# Locality across domains: From morphemes to structures to sounds

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## 1 Introduction

Three systems essential to understanding sound/meaning/structure connections (= "morphophonology in the broad sense") in language:

1. **Morphemes:** Objects stored in memory. (1) Composed of features (T[+past], etc.). (2) The primitives of syntactic derivations.
2. **Syntax:** Constructs complex objects out of morphemes. Cyclic spell out to PF/LF.
3. **PF:** Interprets syntactic objects for "sound" purposes: (1) linear order; (2) adds phonological content ("Vocabulary Insertion"); (morpho)phonology; etc.

*Why does morphophonology look the way it does?* Two major points:

**Point 1** The surface complexity of morpheme-to-structure-to-sound connections arises from the *interaction* of *several distinct representational systems*, each of which operates in terms of its own locality conditions.

**Point 2** In some instances, PF-specific properties *restrict* the interactions that are allowed syntactically; in other cases, PF processes (phonological ones, in particular) *override* other types of locality conditions in limited ways.

In the way that I will talk about the architecture:

- information is manipulated in a way that involves serial ordering of the different representations (morphemes, then syntax, then PF representations);
- thus, the claim is that morphophonological or surface properties in language look the way they do because of how "deep" systems (cycles, etc.) interact with a particular PF system that realizes objects linearly and phonologically.

PLAN: A look at some of the key types of locality that are implicated in this general area, followed by some specific illustrations of Points 1 and 2.

## 2 Locality conditions on alternations

The main points of interest in the path from morphemes to structure to sound involve cases in which there are *alternations* in form; here are three types:

1. ***Suppletive Allomorphy:*** In e.g. English past tense, or $n$, determined by the Root:

(1) VIs for T[+past]

T[+past] $\leftrightarrow$ -t/ $\{\sqrt{\text{LEAVE}}, ...\}$___
T[+past] $\leftrightarrow$ -Ø/$\{\sqrt{\text{HIT}},...\}$___
T[+past] $\leftrightarrow$ -d

(2) VIs for $n$

$n$ $\leftrightarrow$ -al/$\{\sqrt{\text{ARRIVE}}....\}$___
$n$ $\leftrightarrow$ -age/$\{\sqrt{\text{MARRY}}....\}$___
$n$ $\leftrightarrow$ -Ø/$\{\sqrt{\text{BREAK}}....\}$___

2. ***Morphophonology, Including Stem Allomorphy:*** For instance, English *sing* is realized as *sang* in the past tense; or Spanish *pedir* 'to ask' shows an /i/ stem vowel in certain forms, like 1s *pido*; or German *laufen* 'to run' shows Umlaut in some verb forms– cf. 3s *läuft*. *Not (in any obvious way) "general" phonological changes*. (Cf. Embick 2013b for the scope of the phenomena, and "stems" in particular).

3. ***(Morpho)Phonological "Alterability" in General:*** Phase Impenetrability– what does it mean for elements in cyclic domains to be inaccessible for computation in other cycles? Can an "inactive" (=phase inaccessible) element be affected by (part of) PF?

### 2.1 Locality

For types of locality relations that are relevant to morphophonology in the broad sense:

1. ***Phase Cycles:*** The idea that syntactic structures are sent to the interfaces cyclically (Chomsky 2000, 2001). Idea: if $X$ and $Y$ are in the same phase that excludes $Z$, then it is expected that $X$ and $Y$ can interact for PF purposes, but that $Z$ should not be present to interact with $X/Y$.
2. ***Head-to-Head Relations:*** Implicated for the locality of complex-head creation ("standard" head movement, Travis (1984); maybe Lowering, Embick and Noyer 2001). "Generalized" head-to-head relations play a role in n the idea that information is shared among heads in the same *extended projections* (Grimshaw (2005), and (maybe) some more recent approaches to morphology).
3. ***Linear Relations between Morphemes:*** The idea that morphemes $X$ and $Y$ can interact only when they are in a particular linear relationship– e.g. concatenation $X^\frown Y$– has been explored both for "affixation under adjacency" (Embick and Noyer 2001, Embick 2007) and for visibility for contextual allomorphy (Embick 2010a and refs. cited there).
4. ***Phonological Representations:*** Locality of the type that is found in autosegmental representations (e.g., adjacency on a tier), or in metrical representations, etc.; crucially, these types of locality are defined in terms of *phonological* objects, not in terms of morphemes.

**Notes:**

1. There are other relations that could be considered in this connection. For instance, the idea that crucial interactions (whether affixation, or different types of allomorphy, or "fusion") are defined in terms of syntactic constituency. This kind of approach has both word/phrase competition (e.g. Andrews (1990), Poser (1992), Kiparsky (2005), Hankamer and Mikkelsen (2003,2005)) and "insertion at non-terminal" (e.g. McCawley (1968); or Caha (2009) and refs cited there) versions. See Embick and Marantz (2008) and Embick (2013c) discussion.]

