Cophonologies by Phase*

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1. Introduction

This paper examines the interaction between syntactic structure and conditioned phonological alternations. In a given language, some phonological alternations are seen only in specific morphological contexts. For example, in Alabama the onset of the penultimate syllable is geminated in imperfective constructions.

(1) *Alabama imperfective gemination* (Hardy & Montler 1988, 400-401)

	Base	*Imperfective*	*Gloss*
a.	balaaka	bállaaka	'lie down'
b.	cokooli	cókkooli	'sit down'
c.	atakaali	atákkaali	'hang up one object'
d.	atakli	áttakli	'hang more than one object'

Here we address the following question: How does the phonological component know which phonological alternations to apply in any particular instance of spell-out? For example, in Alabama, how does the phonological grammar know whether the domain being spelled out is one where gemination should occur?

To address this question, we propose a model of the syntax-phonology interface combining Cophonology Theory (Orgun 1996, Inkelas et al. 1997, Anttila 2002, Inkelas & Zoll 2005, 2007) with Phase Theory (Chomsky 2001, Abels 2012, Bošković 2014), which allows cophonologies to scope over spelled-out chunks of syntax. The proposed model adopts central components of mainstream phonology, morphology, and syntax. Specifically, we assume that phonology and morphology are interpreted from syntactic structures, and phonological processes are modeled using ranked or weighted constraints. The inno-

*Hannah thanks her Guébie consultants, and we are grateful to Sharon Inkelas, Larry Hyman, and to audiences at NELS 48 and UC Berkeley. All mistakes are our own. We use the following abbreviations: SG = singular, PL = plural, IRR = irrealis, PROG = progressive, IMPF = imperfective, PFV = perfective, ACC = accusative, Q = polar question particle, 1 = first person, 2 = second person, 3 = third person vation in our model is an enriched conception of the lexicon, called the Vocabulary in Distributed Morphology (Halle & Marantz 1994). We propose that Vocabulary items contain three phonological components: 1) an underlying form containing (supra)segmental features, 2) a prosodic subcategorization frame or template, and 3) a subranking of constraints. Vocabulary-specific subrankings override the default constraint ranking of the language during the spell-out domain in which that Vocabulary item is present, resulting in conditioned phonological alternations. In this paper we focus on morphological realizations that are not explicitly affixal, in other words, cases that have previously been labeled prosodic morphology, process morphology, or morphologically-conditioned phonology. Our model provides a unified framework to account for these phenomena.

We provide further background on the model in Section 2. We then examine three case studies of phonological alternations with limited application from three languages: Hebrew, Kuria, and Guébie, in sections 3, 4, and 5. We conclude in section 6.

2. The model: Cophonologies by phase

2.1 Cophonologies

In this section we outline a unified model of process morphology and morphologically-conditioned phonology. We take the term process morphology to include any case where a non-concatenative phonological process is the sole exponent of a morphosyntactic feature. Examples would include subtraction, tone sandhi, or vowel alternations. On the other hand, morphologically-conditioned phonology covers cases where these same non-concatenative phonological processes co-occur with concatenative segmental or suprasegmental content to expone a morphosyntactic feature. The motivation for unifying these two phenomena comes from the following generalization (Inkelas 2008, 2014).

(2) *Inkelas's Generalization*
Morphologically-conditioned phonology and process morphology make reference to the same phonological operations in terms of *Substance, Scope*, and *Layering*.

Inkelas points out that because process morphology and morphologically conditioned phonology involve the same phonological processes, the phonological processes involved in both types of morphology should be modeled with the same set of theoretical tools.

Put somewhat differently, Inkelas's Generalization shows that the presence of absence of morphologically conditioned phonological processes are independent from whether affixation is overt, producing a four-way typology.

