Morphemes in Phonology: Appendix

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A1 Restrictions on non-concatenative morphemes

The variety of non-concatenative morphemes in the languages of the world summarized in section 1 seemingly implies that morphemes can take any form they want: They can surface as stable or copied segments, as a phonological change affecting base material, or as partial or complete templatic restriction about the size and suprasegmental structure of the word. In the following, I want to emphasize that this impression is far from true and discuss a few exemplifying asymmetries about very rare non-concatenative morphemes and even highlight some imaginable non-concatenative morpheme types that are seemingly unattested. Such restrictions directly pertain to the theoretical question of how to predict non-concatenative morphemes; some of these restrictions are in fact explicit arguments against or for a certain theoretical account.

The first one is the absence of any root morphemes that are non-concatenative. As Gouskova (2023) formulates it, 'roots always have some segmental content' (p.17). There is hence apparently no example of a root that solely consist of a tone or a featural mutation that surfaces on an adjacent affix. The crucial question is whether this is indeed a systematic restriction or whether the fact that at least I'm unaware of any reports of such cases is a coincidence following from the rarity of the phenomenon. The fact that there are arguments that roots can be phonologically zero (Trommer, 2012) leads me to believe that the latter could indeed be true since a non-concatenative root would be the expected intermediate pattern between fully specified roots and those that are completely zero.

And this restriction of course implies some language-independent definition of 'roots' that sets them apart from non-roots. A task which is not at all trivial, especially given claims that completely abandon the root-affix distinction for some or even all affixes (e.g. de Belder, 2011; Creemers et al., 2018). Gouskova (2023) summarizes various possible definitions of roots and settles on a structural definition of roots as morphemes that occupy a special syntactic position.

For a GNA approach, the absence of non-concatenative roots is highly surprising. If affixes are allowed to have underlying representations that only contain nonlinear elements like floating tones or moras, there is no principled reason why roots can't have such a representation. In a stratal model where roots are optimized prior to any concatenation, such a form restriction is of course derivable for a certain language but it does not fall out as a universal of languages. And such a root stratum is not even present in standard stratal models where the first stratum optimizes the stem which already contains the root and stem-affixes. A designated root-stratum is also not present in the Egalitarian stratal model proposed in Trommer (2011) where morphemes are optimized prior to concatenation – but this optimization applies to all morphemes, not only roots. See chapter 'Strata' for more discussion.

A cophonology approach, on the other hand, does predict the non-existence of non-concatenative roots from its architecture. If all non-concatenative strategies fall out from cophonologies, a root that is only expressed by such means would be associated with a cophonology demanding the respective non-concatenative strategy but would not contain any phonological elements in its representations. Such a configuration is of course in principle possible but it would never result in a morphologically conditioned phonological change simply because no phonological material is present at the point where the root cophonology is evaluated. The absence of a non-concatenative root in classical cophonology theory is hence one aspect of the 'Strict Base Mutation Principle' that restricts all morphologically conditioned operations to an inward morphological scope in certain theories: They can apply to their morphological base, never to more outwards material (e.g. Alderete, 2001*b*,*a*; Inkelas, 1998; Rolle, 2018).

A second possible restriction that cross-cuts different non-concatenative morphemes is the

size of their surface effect. Templatic restrictions about whole words or certain parts of words naturally affect a relatively large portion of their base and can result in the application of multiple lengthening/insertion or shortening/deletion processes in different syllables. Still, however, these processes can be characterized as the minimal amount of phonological change that is necessary to realize this particular non-concatenative morpheme. Non-concatenative morphemes like segment lengthening or shortening that manifest themselves on a single phonological element are also restricted in this sense: They lengthen or shorten a single segment (in a designated position) but not all segments in a base.

Some immediate exceptions to this minimality restriction can be found in the domain of tonal morphology and segment mutation. In Hausa, for example, the imperative is marked by replacing the tonal melody of the base with a low-high melody ([taː^{2}shi^{1}] 'get up' – [taː^{1}shi^{2}] 'get up!'). Crucially, the whole base melody is overwritten, even if it contains more TBU's than are necessary to realize the two-tone melody ([ka^{2}ran^{1}taː^{2}] 'read' – [ka^{1}ran^{1}taː^{2}] 'read!' (Newman, 2000, 262-263)). Similar example of maximal tonal overwriting can be found in Asante Twi (Paster, 2010), Kipsigis (Kouneli and Nie, 2021), Igbo (Williams, 1976), or Etsako (Elimelech, 1976). And in Kalam Kohistani, a [-high] vowel mutation expressing noun inflection affects all vowels, not only the one vowel that would be necessary to realize this mutation ([baː^{2}ʧa^{1}] – [bäː^{2}ʧäː^{2}] 'king' (Baart, 1999, 36+169)). Similar mutation patterns are attested in Terena for nasalization of vowels (Bendor-Samuel, 1960) and in Basque for palatalization of consonants (Hualde and Ortiz de Urbina, 2003). However, since spreading of both tones and features is a well-known phonological process, a different perspective on these patterns is possible: They involve a non-concatenative tonal or featural morpheme and an additional morpheme-specific (cf. subsection 3.1) process of spreading. One case of maximal tonal overwriting that cannot easily be explained by tonal spreading is the putative tonal polarity in Kipsigis that has been argued in Kouneli and Nie (2021) to affect every single TBU of the base and reverse its tone. As is argued in more detail below, this pattern receives an independent re-analysis without any polarity in Jolin (2023). I'm aware of only one putative case of a global non-concatenative morpheme outside of mutation and tone, namely the 'maximal' vowel shortening in Kimatuumbi. As described in Odden (1996), all long vowels of a stem are shortened if this stem is contained in the head of a syntactic phrase (§6.1 Odden, 1996). Though the context for this global phonological pattern is non-phonological, it is less clear that this is indeed an instance of non-concatenative morphology given that the process is triggered by the phrasal position of a word. Other imaginable global non-concatenative morphemes are systematically unattested. An example is a global segmental lengthening pattern that affects all base vowels (/kaːrena/ –> *[kaːreːnaː]), a global length polarity pattern affecting all vowels (/kaːrena/ –> *[kareːnaː]) or a global subtraction pattern deleting all coda consonants (/kartental/ –> *[kateta]).

A representational GNA account predicts that a local realization of a non-concatenative morpheme is the expected default. Faithfulness constraints will always harmonically bind candidates where more phonological changes apply than are strictly necessary to realize the floating sub- or suprasegmental affix. There are two independent proposals that explain how affixation of a tonal or featural affix can result in a global effect based on morpheme-specific spreading. One is the circumfixation account proposed in Trommer (2023) already mentioned above as a means to predict templatic effects. It is argued that complete tonal overwriting follows from simultaneous prefixation and suffixation of floating tones. If the grammar ranks a constraint demanding contiguous morpheme structures high, it is predicted that all tones are deleted that intervene between those two exponents of the same morpheme. Interestingly, Trommer (2023) shows that circumfixation of a prefixed and suffixed mora can result in a global shortening pattern where all potential long base vowels are shortened; namely the putative Kimatuumbi pattern. This prediction falls out from a gradient CONTIGUITY constraint that is violated by any mora intervening between these two moras belonging to the same morpheme – and reducing the number of moras without deleting vowels results in vowel shortening. And it has to be emphasized that this circumfixation account is not completely modular since it relies on a phonological constraint that makes reference to the morphemic affiliation of phonological elements. As is

discussed in more detail in A3, allowing this minimal morphological information to be accessible in the phonology predicts a variety of independent processes and might be unavoidable in any representational account. Another mechanism predicting global tone and mutation patterns within a representational account is presented in Zimmermann (im Erscheinen). Within a GSR account, a morpheme can be predicted to result in an exceptional pattern of segmental spreading if the relevant spreading feature has a particular strong activation and hence violates any potential harmony constraints more[1] A representational account can hence predict certain global non-concatenative morphemes from the independent mechanisms of morpheme-specific spreading or templatic overwriting; the default expectation, however, is a local realization.