2. Theories of directionality and the order of insertion into morphemes (e.g. Bobaljik (2000)) will also constrain possible interactions, in addition to locality conditions per se.

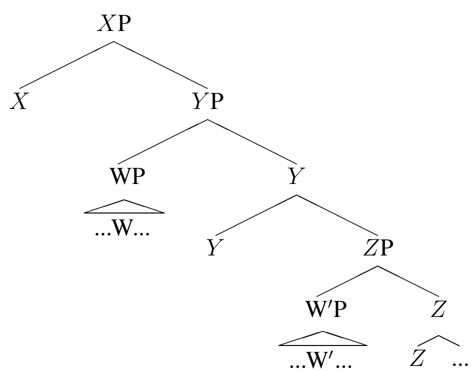
### 2.2 Aside: Head-to-Head Relations

Head-to-head relations are useful for illustrating what it means for conditions to be independent:

- While phase theory says in principle which heads can interact (=be adjoined, etc.), if head-to-head locality is on the right track, there are further restrictions *beyond being in the same phase* that are relevant to when affixation can occur.

Consider the object (3), with $X, Y, Z$ in one phase:

(3) Syntactic object




It can be observed that:

- As far as phases go, $X$, $Y$, and $Z$ are local; i.e., in the same cyclic domain.
- But as far as head-to-head relations go, they are not equally local; $X$ is close to $Y$, and $Y$ to $Z$, but $X$ and $Z$ are not local in the relevant way.

So, for example, we do not expect $Z$ to affix to $X$ in a way that skips $Y$. This is because the head-to-head relations further restrict what could *in principle* interact on account of the phase-cyclic part of the theory. [For this point it really doesn't matter if head movement is part of the PF (e.g. Chomsky 2001)].



### 2.3 Illustrations

Support for the idea that morphophonology in the broad sense involves (the interaction of) **independent** locality conditions like those listed above:

- LINEAR ORDER AND PHASES: Morphemes that could in principle interact as far as phase-theory goes *do not* interact because they fail to meet a linear locality condition; and vice versa.
- LINEAR ORDER OF MORPHEMES AND (MORPHO)PHONOLOGY: 2 illustrations:
  - A type of *opacity*; an effect that looks non-local on the surface is local at the stage of the derivation when the relevant operation applies, but this is masked by action involving later representations.
  - Morphophonological alternations that skip morphemes, because they are defined in terms of phonological representations.
- OVERRIDE: Objects not predicted to be alterable for computation because they are in "finished" phases appear to be affected at PF to a limited degree.

## 3 Phases and Linear Adjacency

Two independent locality conditions for contextual allomorphy (Embick 2010a):

1. **Phases:** Morphemes can interact for allomorphy etc. only when they are in the same phase domain.
2. **Linear:** Morphemes can interact for allomorphy only when they are immediately linearly adjacent, i.e. *concatenated*: $X^\frown Y$.

We expect to find examples of linearly adjacent morphemes that do not interact because of how phases operate; and of phase-local morphemes that do not interact because they are not linearly adjacent.

### 3.1 Phases

FIRST: Category-defining heads are cyclic (Embick and Marantz (2008), Marantz (2001, 2007); Embick 2010a):

(4) Category-defining heads ($v$, $n$, $a$...) are cyclic.

[**Note:** These are not necessarily the *only* cyclic heads; D, C, and other heads could and probably should be included here.]

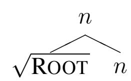
Category-defining heads are realized as the typical "derivational morphemes" (*color-ize*, *dark-en*, *refus-al*, *confus-ion*, *marr-iage*, *vapor-ous*, *compar-able*, etc.). There are important empirical reasons to think that these heads behave different wrt phases than non-cyclic heads (e.g. Tense, etc.) do.

REPRESENTATIVE OBSERVATION: $n$ has many allomorphs in Root-attached [$\sqrt{\text{ROOT}}$ $n$], but not in gerunds [[$\sqrt{\text{ROOT}}$ $v$] $n$] (Chomsky (1970) etc.; cf. Alexiadou et al. (2007)):

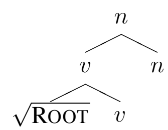
(5) Realization of $n$ heads

| (derived) nominal | gerund |
|---|---|
| marri-age | marry-ing |
| destruct-ion | destroy-ing |
| refus-al | refus-ing |
| confus-ion | confus-ing |
| ⋮ | ⋮ |

(6) noun

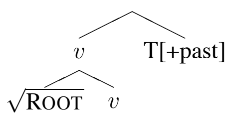



(7) Gerund (simplified)




