereas if it is positioned after an intervening suffix, it will not), while others may not submit to this kind of motivation. For example, Benz (2019) discusses a case of morpheme reordering in Washo which has a prosodic motivation related to stress placement. Similar remarks apply to the analysis of mobile affixes in Huave by Kim (2010, 2015), originally explored in Noyer (1993).

One case of morphotactic displacement and/or doubling of relevance from recent literature is the analysis of agreement in compound tenses in nonstandard and colloquial Turkish, including Anatolian dialects, as studied by Güneş (2020). In these configurations, the exponent of agreement that typically is found in absolute word-final position in examples such as (64) below may, in compound tenses, appear displaced to the left of copula morphemes (65), and even double in both positions (66):

- (64) gel -di -m
 arrive -PST -1SG
 ‘I arrived’

Güneş 2020:236

- (65) gel -di -m -i -se
 arrive -PST -1SG -COP -COND
 ‘if I had arrived’

Güneş 2020:237

- (66) gel -di -**m** -i -se -**m**
 arrive -PST -**1SG** -COP -COND -**1SG**
 ‘if I had arrived’

Güneş 2020:237

Güneş (2020) adopts the GR formalism to account for the optionality of displacement and doubling, and suggests that the relevant morphotactic constraint is for the copula morpheme to follow an instance of the agreement morpheme. As such, this is a relative positional morphotactic, and not an edge-based one. Interestingly, the copula need not immediately follow the agreement morpheme, as shown by examples such as the following, in which the Q-morpheme of polar questions intervenes:

- (67) Başla -sa -**lar** -mı -y- dı -**lar** ?
 start- COND -3PL -Q -COP -PST -3PL
 ‘Should they have started already?’

Güneş 2020:256

While Güneş’s (2020) postulation of morphotactics based on relative order is suggestive, we leave open the possibility that further research may in fact delimit edge constraints within a particular *domain*, as posited in Arregi and Nevins’s (2018) analysis of Spanish mesoclefts. Of particular interest is the question of formalization of these pairwise positional statements, and in particular, when they may not observe an overall transitive ordering between them, as pointed out for Quechua by Ryan (2019). Future work should look into whether cyclic transfer of syntactic structure to the postsyntactic component (e.g. handing off partial aspects of the word structure, not a complete ‘word’) could be one way to model pairwise morphotactics that are not globally transitive.

One question that has inevitably arisen with respect to some of our prior analyses of morphotactics has been the critique that we maintain a separation between constraints and repairs, and that, say, a fully constraint-based analysis of morphotactics (such as the version with violable OT constraints of Clem et al. (2020) or Zukoff (2022)) would not need both constraints and rules. Nonetheless, we contend that a factorization into both constraints and rules allows a more constrained modeling of dialect microvariation, and that extended empirical coverage over the same datasets by competing theories allows for most direct theory comparison. In this respect, the exchange between Kiparsky (2017) and Arregi and Nevins (2017) proved a fruitful method of evaluating the explanatory coverage of different kinds of architectures for word formation (in this case, both involving constraints). It is also notable that Bruening’s (2019) re-analyses of phenomena stated in terms of Local Dislocation in Embick and Noyer (2001) also end up employing constraint-based requirements on the context in which particular morphemes may be allowed to surface, within a derivational syntax. Our own approach is different from both in explicitly separating constraints and repairs (a move made in earlier work in Distributed Morphology, such as Calabrese (1998)). By contrast, in fully constraint-based models, any potential re-ranking of the hierarchy is possible, and so there is a greater degree of variability potentially permitted. On the other hand, in the approach we have taken here, a single constraint may be upheld in constant form across multiple dialects, the difference being only in the suite of repairs that are employed. Future discussions of which architectures are better suited to model morphotactic microvariation across time and/or space can ideally go beyond a blunt wielding of Occam’s razor that simply says “having both rules and constraints is worse than just having constraints” and look towards the nature of the constraints themselves, and the variation they predict.

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