In contrast, the global realization of a non-concatenative morpheme is the expected default within cophonology theory. It was discussed above that morphological consonant subtraction as in Murle easily falls out from assuming a cophonology with a high-ranked NoCoda constraint that penalizes a final coda. Without the high-ranking of constraints that, for example, preserve any morpheme-internal consonants, however, this cophonology results in an unattested Murle' pattern where all coda consonants are deleted, not only the final one. Similarly, a cophonology account predicts global non-concatenative morphemes that manifest themselves as the avoidance of a certain marked structure: A morpheme might solely be expressed as the global avoidance of adjacent identical tones or vowel hiatus that are otherwise tolerated in the language.[2] A cophonology account has hence no problem in predicting the global mutation or tonal overwriting cases mentioned above but it might overgenerate given the absence of any other global non-concatenative morphemes. In addition, every non-concatenative morpheme with a local effect requires additional high-ranked constraints that restrict it to its realization site.

Finally, I want to discuss two rather rare and notoriously debated types of non-concatenative morphemes, namely metathesis and polarity. Morphological metathesis is taken to be a non-concatenative morpheme that is expressed via re-ordering of two segments. Especially Salishan languages are often cited as employing productive morphological metathesis; Clallam in (-1-11) being an example. Another famous example comes from Rotuman (1) where the reversal of the final consonant and vowel marks one of the 'phases' for a word, corresponding to a definite-indefinite distinction for nouns and a complete-incomplete aspectual distinction for verbs (Churchward, 1940; Vamarasi, 2002). The Rotuman pattern has received considerable theoretic interest and is discussed in, for example, Cairns (1976); Besnier (1987); Odden (1988); Blevins (1994); McCarthy (1996), or McCarthy (2000).

(1) Metathesis in Rotuman (McCarthy, 2000, 2)

Complete	Incomplete	
iʔa	iaʔ	'fish'
seseva	seseav	'erroneous'
hosa	hoas	'flower'
parofita	parofiat	'prophet'

Crucially, not only Clallam and Rotuman show metathesis of an adjacent consonant and a vowel; all convincing examples cited in the literature are of this type. The recent discussion of morphological metathesis in Chandlee (2023), for example, lists 12 putative patterns, 10 of which are CV-metathesis. The non-CV-patterns are tonal metathesis in Dangme and CC-metathesis in Hebrew. As Chandlee (2023) already emphasized, neither of these two cases is particularly convincing. For Dangme, the only reason for assuming metathesis of a floating tone in Holscher and Macaulay (1991) is theory-internal and allows for a consistent leftwards tone association process. There is, however, no surface evidence that the floating tone indeed undergoes metathe-

[1] In the account of Guébie in Zimmermann (im Erscheinen), this strong feature is part of a segmental morpheme but the same logic would apply if this were a floating feature that is the only exponent of a morpheme.

[2] One might argue that these are exactly the patterns we find as 'class'-specific morpheme-specific effects (cf. subsection 3.2). For one, as is argued below, many of these patterns might receive an independent explanation. And more importantly, it still remains a puzzling coincidence that specific morphemes are seemingly never associated with such markedness-reducing morphologies, only larger classes of morphemes that share some structural or lexical property.

sis. And CC-metathesis in Hebrew can under closer scrutiny be explained as a phonotactically motivated process across a morpheme boundary (Stonham, 1994). Morphological metathesis is hence restricted to the reordering of a consonant and a vowel and never affects, two consonants or two vowels. In addition, for most of the cases in Chandlee (2023), a crucial observation is made that echoes many claims made earlier for single case studies: Metathesis always ensures that a heavy syllable results(e.g. Buckley, 2011). This is true for our two examples from Clallam and Rotuman where a heavy final syllable is created by the CV-metathesis. This syllable-weight generalization is even more striking since the majority of morphological metathesis examples involve phonologically predictable allomorphy with other non-concatenative strategies that ensure that the resulting form conforms to a certain prosodic template. In Rotuman, the metathesis in (1) predictably alternates with final vowel deletion, vowel mutation, and diphtongization. As McCarthy (2000) points out, all these strategies conspire to form a final heavy syllable. And finally, all convincing examples of metathesis that expone regular morphology (and are not, for example, part of a language game) involve adjacent segments.

All these generalizations easily fall out in a representational GNA account of metathesis where affixation of a prosodic node demands a heavy syllable in a certain position and the phonology of the language provides reordering of segments as one possible strategy. The CV-metathesis in Saanich, for example, that predictably alternates with CV-reduplication and insertion of an epenthetic /ʔ/ coda has been analysed as affixation of a floating mora in Grimes (2002), Davis and Ueda (2006), Stonham (2007), and Bye and Svenonius (2012). And the phonologically predictable allomorphy involving CV-metathesis in Rotuman is argued to follow from affixation of a floating foot in Zimmermann (2017). A cophonology account can in principle re-implement this insight by assuming a cophonology demanding a heavy final syllable (quite similarly to the account in McCarthy (2000) where this templatic restriction follows from morpheme-specific constraints). The question remains whether such a prosodic restriction can follow from independently motivated markedness constraints. A cophonology account is hence similarly restricted in that it does not predict segment reordering as a primitive non-concatenative morpheme: The phonological process of reordering might simply emerge from a prosodic restriction.

This contrasts with the predictions of certain paradigmatic accounts that predict non-concatenative morphemes as unfaithful operations that make the derived form different from a base form. An example is Transderivational Antifaithfulness Theory (Alderete, 2001*b*,*a*) where negated faithfulness constraints can demand that input and output must differ with respect to a specific dimension within a certain morphological context. A negated Linearity constraint readily predicts metathesis since it demands that at least one ordering relation between input segments must be changed in the output. Antifaithfulness Theory relies on morpheme-specific constraints to restrict the correct unfaithful operation to the correct morpho-syntactic context. And it cannot predict the systematic absence of CC- or VV-metathesis or its predisposition of being one allomorph amongst many that form a heavy syllable. Given the overall rarity of polarity and its obvious relation to syllable weight restrictions, the theory hence suffers from an overgeneration problem.

The second non-concatenative morpheme that is at least assumed to be extremely rare, if not even non-existent is polarity which is taken to reverse a binary phonological dimension of the base word into its opposite value in the derived form. The example given in section 2 is from the West Nilotic language Anywa where the vowel length of the monosyllabic base is reversed into its opposite in the frequentative: Long vowel become short and short vowels become long.[3].

For multiple other cases of putative polarity, closer empirical studies revealed that the pattern does not in fact involve polarity. A famous example is the plural formation in Jamul Tiipay (also known as Diegueño) that is cited as length polarity in, for example, Stonham (1994) or Wolf (2007). As de Lacy (2012) argues, however, the plural is not expressed by predictable shortening of long base vowels and lengthening of short base vowels. Shortening is only attested for very few stems and there are many example of short base vowels that remain short in the

[3]Note that the frequentative in Anywa is also marked by gemination of the final stem-consonant and by mutation of certain final consonants and stem-vowels (Reh, 1993).

plural. Since there are also multiple other exponents for the plural whose appearance is not phonologically predictable, de Lacy (2012) concludes that this is rather an instance of lexically conditioned allomorphy. Another putative case is the voicing polarity in Dholou, another Nilotic language. It has been argued extensively and convincingly that this often-cited case also does not involve morphological polarity but rather the surfacing of underlying voicing contrasts (Bye, 2006; Trommer, 2008; de Lacy, 2012). And this pattern is in fact not even a non-concatenative morpheme to begin with since the change of voicing is accompanied by a segmental suffix. Finally, there is a recent argument that Kipsigis employs tonal polarity. In Kouneli and Nie (2021), it is argued that the nominative form always shows the opposite tones of the oblique base form. As was already mentioned above, the second interesting property of this pattern is its globality: All of the base TBU's reverse their tone. However, there is a very convincing argumentation in Jolin (2023) that this pattern does not involve tonal polarity. The main departure from the account in Kouneli and Nie (2021) is the argumentation that the nominative is not derived from the oblique noun form but from a different base, namely the predicative. This morphological re-analysis is then shown to allow an easy representational analysis of the pattern where the oblique is derived from the predicative by prefixation of a floating low tone prefix and the nominative is derived from the predicative by circumfixation of a floating low tone prefix and a floating high tone suffix that leads to complete base overwriting. The existence of productive morphological polarity is thus highly debated and the most convincing examples all involve the reversal of long vowels into short and short vowels into long. And even if the surface effect of morphological polarity exists as such, there are many arguments that there should not be an explicit morphological 'polarity' mechanism. Quite similar to the argumentation given above for metathesis, the surface effect of polarity should emerge from independently motivated morphological exponents (e.g. de Lacy, 2020).