While a cyclic head appears to not see a Root across another cyclic head, it is important to observe that other morphemes that appear outside of a category-defining head appear to be able to see the Root; past tense T[+past], for example:

(8) Past Tense Verb




(9) Vocabulary Items: T[+past]

T[+past] $\leftrightarrow$ -t/___ {$\sqrt{\text{LEAVE}}$, $\sqrt{\text{BEND}}$, ...}
T[+past] $\leftrightarrow$ -Ø/___ {$\sqrt{\text{HIT}}$, $\sqrt{\text{SING}}$, ...}
T[+past] $\leftrightarrow$ -d

The generalizations that are at play appear to be as follows (cf. Embick 2010a):

**Generalization 1** A cyclic head $y$ outside of cyclic $x$ cannot see a Root or other morphemes in the complement of $x$, in e.g. [[$\sqrt{\text{ROOT}}$ $x$] $y$]; but

**Generalization 2** A non-cyclic head $Y$ *can* see a Root (or other morphemes in the complement of cyclic $x$ in [[$\sqrt{\text{ROOT}}$ $x$] $Y$].

A theory of phases that accounts for these generalizations is based on three ideas:

1. When a cyclic head is merged, cyclic domains in the complement of that head are spelled out.
2. In addition, the domains that are spelled out are defined around cyclic heads and their attendant material; that is:
3. A cyclic domain centered on $x$ includes non-cyclic heads between $x$ and the higher head that induces spell-out;
4. But the higher cyclic head that triggers spell out is **not** included in the domain whose spell-out is triggered.

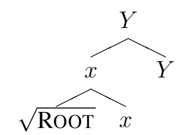
Along with this definition of cyclic spell out, it is necessary to specify how material becomes "inactive" (in the phase impenetrability sense) for computation in later cycles. This can be done as follows:



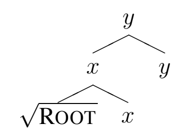
(10) ACTIVITY COROLLARY: In [[ .... $x$] $y$], $x, y$ both cyclic, material in the complement of $x$ is not *active* in the PF cycle in which $y$ is spelled out.

Illustrating, with $x$, $y$, cyclic, and $Y$ non-cyclic:

(11) $\sqrt{\text{ROOT}}$, $x$, $Y$ all active




(12) $\sqrt{\text{ROOT}}$ inactive in $y$'s cycle




A single spell out domain containing cyclic head $x$ will not contain outer, cyclic $y$ when $x$ undergoes VI. But non-cyclic $Y$ attached outside of $x$ will be present. Moreover, the complement of $x$ will be inactive when outer $y$ is operated on.

- For the moment, what is understood under *active* is that an element is not visible *as a particular Root or morpheme*. As will be seen in section 5, things that are inactive in the technical sense still possess phonological representations....

The cyclic part of the theory accounts for contrasts like the one seen above– gerunds versus Tense morphemes:

1. In a gerund [[$\sqrt{\text{ROOT}}$ $v$] $n$] when $n$ is merged it triggers the spell out of the cyclic domain in its complement, centered on $v$. $\Rightarrow$ *The $n$ head is only operated on at PF in a later cycle. In that later cycle, the Root cannot be seen, because it is **inactive**.*
2. In the case of the past tense, the cycle centered on $v$ also contains T[+past], by the definition of domains employed above. $\Rightarrow$ *Thus, the T[+past] head and the Root are both active in the same cycle, which means that T[+past] can have its allomorphy determined by the identity of the Root.*

There are a few more important observations at play here:

**(O1)** In order for T[+past] to see the Root in e.g. [[$\sqrt{\text{LEAVE}}$ $v$] T[+past]], it has to see past the (null) $v$. This can be done in various ways (e.g. deletion rules).

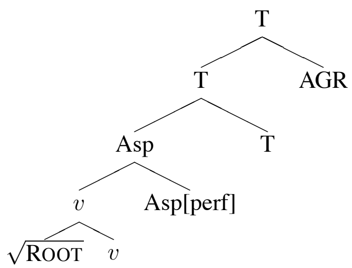
**(O2)** In a gerund [[$\sqrt{\text{ROOT}}$ $v$] $n$], the $n$ cannot see the $\sqrt{\text{ROOT}}$ even though $n$ and the $\sqrt{\text{ROOT}}$ are linearly adjacent on the surface.