(3) *The independence of conditioned phonological processes and affixation*

	Phonological process	*No phonological process*
Affix	Morphologically-conditioned phonology	Regular affixation
No affix	Process morphology	Zero inflection/derivation

The independence of affixation from conditioned phonological processes shows that they should be modeled as separate components of morphemic content. While affixes consist of normal segmental content, we adopt the idea that conditioned phonological processes are due to lexically-associated *cophonologies*, constraint rankings that apply in a particular lexical or morphological context (Anttila 2002, Inkelas & Zoll 2007). In contrast, affixal or item-based views of process morphology (Benua 1997, Alderete 2001, Wolf 2007, Bermúdez-Otero 2012, Trommer & Zimmermann 2014, Bye & Svenonius 2010, Köhnlein 2016), would need to distinguish normal affixes from those which trigger phonological processes, and allow them to co-occur.

The following framework allows us to make this proposal explicit.

(4) *The proposal*: Vocabulary items associate morphosyntactic features with three phonological components:

a. Featural content ($\mathscr{F}$): Tonal or segmental features of Vocabulary items
b. Prosodic content ($\mathscr{P}$): Prosodic selection or subcategorization
c. A constraint subranking ($\mathscr{R}$): A partial constraint ranking, which overrides a default master constraint ranking (Anttila 2002, Inkelas & Zoll 2005, 2007) (or which combines with the master grammar in a weighted constraint model).

Any of $\mathscr{F}$, $\mathscr{P}$ or $\mathscr{R}$ can be null for a particular Vocabulary item. Cases where both $\mathscr{F}$ and $\mathscr{R}$ are specified correspond to morphologically-conditioned phonology, cases $\mathscr{R}$ is specified with $\mathscr{F}$ null emerge as process morphology. If $\mathscr{R}$ is null and $\mathscr{F}$ specified, regular affixation results, while null $\mathscr{R}$ and $\mathscr{F}$ corresponds to phonologically empty morphology. Thus, including separate $\mathscr{R}$ and $\mathscr{F}$ specifications accounts for the independence of phonologically-conditioned processes and affixiation summarized above. The inclusion of a $\mathscr{P}$-specification is motivated by phonology-syntax mismatches (e.g. Julien 2002). $\mathscr{P}$-specifications build prosodic structure, enabling processes such as prosodic adjunction (Ito & Mester 2007) or prosodic smothering (Bennett et al. 2018) to be lexically specified. Affix or clitic direction is also encoded in $\mathscr{P}$, as we take this information to be prosodic.

Consider a hypothetical verbalizing suffix -*ga*, which, with its host, corresponds to a prosodic word and which is associated with a phonological process that results from the constraint-ranking B≫A. The variable X in $\mathscr{P}$ represents the content of $\mathscr{F}$, here /ga/.

(5) *Vocabulary item*: $[v] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & \text{/ga/} \\ \mathscr{P}: & [_{\omega} -X] \\ \mathscr{R}: & \text{B} \gg \text{A} \end{array} \right\}$

If the master or default phonological constraint ranking in a language is as in (6a), and the Vocabulary item in (5) is inserted, the ranking B ≫ A will override the master ranking only during the spell-out domain containing the v-head.

(6) a. Master Ranking (or Weighting): A≫B≫C
b. Active constraint ranking (or weighting) for $[_{\omega}$ –*ga*]: B≫A≫C

We assume that master constraint rankings undergo the minimal changes necessary to comply with both the master ranking and the cophonologies contained inside it.[1]

2.2 Cophonologies by phase

Our model relies on the application of reranked phonological constraints in particular domains. These domains are *phases*, syntactic constituents that are transferred to PF during a process called Spell-Out (Chomsky 2000, 2001). We assume Distributed Morphology, where spell-out is followed by a stage of morphology which consists of structure-manipulating operations such as *lowering* and *local dislocation* (Embick & Noyer 2001, 2007, Pak 2008, Embick 2010). Morphology ends with Vocabulary insertion, at which point morphological feature content and structure is converted into a phonological representation.