A representational GNA account of non-concatenative morphemes is able to predict length-polarity as an epiphenomenon without introducing a morphological reversal process into the grammar. Trommer and Zimmermann (2014) give an account for Päri[4] where the surface effect of length polarity follows from affixation of a floating mora within containment theory. This mora can be prosodically integrated and thus result in vowel lengthening for bases with a short vowel but it cannot associate to a vowel that is already long since this would result in an over-long vowel – quite similar to the GNA account for shortening sketched above. In such contexts, the mora nevertheless needs to be integrated under a syllable node and results in shortening of this syllable since syllables are banned from dominating three moras.

A cophonology approach, on the other hand, has no explanation for morphological polarity. Under a standard constraint system, there is no constraint type that can explicitly force a change along a certain faithfulness dimension; standard OT hence has no way to predict markedness reversals on the surface (Moreton, 2004). Absolutely similar to the discussion given above for metathesis, Transderivational Antifaithfulness Theory predicts polarity as a primitive morphological operation. Given the rarity of polarity cases and the option to predict polarity surface effects as emergent, this account might again suffer from an overgeneration problem.

This exemplary discussion of restrictions about the form of non-concatenative morphemes left us with some arguments for a representational GNA account: It is not only desirable from a standpoint of modularity, it also predicts the absence of unattested global non-concatenative morphemes. The presence of subtracting morphemes requires the additional assumption of containment within a GNA model and perhaps falls out more naturally within a cophonology approach. The absence of non-concatenative roots is also naturally predict within a cophonology account but remains a coincidence under a GNA approach. On the other hand, several non-concatenative morphemes are impossible to predict under a standard constraint system within a cophonology account. Finally, the rarity and restrictiveness of morphological polarity and metathesis cases follows under both a GNA and a cophonology account but not under paradig-

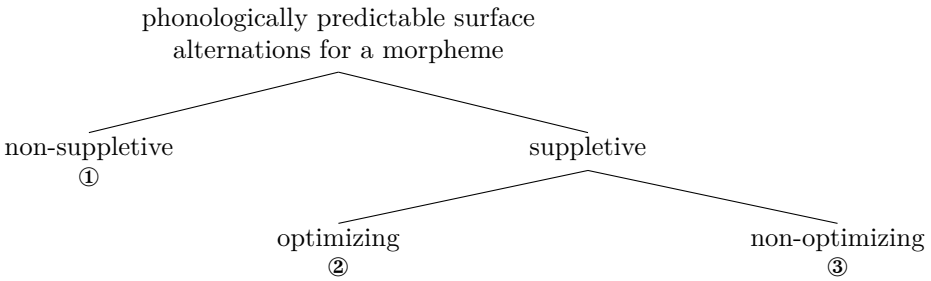
[4]Length polarity can be observed int he frequentative in Päri. It has to be noted, though, that it is accompanied by a segmental suffix /-ɪ/; polarity is hence not the sole exponent but rather an instance of morpheme-specific phonology. As is discussed in section 3, a representational account explains non-concatenative morphemes and morpheme-specific phonology by the same mechanism.

matic account like Transderivational Antifaithfulness. Methodologically, the discussion above emphasized for several cases how important in-depth empirical studies of single languages are in order to be sure that the putative surface generalization is indeed the only or most reasonable understanding of the facts.

A2 Alternating morphemes

Section 1 collected the various surface forms of morphemes in the languages of the world. This section now zooms into the phenomenon of phonologically predictable alternations of different surface forms for the same morpheme within one language. If a single morpheme has different possible surface effects in different phonological contexts, the hypothesis space for such an alternation is often classified as in (2)[5]. In type ①, the application of general phonological principles of the language predicts the observed surface alternations of a morpheme from a single underlying representation. Often, this type is not even labeled 'allomorphy' but subsumed under predictable phonological alternations of the language. In contrast, suppletive allomorphy is assumed to require the storage of more than one underlying form for a morpheme. Two-subtypes are often distinguished: Phonologically optimizing suppletive allomorphy where the choice between the different surface forms is made in accordance with the general phonology of the language ② and non-optimizing suppletive allomorphy where the choice is phonologically predictable but at odds with the general phonological processes of the language ③. A classical example for the former type ② are several suffix alternations in Korean which all help to avoid onset-less syllables and vowel hiatus. The nominative, for example, surfaces as [i] after a consonant-final stem (e.g. [param-i] 'wind') and as [ka] after a vowel-final stem (e.g. [pori-ka] 'barley' (Odden, 1993, p.133)). The mirror-image example of a non-optimizing suppletive allomorphy ③ that creates additional codas and vowel hiatus can be found in Haitian Creole where a definite determiner surfaces as [a] after vowel-final stems (e.g. [trou-a] 'the hole') but as [la] after a consonant-final stem (e.g. [pitit-la] 'the child' (Hall, 1953, p.32))[6]. It is clear that this distribution worsens the syllable structure in both contexts.

(2) Phonologically predictable allomorphy: One typology



When it comes to theoretical accounts for these alternations, it is clear that type ① does not need any additional assumption: The alternation simply follows from assuming a single underlying representation and the application of general phonological processes. For patterns ② and ③, on the other hand, multiple allomorphs need to be stored underlyingly and one main theoretical question is whether the choice between these allomorphs is made in the phonology or the morphology.

[5]This is a simplification in many respects. For example, there are also cases that are often classified as partially optimizing where one of the allomorphs indeed reduces markedness in one context but the preference for another allomorph in another context is not. Such a default preference for one allomorph in the absence of a markedness preference can follow in a multiple input approach (discussed below) if a ranked preference of the allomorphs is assumed (Mascaró, 2007; Bonet et al., 2007). The underlying representations is hence further enriched with non-phonological information.

[6]The allomorphy is in fact more complex and involves additional phonologically predictable alternations that can uncontroversially be regarded as type ①: The determiner surfaces as [na] after a nasal consonant (e.g. [machin-na] 'the machine', p.32) and as nasalized vowel after a nasalized vowel (e.g. [pẽ-ã] 'the break', p.32).

A representative account where the choice between allomorphs is made in the morphology is a subcategorization approach. It assumes that the underlying form of a morpheme can contain phonological selectional requirements that specify the phonological context of its possible appearances. If two morphemes with identical meaning have different phonological subcategorization requirements, they are phonologically predictable allomorphs of each other. One of the first explicit arguments for such phonological subcategorization frames is probably Orgun (1996) but is already implied in, for example, Lieber (1980) (see Paster (2006*a*) for more details and relevant citations). Even though the choice between the different allomorphs is describable by phonological conditions, it is hence not made in the phonology but specified in the lexicon. In terms of modularity, information from the phonology hence invades a non-phonological module. It is clear that this approach easily predicts both ② and ③ since a subcategorization frame is not related to any markedness considerations of the language. In contrast, approaches that I summarize here as 'multiple input' approaches leave the choice between the allomorphs to the phonology and predict suppletive allomorphy as an Emergence of the Unmarked Effect (e.g. Kager, 1996; Mascaró, 1996; Tranel, 1996). The prize for this seemingly modular view are complex inputs that contain multiple possible underlying forms that are in complementary distribution. In multiple input approaches, GEN produces competing candidates based on either one the suppletive inputs; the phonology hence optimizes the choice of allomorph and the application of phonological processes simultaneously. This means that such a view can only predict patterns ② since a markedness-increasing allomorph would always be harmonically bounded by a markedness-reducing one. If a multiple input approach wants to predict non-optimizing allomorphs ③ in the phonology, some additional assumption like lexically indexed constraints sensitive to specific allomorphs are necessary (e.g. Trommer, 2015*b*).

The typology in (2) is helpful since it classifies empirical phenomena but it is also problematic since it does so based on theoretical criteria, namely the question whether an alternation is suppletive or not or optimizing or not. Both questions can of course only be answered based on a theoretical analysis of a specific pattern; they are not empirical criteria. This difficulty of classification mirrors some of the competing arguments made for one or the other approach in the literature. Kager (1996), for example, argues for a multiple input approach and shows that the syllable-counting allomorphy in Estonian is indeed phonologically optimizing as soon as the foot structure is taken into account. This influential proposal hence implies that one might be able to classify more putative ③ patterns as ② and leave the choice between different allomorphs to the phonology.