This second observations highlights the idea about independence of conditions: morphemes that are linearly adjacent cannot see each other because of phase-cyclic locality. The next section elaborates further on this point

### 3.2 Linear adjacency within Phase Domains

The theory of allomorphy outlined above also holds that morphemes must be concatenated $X^\frown Y$ in order to see each other for allomorphy. An illustration of this linear locality condition is provided by Latin perfects. Syntactico-semantically, these have the structure in (13), with the features in (14):

(13) Structure:




(14) Features of T:

[pres] = Present Perf.
[past] = Pluperfect
[fut] = Future Perfect

The key observations about the perfect center on the AGR morphemes. In (15), notice in particular that the perfect indicative "Perf. Ind." has endings that stand out, shown here in **bold**:

(15) Perfect forms of *amo* 'love'

| **p/n** | **perf. ind.** | **plpf. ind.** | **perf. subj.** | **plpf. subj.** | **fut. perf** |
|---|---|---|---|---|---|
| 1S | ama-v-**ı** | ama-ve-ra-m | ama-ve-ri-m | ama-vi-s-se-m | ama-ve-r-o |
| 2S | ama-v-**istı** | ama-ve-ra-s | ama-ve-rĭ-s | ama-vi-s-se-s | ama-ve-rĭ-s |
| 3S | ama-vi-t | ama-ve-ra-t | ama-ve-ri-t | ama-vi-s-se-t | ama-ve-ri-t |
| 1P | ama-vi-mus | ama-ve-ra-mus | ama-ve-rı-mus | ama-vi-s-se-mus | ama-ve-rĭ-mus |
| 2P | ama-v-**istis** | ama-ve-ra-tis | ama-ve-rĭ-tis | ama-vi-s-se-tis | ama-ve-rĭ-tis |
| 3P | ama-v-**erunt** | ama-ve-ra-nt | ama-ve-ri-nt | ama-vi-s-se-nt | ama-ve-ri-nt |

That is, in agreement we see four exponents restricted to perfect indicatives:

(16) Agr forms:

a. In perfect indicative only: 1s *-ı*, 2s *-istı*, 2p *-istis*, 3p *-erunt*.

b. Elsewhere: 1s *-o*, *-m*; 2s *-s*, 3s *-t*, 1p *-mus*, 2p *-tis*, 3p *-nt*

The behavior of "special" AGR illustrates the effects of immediate linear adjacency (concatenation); (see also Carstairs (1987); Carstairs-McCarthy (2001,2003) and Adger et al. (2003); as well as Lieber (1992) for discussion).

OBSERVATIONS:

1. The Asp[perf] morpheme is realized as *-vi*.
2. The final morphemes in all of these forms are AGR.



3. The special "standout" AGR allomorphs are found only in the Perfect Indicative; that is they are found *only when tense/mood morphemes are not realized overtly, so that AGR is linearly adjacent to Asp[perf]*.
4. There is no overt T[+pres] in Latin. Recall from above that "zero" realizations of morphemes can be "transparent" (perhaps via deletion) for linear adjacency.
5. When AGR is not adjacent to Asp[perf], we find AGR as it is elsewhere in the language:

(17) Present and Imperfective Indicative of *amo*

| **p/n** | **present** | **imperfect** |
|---|---|---|
| 1s | am-o | ama-ba-m |
| 2s | ama-s | ama-ba-s |
| 3s | ama-t | ama-ba-t |
| 1p | ama-mus | ama-ba-mus |
| 2p | ama-tis | ama-ba-tis |
| 3p | ama-nt | ama-ba-nt |

The special realizations of AGR are the result of Vocabulary Items that refer to Asp[perf]. These can apply only in the perfect indicative, since it is only there that AGR is concatenated with Asp[perf]. Otherwise, the Vocabulary Items used in the other perfect tenses are those that realize AGR elsewhere in the language (as in (17):

(18) VIs: A Fragment of AGR in Latin

| | | | |
|---|---|---|---|
| 1s | ↔ | -ı | /Asp[perf]$^\frown$__ |
| 2s | ↔ | -istı | /Asp[perf]$^\frown$__ |
| 2p | ↔ | -istis | /Asp[perf]$^\frown$__ |
| 3p | ↔ | -erunt | /Asp[perf]$^\frown$__ |
| 1s | ↔ | -o | |
| 2s | ↔ | -s | |
| 2p | ↔ | -tis | |
| 3p | ↔ | -nt | |

### 3.3 Summary

Phase-based and linear conditions on locality both appear to be relevant for contextual allomorphy. In the theory that is outlined above, the linear condition (concatenation) restricts further the interactions that could be defined in terms of cyclic locality alone. Highlighting independence, we see

- Instances in which superficially adjacent morphemes do not interact for allomorphy, because of an intervening phase boundary; and
- Instances in which phase-local morphemes fail to see each other, because of the linear condition not being met.