Phonological operations apply to the phonological content that is spelled out at each phase. Earlier models which assume that morphological and phonological operations apply to spelled-out chunks of syntactic structure are adopted in Kratzer & Selkirk (2007), Pak (2008), Jenks & Rose (2015), Sande (2017), and Kastner (to appear), among others.

While the precise characterization of phases is the focus of ongoing work, we assume that phase heads trigger spell-out, and that phase heads include lexically specified categories such as C and D (Chomsky 2000, 2001, Marvin 2002), as well as category-defining heads such as *n* and *v* (Arad 2003, Embick 2010). However, phase size has been argued to vary with syntactic processes such as head-movement (Gallego & Uriagereka 2007) or the size of extended projections (Bošković 2014), and we make no claims about the universality of particular phase heads. We do assume that spell-out of a phase includes the phase head, rather than just its complement Bošković (cf. 2016, a.o.).

Cophonologies, or subrankings of constraints associated with vocabulary items, override the default phonological grammar of the language during Spell-Out of the phase containing that vocabulary item.

(7) *Cophonologies by Phase (CBP):*
Cophonologies take scope over the phase in which they are interpreted.

Segmental content, prosodic requirements, and the cophonologies within a phase compose and are inherited by the phase head, and together scope over the entire phase domain. Phonology consists of the generation of candidates (GEN) which are evaluated by the constraint ranking associated with that phase, resulting in a prosodically structured phonological string. After a phase is spelled-out, its corresponding cophonologies are lost. Later phases are not affected by Vocabulary-specific rankings associated with earlier phases.

In the remainder of this paper, we survey three case studies where syntactic heads trigger a phonological process, modeled in CBP, with constraint sub-rankings whose domain is a phase, and we discuss a fourth relevant case in the conclusion. Two of these three cases

[1] Work on how conflicting cophonologies within the same spell-out domain are resolved is yet unclear, due to lack of empirical evidence, an issue we discuss in Section 6.

are examples of morphologically conditioned phonology which crosses word boundaries but is constrained by a syntactic phase, cases that we feel CBP is especially well-suited to account for. First, however we examine Hebrew noun- and verb-formation, showing that process morphology can be triggered by category-defining heads (v and n), resulting in category-specific phonological processes or prosodic requirements. Second, we examine Kuria tone marking on verbs, determined by aspect. This case dramatically demonstrates that phonological processes, here triggered by tense/aspect morphology, can cross word boundaries. Our third case study, from Guébie imperfective tone marking, shows that phonological processes are suspended until the phase is complete, even if triggered by lower elements.

3. Case study 1: Hebrew category-specific prosodic shape

In Hebrew (Semitic), verbs are disyllabic, but the prosodic shape of nouns is less restricted (Bat-El 1994, Smith 2011). This categorical difference is most clearly seen in loan words.

(8) *The prosodic shape of Hebrew nouns vs. verbs* (Bat-El 1994, 577-578)

Noun		*Verb*	
xantariʃ	'nonsense'	xintreʃ	'talk nonsense'
télegraf	'telegraph'	tilgref	'telegraph'
sinxróni	'synchronic'	sinxren	'synchronize'
ksilofon	'xylophone'	ksilfen	'play the xylophone'
nostálgia	'nostalgia'	nistelg	'be nostalgic'
flirt	'flirt'	flirtet	'to flirt'
blof	'bluff'	bilef	'to bluff'

Arad (2003) argues that similar cases are instances of noun-to-verb derivation, making these instances of truncation or expansion to a bisyllabic foot. Prosodic size constraints are a classic type of process morphology, as they involve fitting a phonological input to an independent prosodic template.

We assume the Hebrew verbalizing head v is associated with the featural content of two vowels: [i e], the prosodic subcategorization specifying its status as a phonological word, ω, and the constraint subranking $\omega{=}\sigma\sigma \gg$ FAITH. This ranking results in a phonotactic constraint on the number of syllables in a prosodic word.