On the other hand, Paster (2006*a*) argues based on a typology of 173 phonologically conditioned suppletive allomorphy patterns that not all of them are phonologically optimizing and that ③ indeed exists – a subcategorization approach is hence needed anyways and should thus account for all types of suppletive allomorphy. This means that one is left with only two theoretical explanations: The general phonology predicts surface alternations for a single underlying form and subcategorization frames predict the phonologically conditioned insertion of different underlying morphemes. Paster (2006*a*) also mentions the interesting hypothesis that this does not mean that type ② patterns should necessarily be accounted for by subcategorization but that they might in fact fall out from a single input and the application of general phonology, exactly like patterns ① (Paster, 2006*a*, 214). Ideally, all phonologically optimizing allomorphy would hence be of type ① and thus be an epiphenomenon arising from general phonology. The phonology would hence never 'choose' between different listed allomorphs, contra the multiple input proposals and more in line with a fully modular view.

In the following, I want to explore this hypothesis a bit further and start with discussing a concrete example from the theoretical literature: The syllable-counting allomorphy in Estonian (Mürk, 1991). As can be seen in (3)[7], the genitive singular and partitive plural show two different surface forms, depending on the number of syllables in the base (=the vowel-final stem of the genitive singular). For even-numbered bases, the former is marked by suffixing [te] and the latter

[7]Kager (1996) notes that the original source Mürk (1991) does not provide glosses for the examples.

by suffixing [sit][8]. Odd-numbered bases show [tte] with an initial geminate and [it] instead. No regular phonological process of the language would account for the insertion or deletion of /s/ and gemination or degemination of /t/ in these positions.

(3) Estonian: Syllable-counting allomorphy (Kager, 1996, 158)

	GEN.SG	GEN.PL	PART.PL
2 syllables	visa	visa-te	visa-sit
	pesa	pesa-te	pesa-sit
4 syllables	atmirali	atmirali-te	atmirali-sit
	telefoni	telefoni-te	telefoni-sit
3 syllables	paraja	paraja-tte	paraja-it
	raamattu	raamattu-tte	raamattu-it

Kager (1996) argues that this allomorphy is phonologically optimizing and ensures the best foot parsing possible. He proposes a multiple inputs approach, briefly illustrated in tableau (4), taken in abbreviated form from Kager (1996).[9] The genitive singular, for example, has the representation /{te, tte}/ and hence contains two alternative inputs that are in complementary distribution. For an even-numbered base, an output candidate based on the allomorph /te/ allows perfect alignment of a foot and the stem boundary (4-i-a) whereas a candidate realizing the alternative input /tte/ violates the relevant ALIGN constraint (4-i-b). For an odd-numbered stem, alignment between the stem and a foot is impossible for either allomorph and low-weighted *HD/L[10] favoring foot heads that are heavy syllables, decides the competition in favor of [tte] (4-ii-b).

(4) Estonian: Genitive plural allomorphy with suppletive allomorphs (after Kager (1996))

	ALIGN(ST,R;FT,R)	*HD/L
i. IP: visa-{te, tte}		
☞ a. (ví.sa)te		*
b. (ví.sat)te	*!	*
ii. IP: paraja-{te, tte}		
a. (pá.ra)(jà.te)	*	*!
☞ b. (pá.ra)(jàt.te)	*	

Similarly, the choice between the allomorphs /sit/ and /it/ improves the foot structure in terms of syllable weight: The allomorph /it/ is chosen in contexts where its realization allows a heavy syllable as foot head (e.g. (pá.ra)(jài)t) and where the realization of /sit/ would result in a light foot head (*(pá.ra)(jà.si)t). On the other hand, /sit/ is chosen if it allows a light syllable to surface in the foot non-head position (e.g. (ví.sa)sit) and where realization of /it/ results in a heavy non-head foot (*(ví.sai)t). This account hence derives the phonological generalization that the syllable-counting allomorphy is prosodically optimizing. It is striking, however, that the different surface forms of these morphemes are very similar and [tːe] and [sit] are in fact supersets of [te] and [it]. Paster (2006*b*) hence concludes that this might in fact not be suppletive allomorphy but can be re-analysed as a case where a single underlying form predicts all surface effects of the morpheme. Though she sketches an account based on a morpheme-specific rule (Paster, 2006*b*, 215), the most interesting hypothesis would be that this alternation is indeed

[8]This is a simplification: There is an additional optional variant with vowel mutation.

[9]I omit, for example, all constraints deriving the correct foot parsing. Estonian is characterized as a 'Generalized Trochee' system in (Kager, 1993). Slightly simplifying, Estonian has initial main stress and secondary stress on all nonfinal odd-numbered syllables, counting from the right. In addition, a heavy final syllable (note: there is final consonant extrametricality) receives secondary stress if an unstressed syllable precedes. This pattern is captured by assuming that left-aligned syllabic trochees are built and a final unfooted syllable can form a trochee on its own if it is heavy. This means that all possible shapes of a generalized trochee are attested in Estonian but moraic ($\sigma_{\mu\mu}$) trochees are restricted to final position.

[10]Departing from the original PK-PROM in Kager (1996), I adopted the constraint system from de Lacy (2004).

predictable from the general phonology of the language and hence classify the pattern as ①.

Such arguments that a seemingly suppletive pattern can indeed be predicted from assuming a single underlying representation are well-known from the literature. One extensive argument along these lines is made in Scheer (2016) where it is shown how several seemingly suppletive cases fall out from a single underlying representation that contains floating material. And Kiparsky (2021) presents a detailed morphological and phonological study of a putative outwards-sensitive allomorphy in Nez Perce and concludes that it can be reduced to a single underlying representation that is modified by general phonological principles of the language. A final example is the argumentation in Bonet (2023) that a single underlying exponent can predict putative allomorphy in Spanish conjunctions from assuming that only those are subject to dissimilation due to their minimal /V/-shape.

A monorepresentational re-analysis for the Estonian pattern would rely on the assumption that the alternating portion of the morphemes (i.e. the mora for the genitive plural and the /s/ for the partitive plural) is a latent element that is more easily deleted than non-latent elements. One representational account of latent segments is the assumption that those are weakly active elements within a GSR framework. As has been argued in Zimmermann (2019), gradient activity can predict certain properties of latent elements that alternative accounts cannot predict as easily.[11]

This mono-representational account based on latent elements is illustrated in tableaux (5) for the genitive plural morpheme. The /t/ is underlyingly a geminate and hence dominated by a mora – this mora, however, only has the weak activity of 0.5, notated as $\mu_{0.5}$. This weak activity means that 1) it is costly to realize this mora and 2) it is relatively easy to delete it. More concretely, realization of this mora as a fully active surface element with activity 1 implies a -0.5 violation of DEP-μ (5-i+ii-a) whereas deletion of this mora only induces a -0.5 violation of MAX-μ (5-i+ii-b). Note that realization of the mora is abbreviated as $^{\mu 1}$ in (5). Since MAX-μ has a higher weight than DEP-μ, the mora is in principle predicted to be realized as in optimal (5-i-a). However, if realization of the mora and hence the syllabification of a geminate results in a heavy syllable in the foot non-head position, the violation of the low-weighted markedness constraint *NHD/H penalizing a heavy syllable in a foot-non-head (de Lacy, 2004) tips the scale and the weak mora remains unrealized as in optimal (5-ii-b). Tableau (5-iii) shows that this degemination is only expected for latent and hence weakly active moras. It optimizes the form [pímestàvasːe] 'blinding' (ILL.SG) (Kager, 1993, 301) where the underlyingly fully active mora dominating the final /s/ is realized, even if it implies a heavy non-head syllable (5-iii-a). This follows because a -1 violation of MAX-μ is worse than a *NHD/H violation. The tableau also shows the violations of *HD/L, the constraint demanding that foot heads should not be light syllables. As *NHD/H, it has only a weight of 1 and trochees with heavy or light syllables in all foot positions are expected. As can be seen in (5), GSR accounts are not based on ranked constraints but weighted constraints (Legendre et al., 1990; Potts et al., 2010).

[11] An alternative representational account of latent segments is underspecification. A latent segment is either taken to be a segment without a prosodic position (e.g. Hyman, 1985; Noske, 1985; Rubach, 1986; Sloan, 1991; Zoll, 1996; Kiparsky, 2021) or an empty position without melodic content (e.g. Spencer, 1986; Szypra, 1992). However, such an account cannot easily be extended to Estonian since it involves a weak or latent mora. Though a floating or unassociated mora might in principle be a reasonable representation for an underspecified geminate, it would remain mysterious why the floating mora associates only intra-morphemically to a consonant and not heteromorphemically to some other segment.