## 4 Adjacency between morphemes and morphophonology

The last section shows how morphemes that are in the same cyclic domain interact only when they meet a further linear locality condition. I now turn to cases in which phonologically-defined locality conditions interact with morpheme-defined locality:

- Sometimes it appears that morphemes are not concatenated on the surface, but nevertheless interact allomorphically. In cases of this type, there should be evidence that later, phonological processes have obscured a relation that was local when VI occurs.
- On this theme, the locality conditions that apply to "morphophonological" alternations are (for some alternations, at least) defined phonologically, *in way that can ignore morphemes*, so that there should be "morpheme skipping" morphophonology.

### 4.1 Linear adjacency and Opacity

Palauan (Austronesian; Flora (1974); Josephs (1975,1990)– the "Verb Marker" (VM), which relates to transitivity, voice, etc., so that it can be treated as a realization of $v$ or Voice. Typically realized as a prefix/infix *mə-*, as in (19a), but also as *o-* for phonological reasons in (19b) where the Roots are all /b/-initial:

(19) VM-Verb

| | **verb** | **gloss** |
|---|---|---|
| a. | mə-rael | 'walk, travel' |
| | mə-ngədub | 'swim' |
| | mə-ləʔo | 'bathe' |
| | me-ʔiuaiu | 'sleep' |
| b. | o-bəkall | 'drive' |
| | o-bail | 'clothe' |
| | o-boes | 'shoot' |
| | o-bes | 'forget' |

(20) *o-* allomorph verbs

| **verb** | **gloss** |
|---|---|
| o-ker | 'ask' |
| o-klukl | 'cough' |
| o-koad | 'fight' |
| o-sus | 'greet' |
| o-ʔərʔur | 'laugh' |
| o-siik | 'look for' |
| o-kor | 'refuse' |
| o-kiu | 'go by way of' |

Other verbs, shown in (20), have an *o-* allomorph of the VM; i.e., one that is underlying, not derived from *mə-* phonologically.

Minus the fact that *o-* can also be the result of the phonology, this looks like a typical case of allomorphy in which the VM has to see the Root that it attaches to:

(21) VM ↔ o-/__⁀LIST
VM ↔ mə-

Interestingly, there are forms in which it appears that the VM is not concatenated with the Root; and with the Roots in (20), we still find *o-*:

(22) Past tense forms; past = *-il*



| | **present** | **past** | **gloss** |
|---|---|---|---|
| a. | mə-nga | m-il-ənga | 'eat' |
| | mə-ngəlebəd | m-il-əngəlebəd | 'hit' |
| | mə-lim | m-il-lim | 'drink' |
| | mə-luʔəs | m-il-luʔəs | 'write' |
| b. | o-siik | o-il-siik | 'look for' |
| | o-ker | o-il-əker | 'ask' |
| | o-kiu | o-il-əkiu | 'go by way of' |
| | o-muʔəl | o-il-əmuʔəl | 'begin' |

*[Phonologically-derived /o/ is also retained under infixation]*

The surface order of the morphemes in these verbs is shown in (23):

(23) Surface Form: VM-TNS-Root

Points:

- As seen in (23), the fact that VM is realized in *o-* in a Root conditioned way in (20b) looks like a problem for the concatenation condition on allomorphy.
- In line with the general goals outlined above, I will show that there is evidence that action after VI is what creates the apparent problem; that is
  - The "intervening" tense morpheme is infixed in the phonology, so that
  - VM and the Root *are* concatenated when VI occurs.

Evidence for this analysis can be found in the fact that tense *-il* is infixed **phonologically** into whatever is on its right. The following forms, in which *-il* is infixed into a Root, illustrate exactly this:

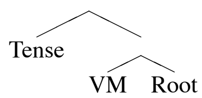
(24) Perfective Forms

| **root** | **perfective** | **past perfective** | **gloss** |
|---|---|---|---|
| dasəʔ | d-m-asəʔ | d-il-asəʔ | 'carve' |
| deel | d-m-eel | d-il-eel | 'nail' |
| kiis | k-m-iis | k-il-iis | 'dig' |
| leng | l-m-eng | l-il-eng | 'borrow' |

The fact that *-il* can be inserted into (the phonology of) a Root is clear evidence that it is being placed in a way that is defined phonologically, not morphologically.

An analysis of the opacity seen in (20) begins with the idea that structurally, a past tense verb is as follows, where Tense is outside of $v$/Voice; then, the derivation of one of the "allomorphically opaque" forms is as in (26):

(25) Past Tense Verb




(26) o-il-siik (ulsiik) 'look for-PAST'

a. Structure: [ Tense [ VM $\sqrt{\text{SIIK}}$ ]]]

b. PF

i. Concatenation: Tense⁀VM, VM⁀$\sqrt{\text{SIIK}}$

ii. Vocabulary Insertion: [Tense,-il]⁀VM, [VM,o-]⁀$\sqrt{\text{SIIK}}$

iii. Phonological Representation: -il-o-$\sqrt{\text{SIIK}}$

iv. **Phonological Infixation:** o-il-$\sqrt{\text{SIIK}}$

SUMMARY:

- When allomorphy for VM is computed, VM⁀Root, even though these might not wind up being adjacent on the surface.
- The complex surface patterns arises from the way in which later operations– which operate under their own locality conditions– can render opaque the representations on which earlier operations apply.

### 4.2 Phonological representations and morphemes

The general area where phonological operations are relevant to morphology here is "morphophonology in the narrow sense":

(27) ***Morphophonological Alternations:*** Phonological changes that are not (obviously) part of the "normal" phonology, because the changes have a trigger, or target (or both), that appears to be a particular set of Roots or morphemes.

On the general theme of how phonological locality is different from the concatenation of morphemes, there are many examples that have been discussed in the literature in which morphophonological changes skip linearly intervening morphemes; three points:

1. In the same way that concatenation of morphemes $X⁀Y$ is needed in addition to phase-based locality, *phonological locality* is needed in addition to concatenation.
2. That is, some morphophonological alternations occur under circumstances that do not involve concatenated morphemes (for phonology and phases, see §5).
3. Knowing where to draw the lines between (i) suppletion, (ii) morphologically-conditioned phonological changes, and (iii) "abstract" phonology is not always clear. For purposes of this argument, that doesn't matter, as long as the locality conditions are not defined in terms of morphemes.



Morpheme-skipping; a few examples (triggers: **bold**; targets: underlined):

(28) Zulu palatalization of labials (Carstairs-McCarthy 1992:70)
*(Triggered by passive)*

| | **active** | **passive** |
|---|---|---|
| a. | bamb-a 'catch' | banj-**w**-a 'be caught' |
| | boph-a 'tie' | bosh-**w**-a 'be tied' |
| b. | bamb-is-a 'cause to catch' | banj-is-**w**-a 'be caused to catch' |
| | boph-is-a 'cause to tie' | bosh-is-**w**-a 'be caused to tie' |

(29) Italian Metaphony (Calabrese 1999,2009; ex. from Maiden 1991:159)
*(Triggered by 2s AGR)*

| | *St. Italian* | | *Ischia, Campania* | |
|---|---|---|---|---|
| | **pr. ind.** | **impf. ind.** | **pr. ind.** | **impf. ind.** |
| 1s | cant-o | cant-a-v-o | kand-ə | kand-a-v-ə |
| 2s | cant-i | cant-a-v-i | kɛnd-**ə** | kand-ɛ-v-**ə** |
| 3s | cant-a | cant-a-v-a | kand-ə | kand-a-v-ə |

⇒Examples of this type are important because they show that *some morphophonological alternations occur in locality relations that do not involve concatenated morphemes*.

Some important further questions in this domain:

**(Q1)** One question– is whether alternations like those seen here, and other stem alternations (think *sing/sang* etc.) to be analyzed with

(a) Vocabulary Insertion alone, on the assumption that the exponents of VIs can contain or consist of autosegments (Lieber (1987), Noyer (1992), Akinlabi (1996, 2011), Mondon (2003), Wolf (2006) and Bye and Svenonius (2012) for different implementations); or

(b) Morphologically conditioned phonological rules– *Readjustment Rules* in some work in Distributed Morphology (e.g. Halle and Marantz 1993, Embick and Halle 2005; term probably covers more than one phenomenon).

Ultimately this becomes the question of how "abstract" underlying phonological representations, which, as everyone knows, is quite complicated.

**(Q2)** Are all "morphophonological" alternations the same? One approach says that there's a more "phonological" type– like the ones seen above, and a more "morphological" type, where both the trigger and target are particular morphemes (e.g. *sing/sang* is of this type). Embick (2010b, 2012, 2013a) hypothesizes that this latter type of alternation must be restricted to concatenated morphemes; cf. Calabrese (2012) for an important case study.

There's a lot that remains to be said about the details of "morpheme specific" phonology. For immediate purposes, what is important is that morpheme-specific alternations can operate in ways that do not require concatenated morphemes.

### 4.3 Interim Summary

Reviewing, to this point:

- In the first interactions in section 3, it was shown how independent phase-cyclic and linear locality conditions interact. In essence, the PF-specific linear condition further restricts possible interactions.
- This section shows how the phonology– which operates in terms of its own representations, and thus can ignore morpheme-based locality– allows for alternations to occur between elements that are not concatenated morphemes.
- In a way, this section shows how phonological concerns can override the locality that arises from the concatenation of morphemes. The next section takes up a further point along these lines– the interaction of phonological concerns with phases.