(5) Estonian: Genitive plural allomorphy as latent mora realization

	MAX-μ 11	Dep-μ 10	*NHD/H 1	*HD/L 1	
i. IP: paraja-$t^{\mu 0.5}$e					
☞ a. (pá.ra)(jàt$^{\mu 1}$.te)		-0.5		-1	-6
b. (pá.ra)(jà.te)	-0.5			-2	-7.5
ii. IP: visa-$t^{\mu 0.5}$e					
a. (ví.sat$^{\mu 1}$)te		-0.5	-1	-1	-7
☞ b. (ví.sa)te	-0.5			-1	-6.5
iii. IP: pimestavas$^{\mu 1}$e					
☞ a. (pí.mes)(tà.vas$^{\mu 1}$)se			-2	-2	-4
b. (pí.mes)(tà.va)se	-1		-1	-2	-14

The same logic can apply to the allomorphy in the partitive plural. A representation /$s_{0.5}i_it_1$/ with a latent and hence weakly active /$s_{0.5}$/ predicts that this consonant remains unrealized to avoid a marked structure that is in principle tolerated in the language. More concretely, this weak consonant remains unrealized in contexts where its deletion results in a foot-head which is a heavy syllable (6-i-b) whereas its realization would result in a foot-head which is a light syllable (6-i-a). Reversely, it surfaces if its realization results in a light syllable in a foot non-head position (6-ii-a) whereas its deletion would result in a heavy syllable in a foot non-head position (6-ii-b) .

(6) Estonian: Partitive plural allomorphy as latent segment realization

	MAX-S 11	Dep-S 10	*NHd/H 1	*HD/L 1	
i. IP: $p_1a_1r_1a_1j_1a_1$-$s_{0.5}i_1t_1$					
a. (p_1á$_1$.r_1a_1)(j_1à$_1$.s_1i_1)t_1		-0.5		-2	-7
☞ b. (p_1á$_1$.r_1a_1)(j_1à$_1i_1$)t_1	-0.5			-1	-6.5
ii. IP: $v_1i_1s_1a_1$-$t^{\mu 0.5}$-$s_{0.5}i_1t_1$					
☞ a. (v_1í$_1$.s_1a_1)$s_1i_1t_1$		-0.5		-1	-6
b. (v_1í$_1$.$s_1a_1i_1$)t_1	-0.5		-1	-1	-7.5

Crucially, the markedness constraints *HD/L and *NHD/H never trigger a repair outside of these latent element contexts: Only weakly active elements remain unrealized to avoid these markedness violations. A latent segment alternative can hence derive the same phonological generalization than a multiple input approach: The choice between allomorphs is simply replaced by the choice between realizing a latent element or not. For the Estonian [sit]∼]it] and [tːe]∼[te] alternations, such a representational account based on latent elements suggests itself since one surface exponent is clearly the subset of another exponent. But what about other cases where such a relation seemingly does not hold? One other classical example for phonologically optimizing suppletive allomorphy is Maroccon Arabic where the third person singular masculine enclitic surfaces as [h] after vowel-final bases (e.g. [xt$^{\text{ʕ}}$a=h] 'his error') but as [u] after consonant-final bases (e.g. [ktab=u] 'his book'). The surface exponents are clearly not a superset of each other; a re-analysis of this ② pattern as ① is hence less promising at first glance. However, it is nevertheless possible. A mono-representational account for this alternation based on latent segments would assume that the underlying representation for this enclitic contains two latent segments /$h_{0.5}u_{0.5}$/ and that only the segment that does not create a vowel hiatus or a complex coda is realized. A tableau illustrating this latent segment analysis is given in (7). Firstly, the interaction of DEP and MAX predicts that both segments ideally remain unrealized: Strengthening to a fully active surface segment is hence more costly than deleting the latent seg-

ment. However, there is a higher-weighted RealizeMorpheme (=RM) constraint penalizing morphemes without any phonological surface effect[12]; at least one of these segments hence needs to be strengthened to a fully active surface segment. And the choice between these two segments is now made by rather low-weighted syllable markedness constraints: The markedness of a vowel hiatus excludes strengthening [u] after a vowel (7-i-d) and the markedness of a complex coda excludes strengthening [h] after a consonant (7-ii-c).

(7)

	RM 20	Dep-S 11	Max-S 10	*Hiatus 1	*CC 1	
i. IP: $x_1t^{ʕ}{}_1a_1{=}h_{0.5}u_{0.5}$						
a. $x_1t^{ʕ}{}_1a_1h_1u_1$		-1				-11
b. $x_1t^{ʕ}{}_1a_1$	-1					-20
☞ c. $x_1t^{ʕ}{}_1a_1h_1$		-0.5	-0.5			-10.5
d. $x_1t^{ʕ}{}_1a_1u_1$		-0.5	-0.5	-1		-11.5
ii. IP: $k_1t_1a_1b_1{=}h_{0.5}u_{0.5}$						
a. $k_1t_1a_1b_1h_1u_1$		-1				-11
b. $k_1t_1a_1b_1$	-1					-20
c. $k_1t_1a_1b_1h_1$		-0.5	-0.5		-1	-11.5
☞ d. $k_1t_1a_1b_1u_1$		-0.5	-0.5			-10.5

It is hence in principle possible to predict an alternation between different segmental exponents that do not share any phonological element from a single underlying representation. It has to be emphasized, however, that this account relies on a RealizeMorpheme constraint – it is hence not completely modular and allows some reference to morphological information in the phonology.

Phonologically optimizing allomorphy between seemingly suppletive segmental exponents can hence fall out from a single underlying superset representation that contains underspecified or weakly active elements. Given that it is more than common for morphemes to be non-concatenative (cf. section 2), the next question is whether such an argument can be extended to phonologically predictable allomorphy between different non-concatenative exponents.

An example for such a pattern can be found for the imperfective morpheme in Alabama, a Muskogean language. It involves the predictable alternation between gemination of the penultimate onset (e.g. /balaaka/ –> [bállaaka] 'lie down') and lengthening of the penultimate vowel in case gemination would result in an illicit syllable structure (e.g. /ibakpila/ –> [ibakpíila] 'turn upside down' (Montler and Hardy, 1988, 400+404)). Another example is the imperative morpheme in Hidatsa, a Siouan language, where vowel shortening for bases ending in a long vowel (e.g. /kuraʔáa/ –> [guraʔá] 'carry!') alternates predictably with vowel deletion for bases ending in a short vowel (e.g. /ráapa/ –> [náab] 'pass by!' (Boyle, 2007, 201+202)). Zimmermann (2023) lists 13 such cases of phonologically predictable allomorphy between different non-concatenative exponent strategies.

For proponents of a GNA approach to non-concatenative exponents, such instances are in fact a major argument for an item-based approach: If a non-concatenative exponent arises from realizing a more abstract autosegmental element like a floating feature or prosodic node, it is in fact expected that this element might have different non-concatenative surface effects. This argument has most convincingly be made for floating moras whose realization easily results in an alternation between different strategies that add prosodic weight to a syllable or create a new light syllable (vowel lengthening, consonant lengthening, CV-Metathesis, and (C)V-reduplication). For Shizuoka Japanese, for example, Davis and Ueda (2002) argue that the alternation of vowel

[12]There are many versions of such a constraint with slightly different predictions. This account is compatible with a constraint demanding the preservation of some part of a morpheme (e.g. Akinlabi, 1996), one demanding the preservation of something distinctive (e.g. Gnanadesikan, 1997), or even a constraint demanding a surface contrast between base and derived form (e.g. Kurisu, 2001).

or consonant lengthening and nasal insertion to form the emphatic follows from adding a mora to the initial syllable. Crucially, the choice between these strategies follows from the ranking of general markedness constraints of the language that penalize a certain strategy for a certain base. Similar mora-affixation accounts have been proposed for Saanich (Davis and Ueda, 2006; Stonham, 2007; Bye and Svenonius, 2012) and Alabama (Grimes, 2002). And Bals Baal et al. (2012) argue that even the predictable alternation between consonant mutation and vowel lengthening in North Saami can be analysed as mora affixation. That the affixation of larger prosodic units can also predict phonologically predictable allomorphy between non-concatenative exponents is the argument in Zimmermann (2013) where the predictable alternation between stress shift, vowel lengthening, reduplication, and epenthesis in Upriver Halkomelem is argued to fall out from affixing an empty foot. As is argued in Zimmermann (2023), all the 13 cases of phonologically predictable non-concatenative allomorphy listed there can be analysed as predictable alternations of a single supra- or sub-segmental phonological element – in accordance with the hypothesis that phonologically optimizing allomorphy is never suppletive.

The last class of relevant phonologically predictable alternations are mixed patterns where segmental and non-concatenative exponents alternate in a phonologically optimizing way. One example is the alternation between low tone realization or segmental suffixation of [yu^{1}] in Yucunany Mixtepec Mixtec that marks the first person singular (Paster and Beam de Azcona, 2004; Paster, 2007). This alternation is phonologically predictable since the segmental suffix only surfaces for bases that end in a low toned TBU (e.g. [tu^{2}tu^{1}] 'paper' – [tu^{2}tu^{1}yu^{1}] 'my paper') and low tone realization surfaces for all other bases (e.g. [na^{1}ma^{3}] 'soap' – [na^{1}ma^{31}] 'my soap' (Paster and Beam de Azcona, 2004, 71,73)). Paster and Beam de Azcona (2004) generalize that this alternation is due to homophony avoidance: [yù] surfaces if realization of a floating low tone would not cause a detectable surface difference between base and derived form. Zimmermann (2015) formalize this intuition into a mono-representational and purely phonological account. It is based on a superset representation for the first person singular morpheme that contains both a floating low tone and the segmental string [yu] which is defective since it lacks a syllable node. Ideally, the phonology hence avoids realization of the [yu] since it comes at the cost of inserting a syllable. The default realization of the morpheme is hence realization of the floating low tone. This tone, however, can not associate to a TBU that already is associated to a low tone due to a ban on redundant double associations. In this contexts, the [yu] must be realized as a last resort to provide a TBU for the low tone. Another example of phonologically predictable allomorphy between segmental and non-concatenative exponents is the diminutive formation in the Northern Mandarin dialect of Yuanyang. As is described in Yip (1992), the diminutive exponent alternates predictably between suffixation of /u/ (8-a) for vowel-final bases and deletion of the final segment for consonant-final[13] ones (8-b).

(8) Phonologically predictable allomorphy between segmental and non-concatenative exponent: Yuanyang diminutive (Yip, 1992, 24)

		DIM	
a.	sua	suau	'brush'
	tçie	tçiau	'eggplant'
	pi	piou	'nose'
b.	p^{h}an	p^{h}a	'plate'
	kuan	kua	'container'

Yip (1992) argues that this allomorphy falls out from assuming that the diminutive consists both of an underlying suffix exponent /-u/ and a templatic restriction that bans a root+suffix combination that is longer than one syllable. This monosyllabicity restriction is pervasive in many dialects of Chinese. Crucially, the monosyllabic template is only enforced after suffixation and syllabification. This means that an underlying form like /kuan+u/ is first syllabified as [kua.nu] which is then subject to deletion of any syllable but the first. This derivational account

[13]Yip (1992) notes that all available data consist of either V- or /n/-final bases even though Mandarin dialects usually allow for final /G/ and /ŋ/ as well.

might even be translatable into a parallel account as soon as non-realized and hence floating material like the /u/-suffix of consonant-final bases is still part of the structure and can demand unmarked syllabification which includes an onset. This is sketched in (9): Although only one syllable can be properly prosodified under the highest prosodic node and is hence phonetically realized in (9-a), the /u/ must nevertheless be syllabified into an unmarked syllable with an onset. The alternative structure in (9-b) would allow the /n/ to be realized but it would be excluded since it leaves the /u/ without any syllable.

(9) Parallel account: Suffixation and truncation in Yuanyang

Underlying	a. Optimal	b. Sub-optimal
k u a n + u →	PrWd | Ft | σ σ k u a n u	* PrWd | Ft | σ k u a n u

Such an account would be reminiscent of the subtraction accounts within containment discussed above where prosodic nodes that cannot be integrated into the overall prosodic structure and hence remain unrealized can nevertheless demand to dominate segmental content and hence 'steal' vowels or consonants from their base.

This review of several relevant case studies leaves us with hope that Paster's hypothesis might indeed be true: There is no need for phonologically optimizing suppletive allomorphy ②. In contrast, morphemes can have potentially complex underlying representations with latent or weak phonological elements that can result in seemingly unrelated surface exponents for morphemes that optimize the phonological structure in each context.

A3 Derived Environment Effects

The phonology can also be sensitive to the least specific piece of information about morphemes: Their presence. In morphological Derived Environment Effects (=MDEE; also often referred to as 'non-derived environment blocking'), a certain phonological process only applies if its context is met in a morphologically derived structure and fails to apply if its context is met in a monomorphemic structure. The classical poster-child MDEE cases are processes that apply at morpheme boundaries where the trigger for the process is affiliated with one morpheme and the target with another, termed 'local MDEE' in the following. An often-cited example is the (primary) palatalization of alveolar stops before /i/ in Korean which only applies in a derived environment (e.g. /mat-i/ –> [matʃi] 'eldest'-NOM) but not if the same context is met within a single morpheme (e.g. /mati/ –> [mati] 'knot', McCarthy (2002):13, citing Ahn (1998)). Similar MDEE palatalizations cases are described for Polish (Rubach, 1984; Lubowicz, 2002) and Hausa (Newman, 2000).

There are also MDEE's that cannot be described as phonological processes that apply across a boundary. An example are word minimality conditions that only hold for morphologically derived words but not for monomorphemic roots. In Turkish, for example, monomorphemic words can consist of only a single syllable (e.g. [ye] 'eat!') but monosyllabic morphologically complex words are systematically impossible (*[ye-n] 'eat'-PASS, (Itô and Hankamer, 1989, 60+61)). A similar MDEE word minimality pattern is described for Japanese as well (Ito, 1990). In these cases, a phonological generalization hence holds over a morphologically derived constituent without being restricted to a morpheme boundary context. I will call these patterns 'global MDEE' in contrast to the local MDEE described above. Another example for such a global MDEE discussed in Inkelas (2014) is stress in Tohono O'odham that can only surface on the final syllable in morphologically complex words but never in monomorphemic ones. And in Jurgec and

Bjorkman (2018), examples of global MDEE's from loanword nativization are discussed. In Tagalog, for example, the otherwise illicit sound [f] is tolerated within loanwords as long as they are monomorphemic (e.g. [filipino] 'Filipino'). As soon as any affix is added, a repair applies (e.g. [pam-pilipino] 'Filipino'-INS, (Jurgec and Bjorkman, 2018, 582)).

MDEE's have received a substantial amount of theoretical interest; probably starting with the adoption of the 'Strict Cycle Condition' into phonology by Kean (1974), Mascaró (1976), and Kiparsky (1982, 1985). Although the original empirical motivation for the Strict Cycle Condition was the existence of cyclic counterfeeding, it became a prominent explanation for MDEE (cf. Gleim (2023) for a concise summary). Since it restricts cyclic rules from applying solely to material that already was present in an earlier cycle, it explains the morphological restriction on a phonological process by interleaving phonology and morphology. In the following, I want to mention four theoretical accounts of MDEE that are implemented within OT. As Inkelas (2014) already points out, no existing account can successfully predict local and global MDEE's as different instantiations of the same unified phenomena.

Firstly, there are representational accounts of MDEE that are based on the insight that a certain process can only alter underspecified elements but not fully specified ones. For our Korean example, this amounts to assuming that a /t/ preceding an /i/ within a morpheme is fully specified whereas a /t/ at the end of a morpheme is underspecified and hence potentially subject to palatalization if a following morpheme starts with /i/. In Kiparsky (1993), this underspecification arises during acquisition given the non-stability of elements in some contexts (e.g. the morpheme boundary in Korean) and in Rasin (2023), it is a predictable consequence of a Morpheme Structure Constraint that ensures that within morphemes, all relevant elements in the correct context (e.g. underlying /t/ before /i/ in Korean) are fully specified before morphemes are concatenated. This latter view is hence an account that explains the relevance of morphemes in phonology via interleaving the two and assuming that smaller morphological constituents (=single morphemes) are subject to a prior phonological computation before morphologically complex structures are fed into the phonology. Underspecification, however, cannot predict global MDEE's. For one, the word minimality patterns in Turkish and Japanese and the stress assignment in Tohono O'odham can not be explained as a phonological process affecting only certain segments in a specific (edge) position within in a morpheme: They are restrictions over whole words. And in the Tagalog case, the derived environment does not add the phonological context for a process – the segment /f/ is marked on its own without any context information. If the root-initial /f/ is underspecified in a derived context /pam-filipino/ to correctly yield [pam-pilipino], it should also be underspecified and subject to repair in a monomorphemic context /filipino/ resulting wrongly in *[pilipino].