## 5 Phases and Phonological Override

The theory of phases involves a notion of *impenetrability*. In the theory outlined above, this part of the theory takes the form of the ACTIVITY COROLLARY:

(30) ACTIVITY COROLLARY: In [[ .... $x$] $y$], $x, y$ both cyclic, material in the complement of $x$ is not *active* in the PF cycle in which $y$ is spelled out.

Recall that the ACTIVITY COROLLARY plays a crucial role in explaining why outer cyclic heads cannot see Roots across inner cyclic heads. Importantly, it says only that material is inactive at a particular point; it doesn't say exactly what *activity* means, except "not visible as a particular morpheme".

This leads to the empirical question to be addressed in this section, which concerns Phase Impenetrability for Phonology (PIP):

(31) **PIP:** The complement of a phase head $x$ is inaccessible to computation (=cannot be seen or altered) for phonological computation at the next phase head $y$ outside of $x$ and beyond.

Taken at face value, PIP says that

1. Root phonology should not be seen or altered by computations in a cycle centered on $y$ in [[$\sqrt{\text{ROOT}}$ $x$] $y$],
2. For the same reason that $y$ cannot see the Root for allomorphic purposes.

For implementations of this intuition related to what I have in mind see Marvin (2002, 2013), Newell (2008) and related work; see also Lowenstamm (2010) for some important observations.



*My point for this section is that PIP holds, but in only in part, and in a way that relies on exactly the definition of "active" mentioned above (= "identifiable as a particular morpheme). There are some ways in which the concerns of PF **override** cyclic domains in limited ways.*

### 5.1 Some observations

On the one hand, it looks like there are morphophonological processes that fail to apply because of phase-boundaries, as expected if morphemes cannot be identified as such when inactive (Embick 2010a). For example (cf. Marantz 2013):

(32) Morphophonological alternation in $\sqrt{\text{HOUSE}}$

a. *to house*; final /z/: no actual houses involved: [$\sqrt{\text{HOUSE}}$ $v$]

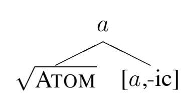
b. *to house*; final /s/: to provide with houses, etc.: [[$\sqrt{\text{HOUSE}}$ $n$] $v$]

We can say here that– in the same way that $n$ cannot see a Root in a gerund [[$\sqrt{\text{ROOT}}$ $v$] $n$], the Root $\sqrt{\text{HOUSE}}$ is not visible in (32b), so that the special voicing process is not able to apply.

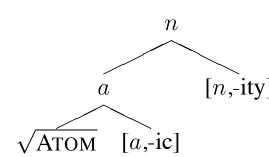
On the other hand, there do appear to be cases where the phonology of "inactive" material is either seen or altered by PF computations in later cycles. These are examples of what I am calling *override*.

1. ***Stress shift:*** As discussed in Lowenstamm (2010), English derivational morphology induces changes that go against (PIP). Consider

(33) atómic




(34) atomícity




In *atomicity*, the Root $\sqrt{\text{ATOM}}$– which is inactive by (30), is affected phonologically, in the sense that stress is shifted off of it (and perhaps the /t/ is flapped as well). Cf. also Marvin 2003, 2013.

2. ***Flapping, cont.*** Consider *The man holding the yellow cat*. The final segment of the final word can be flapped if the following verb is e.g. *attacked*. When the flapping process applies, $\sqrt{\text{CAT}}$ is cyclically inactive, so that this flapping is evidence against (PIP). Or, agentive nominals, which have $n$ outside of $v$ (cf. Alexiadou and Schaefer (2007) and references cited there). The final segment of $\sqrt{\text{HIT}}$ is flapped in *hitt-er*, when the Root is inactive.

3. ***Harmony*** I take it that the Turkish examples in (35) are adjectives derived from nouns $[[\sqrt{\text{ROOT}}\ n]\ a]$, on the basis of the transparent relationship of the adjective to the noun. The $a$ affixes are *-sIz* '-less', and *-(s)Al*, 'pertaining to N' (Kornfilt 1997:454); the $n$ in these examples is null:

(35) a. merhamet 'pity, compassion'; merhamet-**siz** 'without compassion'
yağmur 'rain'; yağmur-**suz** 'without rain; dry'

b. kamu 'the public'; kamu-**sal** 'public'
bilim 'science'; bilim-**sel** 'scientific'
öz 'self'; öz-**el** 'private'

Harmony refers to the inactive Root's phonology to determine the form of the outer affix. In general harmony and related processes seem like good things to study for questions about inactivity.

4. ***Infixation*** The Austroasiatic language Jahai (Burenhult 2005) has a nominalizer that appears to attach outside of $v$ (it is used for gerunds etc.). Its form is *-nC*, where -C- is copied from the end of the host.