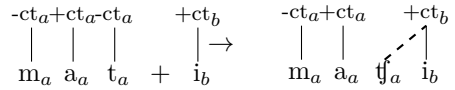
A parallel OT-account that implements the putative derivational nature of MDEE is the assumption of comparative markedness which allows to distinguish whether a marked structure is 'new' or 'old' (McCarthy, 2003*a*,*b*). In this theory, MDEE's fall out from a paradigmatic OO-$_{\text{N}}$ markedness constraint that penalizes a certain marked structure that was not already present in the morphological base output. In our Korean example, OO-$_{\text{N}}$PAL hence penalizes the [ti] sequence in an output candidate for /mat-i/ since the corresponding base form of the monomorphemic root /mat/ did not already contain the marked sequence. A monomorphemic input /mati/, on the other hand, does not violate OO-$_{\text{N}}$PAL since no related base form without the marked structure exists. In our typology of modularity, this approach based on output-output constraints hence allows the phonological evaluation to refer to specific morphological information. In contrast to morpheme-specific constraints, this is not information about specific morpho-syntactic features of a morpheme but rather a morphologically related output form. As the representational approach, underspecification cannot predict global MDEE's, a point convincingly shown in Inkelas (2014). For our Turkish word minimality example, the OO-$_{\text{N}}$WORDMIN constraint penalizing new monosyllabic words would only be violated by morphologically complex [ye-n] if the corresponding unaffixed base [ye] does not already violate the minimality constraint — but it clearly does. There is hence no way that the avoided marked structure can be interpreted as 'new'.

An alternative way to predict MDEE in a system without any interleaving of morphology and phonology is the assumption of the constraint Alternation (van Oostendorp, 2007) that bans epenthetic association lines between phonological elements that belong to the same morpheme (10). This constraint is formulated within a model assuming morphological colours: Every morpheme has an identifying colour and all phonological elements in the underlying representation of this morpheme will bear this colour (cf. also, for example, Revithiadou, 2007; Trommer and Zimmermann, 2014; Trommer, 2015*a*). Given Consistency of Exponence (cf. appendix A4), morphological colour can not be changed, added, or deleted by any phonological process. In such a model, the phonology is hence able to identify whether 1) two phonological elements have the same or a different morphological colour and 2) which elements are epenthetic (=colourless). It crucially does not allow access to the specific meaning or morpho-syntactic features of a morpheme – there can hence be no morpheme-specific constraint in such a model. In our typology of modularity shown in section 1, this model is of type c. but allows far less 'seepage' of morphological information than a lexical indexation approach. As van Oostendorp (2007) rightly points out, this minimal morphological information is implied in most phonological theories, even though it might not be made explicit and might not be formulated as 'colour'. The effect of the constraint Alternation can be seen for the Korean example in (11) where letter indices notate the morphological colour and dashed lines mark new association lines added in the phonology. The feature [+continuant] (=[±ct]) of a suffixed vowel can spread to a preceding stem-segment (11-a) since both have different colours but such a spreading is impossible if both the [+ct] feature of the vowel and the preceding plosive are part of the same morpheme (11-b) since this induces a violation of Alternation.

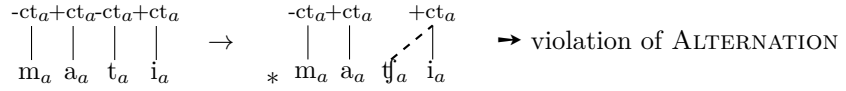
(10) Alternation: If an association line links two elements of colour a, the line should also have colour a. (van Oostendorp, 2007, 16)

(11) MDEE with Alternation

a. Spreading possible if target and host have different colours



b. Spreading impossible if target and host have the same colour



This simple constraint hence straightforwardly predicts MDEE's involving spreading of an autosegmental node but it at first glance is not a very general explanation of the phenomenon. Strikingly enough, however, an investigation of 12 local MDEE patterns cited in the theoretical discussion[14] reveals that this one general process is indeed sufficient to restrict all of them: 5 cases involve palatalization (Hausa (Newman, 2000), Korean (Ahn, 1998), Meskwaki (Goddard, 1994; Wier, 2005), Polish (Rubach, 1984; Lubowicz, 2002), Romanian (Rasin, 2017)), 2 cases involve post-/intervocalic voicing (C. Sardinian (Bolognesi, 2012), Tuscan Italian (Krämer, 2005)), 1 case involves place assimilation (Finnish (Kiparsky, 1973)), and 1 case assibilation (Finnish (Kiparsky, 1973)). All these processes are prima facie examples of autosegmental spreading of one feature to an adjacent segment. The three remaining patterns involve deletion of segments or features (Chumash (Applegate, 1972; Kiparsky, 1993), Indonesian (Pater, 2004), Norwegian (Travis, 2002)) and hence processes that can also be taken to involve autosegmental spreading if deletion implies reassociation of some features to an adjacent host with an identical specification. OCP-triggered deletion in Norwegian that simplifies /rd/-sequences across morpheme boundaries (Travis, 2002), for example, can taken to be restricted by the need to 'rescue' the to-be-deleted Coronal feature to an adjacent segment: Deletion is only possible if this association

[14]Some cases that are often cited as MDEE turned out to be insufficiently described as a 'derived environment' under closer empirical inspection (e.g. Karvonen and Sherman (1997) on Icelandic u-umlaut or Anttila (2006) on Finnish assibilation).

is not tautomorphemic.

And it has to be emphasized that ALTERNATION is not a constraint exclusively formulated to account for MDEE; a ban on tautomorphemic autosegmental associations[15] is necessary in all accounts assuming floating phonological material that can accompany a segmental morpheme (cf. subsection 3.1). In the default case, floating material will dock to the base to which the affix attaches; mirroring the 'Strict Base Mutation' principle (cf. above). However, given the tenets of autosegmental phonology, floating material is of course in principle free to associate to any appropriate phonological host – it can hence in principle also dock to its sponsor. In Zimmermann (2017), it is argued that this tautomorphemic docking is indeed attested in cases of phonologically predictable allomorphy where a morpheme can host its own floating nonlinear element as a last resort if no other host is available (Zimmermann, 2017, 59).

Although it is striking that the independently motivated restriction on tautomorphemic autosegmental association can seemingly predict all cases of global MDEE, ALTERNATION does not offer any explanation for global MDEE's since they do not involve a spreading process across a morpheme boundary.

The fourth account I want to mention is thus one that explicitly tackles global MDEE: The principle of extended lexical indexation proposed in Jurgec and Bjorkman (2018). In this approach, morpheme-specific constraints are further specified for a certain morpho-phonological domain. This morpho-phonological domain is now only exceptional and thus subject to the morpheme-specific constraint if all of its parts – all of the involved morphemes – are exceptional. In Tagalog, $\text{IDENT}_{\text{L,WORD}}$ hence only preserves words that exclusively contain morphemes of class L. Given that only (loanword) roots are of class L, the constraint hence preserves the marked /f/ in monomorphemic [filipino] but not in morphologically complex [pam-pilipino|, simply because the prefix is part of the word but not part of class L. Note that this theoretical approach to global MDEE is in spirit very similar to the one proposed in Gouskova and Linzen (2015) for non-local regularization patterns. Jurgec and Bjorkman (2018) in fact argue that they can predict the Russian pattern discussed in subsection 3.1 if extended lexical indexation also applies to markedness constraints.

There is no account that can successfully predict all types of MDEE's. This, together with the insight that an in-depths empirical investigation reveals intervening lexical and phonological factors for many MDEE patterns leads Inkelas (2014) to the conclusion that MDEE's are not a unified phenomenon that warrants a special theoretical account. In contrast, it is argued that MDEE are instances of morpheme-specific phonology that is best accounted for with cophonologies.

A4 Consistency of Exponence

All models of the information transfer type that allow some reference to morpheme identity in the phonology are faced with the question whether this morphemic affiliation can be manipulated in the phonology. In the discussion above, this question is relevant for a number of mechanisms: Not only for constraints indexed to specific morphemes, lexical categories, or the 'root' but also for the constraints ALTERNATION and REALIZEMORPHEME and for the scaling factors with their locality restriction. This question arises since GEN is standardly taken to be unrestricted: It can insert, delete, change, or reorder any phonological element. If phonological constraints can refer to morphological information as well, we might hence expect that GEN can also change this type of information.