(36) V → 'Act of V-ing' etc.

| | verb | noun | gloss |
|---|---|---|---|
| a. | cɨp | **np**-cɨp | 'go'/'act of going' |
| | sam | **nm**-sam | 'hunt'/'act of hunting' |
| b. | ɟhɨt | ɟ-**nt**-hɨt | 'smoke'/'act of smoking' |
| | tbɔh | t-**nh**-bɔh | 'beat'/'act of beating' |
| c. | ckwɨk | c-**n**-kwɨk | 'talk'/'act of talking' |
| | kajil | k-**n**-ajil | 'fish'/'act of fishing' |

In the (36a,b) examples, the inactive Root's final consonant is copied onto the *-nC* affix; in the (36b,c) examples, the affix is infixed into the inactive Root. [Other copying processes relevant to inactivity– Bennett (2010)).

### 5.2 A revised theory (of PIP)

In some of these examples seen above (and others like them), inactive material is simply visible for later computation. In others, the inactive material is actually altered. Neither of these things should not happen if PIP held. Options:

- Recast the theory of cyclic domains (this is what Lowenstamm 2010 does); in my view this gives up too much of what is needed for contextual allomorphy etc.

- Acknowledge that some phonological operations can affect inactive material.

Which operations? To this point, the counterexamples to (PIP) that I have identified seem to all involve either



- metrical processes that affect higher levels of metrical organization; or

- relatively automatic processes that do not care about the identity of the objects that they apply to as morphemes.

With this in mind, a reformulated PIP (rPIP; Embick 2013d):

(37) **(rPIP)** Material that is phase-cyclically inactive

a. has a visible phonological representation, but cannot be identified as a particular morpheme; and

b. may be seen or altered by non-cyclic or phrasal phonological rules, but not by cyclic phonological rules.

Essentially, this says that when an element is *inactive* as defined in (30), it has a phonological representation that can still be seen or affected by particular types of phonological changes:

⋆ Importantly, the idea that inactive elements cannot undergo cyclic processes, but can undergo non-cyclic and phrasal rules, means that phase theory **does** play an important role in this part of the theory.

An important question is *why* phonological concerns can override phase-cyclic locality in even this limited way. I suspect that this is because of the ("superficial") requirement that phonological representations be realized in a single continuous sequence. That is:

- The cyclic part of the theory (syntax) generates independent domains, each of which gets a phonological representation: $\Phi_1$, $\Phi_2 ... \Phi_n$.

- As far as this part of the theory goes, the phonological representations are independent, and therefore not expected to interact (or to violate PIP).

- However, each $\Phi_i$ must be linearized with respect to others, given the properties of the particular PF system we have, which (ultimately) realizes representations in a *single* sequence: $\Phi_1$-$\Phi_2$-...-$\Phi_n$

- I conjecture that "automatic" phonological processes like those that violate (PIP) arise as a concomitant of the general requirement the independent phonological representations be linearly integrated.

There is a lot more to be said about how the phonology works in this kind of theory (see Shwayder (in prep) for some concrete proposals. The point for today's purposes is that superficial requirements of PF allow for more interactions than we might expect, by overriding phase-domains in a limited way.

## 6 Conclusions

The surface complexity of the (morpho)syntax/(morpho)phonology interface arises because of interactions of two types of locality conditions; conditions arising from

- Cyclic domains, defined by the way that syntactic derivations work, and how they are sent to the interfaces
- Linear representations, which are as they are because of the way that PF works.

These conditions interact in different ways:

- In the case of concatenation, the PF condition further restricts when morphemes can see morphemes within a cyclic domain, as illustrated with contextual allomorphy.
- Morphologically-relevant phonological representations can render concatenation-based locality opaque, and operate in ways that ignore morphemes altogether.
- In the cases examined in section 5, the idea is that requirement that structures be linearized appears to partially override cyclic domains, by allowing (apparently restricted) new interactions of inactive elements.

In terms of what we learn about the general properties of the system, it appears that we see at least two kinds of conditions interacting:

- General conditions that derive from the theory of syntactic cycles (phases), that determine when objects are spelled out (and therefore which morphemes are in principle active at the same time); and
- Interface-parochial constrains, that derive from properties of PF. In particular, the requirement that PF linearize syntactic structures imposes further conditions on certain types of grammatical interactions.

Different definitions of how phases work, or which PF or syntactic relations are relevant for locality of alternations are being explored.

⋆ However, if the theory here is on the right track, surface complexity is not the result of a "single" system whose locality properties explain everything;

⋆ The idea that syntactic and interface-specific conditions are interacting is critical.

There may or may not be something to say about the "conceptual" status of this conclusion. To my mind it makes this part of the system look a lot like systems that have been explored in other cognitive domains; but that will have to be a topic for another occasion.



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