However, the vast majority of accounts is restricted by the assumption that morphemic affiliation of elements can never change, called the 'Consistency of Exponence' assumption. Root elements, for example, will hence always remain root elements and will always remain susceptible to root faithfulness constraints. As van Oostendorp (2007) rightly emphasizes, Consistency of Exponence is usually implicitly assumed and the option of violating it are rarely discussed. I am

[15] One alternative formulation is, for example, NOTAUMORDOC in Wolf (2007).

aware of two explicit arguments that Consistency of Exponence is a violable principle and not a GEN restriction: Walker and Feng (2004) and Lubowicz (2010). In the following, I want to discuss the case studies discussed there and will concludes that neither of them provides a very convincing argument for the violability of Consistency of Exponence since re-analyses based on independently motivated principles are easily possible for all cases.

The argument in Walker and Feng (2004) is based on a case study of diminutive formation in Anxiang Chinese. The diminutive is formed by suffixing /Cər/ where C is copy of the initial stem-consonant (/p^ha/ –> [p^hap^hʃr] 'claw'-DIM, p.783). Walker and Feng (2004) assume that the underlying representation of the diminutive is only /r/ and the additional segments are realized to ensure that every morpheme is exactly one syllable. In their OT-account, this is ensured by the constraint ALIGN(M,σ). In order for the copied stem-consonant and the epenthetic /ə/ to be helpful in satisfying ALIGN(M,σ), both elements must change their affiliation and become exponents of the diminutive morpheme. Consistency of Exponence is hence a violable constraint, namely IDENT-MM in their 'Ternary Model of Morphology-Phonology Correspondence'.

This argument is mainly corroborated by the language-external evidence that [r] on its own is the diminutive marker in other Chinese dialects and by the fact that morphemes are generally restricted to a single syllable in Chinese (cf. the discussion around (8) above). However, neither of these arguments is convincing enough to throw out an otherwise rather uncontested principle. Especially since the simple re-analysis of the diminutive as a reduplicative morpheme with two fixed segments is perfectly in line with Consistency of Exponence and does not rely on any principles that are not independently needed for fixed segmentism reduplication (e.g. Alderete et al., 1999).

The theoretical account of this pattern in Feng (2002) is in fact very similar in spirit to the one in Walker and Feng (2004) but does not rely on a violable Consistency of Exponence. It is rather based on an existential ANCHORING constraint that demands that input edge elements must be at the edge of some syllable in the output. For an input /p^ha + DIM/, the output *[p^har] is hence sub-optimal since the [a] is not aligned with a syllable. In optimal [p^ha.pər], all input edge elements are at also at a syllable edge.

The second explicit argument for the violability of Consistency of Exponence is made in Lubowicz (2010) and based on infixation. It is argued that infixes in Palauan and Akkadian are absorbed into the root and consequently subject to root-specific constraints. In Palauan, the verb marker /m/ can be realized either as a prefix (12-a) or as an infix after the first consonant (12-b). The choice between these options is not phonologically predictable but depends on the morphosyntactic properties of the verb. This marker undergoes dissimilation to [o] or [u] if another labial consonant is adjacent in both prefixed and infixed position (12-c+d)[16]. Interestingly, the infixed /m/ also undergoes dissimilation triggered by a non-adjacent labial (12-f) but the prefixed one never does (12-e). Monomorphemic roots never undergo any dissimilation (12-g).[17]

(12) Palauan labial dissimilation (Lubowicz, 2010, 2-4)

a.	dakt	'fear'	mə-dakt	'be/get fearful'
b.	latk	'remembrance'	l-m-atk	'remembered'
c.	burək	'swelling'	o-burək	'be/get swollen'
d.	tabək	'patch'	t-o-bəkiy	'patched'
e.	dub	'poison'	mə-dub	'be/get poisoned/bombed'
f.	teʔib	'pull out'	t-u-eʔib	'pulled out'
g.	maməd	'bedding given to visitors'		

[16]Note that the local dissimilation in example d. feeds hiatus-avoiding vowel deletion and the two labial consonants are not directly adjacent underlyingly: /t-m-abek/ –> [tobekyiy]. Local dissimilation hence applies if no non-labial consonant intervenes between /m/ and another labial consonant.

[17]It is maybe interesting to note that Joseph does not mention any phonological generalization: 'Less frequently, the verb marker takes the form of a prefix [o-]' (p.131) and the three examples he gives have no labial and are hence no context for dissimilation ([osiik] 'look for', [oker] 'ask', [oklukl] 'cough', p.131).

The account for this asymmetry proposed in Lubowicz (2010) is based on the assumption that infixed /m/ is absorbed into a root but prefixed /m/ is not. Only the infixed /m/ that became part of the root is then subject to the root-specific markedness constraint $\text{OCP}_{\text{ROOT}}\text{LAB}$ demanding (non-local) labial dissimilation[18]. This morpheme absorption that turns an affix into root material is predicted in Palauan since the MORPHEMELOCALITY penalizing any discontiguous morphemes dominates MORPHEMEDEPENDENCY penalizing any change in morpheme affiliation; the violable Consistency of Exponence equivalent. Finally, the fact that the absorbed /m/ undergoes non-local dissimilation but 'normal' root segments never do follows since $\text{IDENT}_{\text{ROOT}}$ demanding preservation of root segment's feature specification is defined over the input and hence does not protect any elements that only became root elements in the output.

The account is hence based on the somehow counterintuitive generalization that a process is required only within a certain domain (=$\text{OCP}_{\text{ROOT}}\text{LAB}$) where it in principle never surfaces (=$\text{IDENT}_{\text{ROOT}}$) – only the special absorbed infixes are undergoers.

The other example for morpheme absorption discussed in Lubowicz (2010) is Akkadian which is very similar in spirit to the Palauan case but shows a different repair. As in Palauan, an infix becomes absorbed into the root and is consequently in the scope of an OCP constraint penalizing homorganic root consonants. In Akkadian, however, the repair is not dissimilation but prefixation or coalescence. The former strategy applies if the homorganic affix and root consonant are not adjacent: In those cases, the infix is realized as a prefix in order to escape the scope of the OCP constraint. And if both consonants are homorganic and strictly adjacent, coalescence into a single segment applies to resolve the OCP problem.

Re-analyses of these patterns without morpheme absorption that retain Consistency of Exponence as an inviolable GEN principle, however, are easily possible. As van Oostendorp (2007) already pointed out, one straightforward alternative for both Palauan and Akkadian is the assumption that prefixes are not prosodified into the same prosodic word as the root whereas infixes are grouped into a single prosodic word together with their root.[19] If the prosodic word is the domain for a general OCP constraint, the patterns are readily predicted. As in the morpheme absorption approach, only the infixes would hence be part of the domain for non-local dissimilation. But in contrast to the morpheme absorption, the relevant domain is an independently motivated prosodic constituent.

For Palauan, an even simpler generalization might be possible that is compatible with at least all the data given in Lubowicz (2010). That prefixed /m/ is exempt from non-local dissimilation could be an epiphenomenon arising from the fact that prefixed /m/ is always word-initial. Such a generalization could easily be captured by a positional faithfulness constraint protecting the initial consonant (Beckman, 1997, 1998). The general OCP demanding non-local dissimilation would hence be dominated by both root-faithfulness and a faithfulness constraint for the initial consonant which predicts that only non-root segments in non-initial position would ever undergo it.[20]

In sum, neither of the explicit arguments that Consistency of Exponence is a violable constraint are compelling and all three case studies can be re-analysed in a model where underlying morpheme affiliation cannot be changed in the phonology.

[18] It is not explicitly mentioned in Lubowicz (2010) but it is clear that a more general OCP constraint that only penalizes adjacent labial elements is also necessary for the account.

[19] Tebay (2021) presents a typological study about the interaction between infixation and the application of root restrictions: Infixes can either be part of the domain for the root restriction or be exempt from it, leaving a discontinuous root domain. It is shown that this typology can follow from prosodic structure differences within the theory of 'Hierarchical Morphoprosodic Structure'.

[20] And one would even loose the need for root-faithfulness if one takes dissimilation to be an exceptional property of the verb marker /m/ (cf. the solutions discussed in 3.1) that is seemingly the only undergoer of this process.

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