(9) *Vocabulary items*

a. $$[\sqrt{\text{TELEGRAPH}}] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & /\text{télegraf}/ \\ \mathscr{P}^1: & \emptyset \\ \mathscr{R}^1: & \emptyset \end{array} \right\}$$

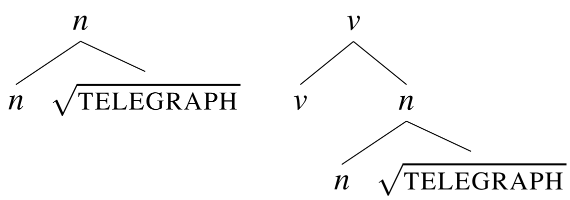
b. $$[n] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & \emptyset \\ \mathscr{P}^2: & [_\omega\, X\,] \\ \mathscr{R}^2: & \emptyset \end{array} \right\}$$

c. $[v] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & /\text{ie}/ \\ \mathscr{P}^3: & [_{\omega}X] \\ \mathscr{R}^3: & \omega{=}\sigma\sigma \gg \textsc{Faith} \end{array} \right\}$

The indices on the prosodic subcategorizations and constraint rankings above have no theoretical status, they will be used for expository purposes below.

The structure of nouns (*n*) and denominal verbs (*v*) with the root ‘telegraph’ are provided below. The proposed structure is based on the arguments of Arad (2003), who shows that these verbs include an *n* phase.

(10) *Structure of Hebrew noun and denominal verb*



Vocabulary insertion replaces the morphosyntactic features in the structure with their corresponding phonological content. The content at each terminal undergoes phonological composition from the bottom up. This process involves concatenation of terminal nodes (Embick 2010), along with unification of the prosodic and (co)phonological requirements of each node to the terminal. The output of this composition process for the noun /télegraf/ is represented in (11a). The output of the *v* phase, resulting in the verb /tilgref/, is shown in (11b). The phonological representation /X/ is a kind of phonological interpretation function, relativized to the prosodic and (co)phonological parameters specified by the component Vocabulary items. These superscripts indicate that the morphemes between the forward slashes will be evaluated relative to the composed component cophonologies as specified in the Vocabulary items in (9) (e.g. $\mathscr{R}^{1+2}$), and that the candidates must respect the lexically specified prosodic constraints (e.g. $\mathscr{P}^{1+2}$).

(11) a. *Noun after vocabulary insertion and composition*
/télegraf/$^{(\mathscr{P}^{1+2},\mathscr{R}^{1+2})} \rightarrow [_{\omega}$ té.le.graf]

b. *Verb after vocabulary insertion and comoposition*
/ie-$[_{\omega}$ télegraf]/$^{(\mathscr{P}^{3},\mathscr{R}^{3})} \rightarrow [_{\omega}$ til.gref]

The tableau in (12) corresponds to the phonological evaluation in (11b). All candidates follow the prosodic specification of $\mathscr{P}^3$, which we assume serves as a constraint on GEN. In the case of Hebrew verbs, this specification ensures that the verb is coextensive with a prosodic word. We do not list the constraints enforcing vowel replacement, which we take to be part of the master ranking; see Kastner (to appear) for details. Additionally, we assume the ranking REALIZEMORPH ≫ FAITH in the master ranking of Hebrew (Kurisu 2001).

(12) *Phonological interpretation of Hebrew verb*

/i,e télegraf/	ω=σσ	REALIZEMORPH	FAITH
a. [$_\omega$ té.le.graf]	*!		
b. [$_\omega$ tí.li.gref]	*!		
c. ☞ [$_\omega$ til.gref]			*
d. [$_\omega$ tel.graf]		*!	*

The optimal candidate is stored and linearized relative to later phonological constituents and phases. During phonological evaluation of later stages in the derivation, previously spelled-out content can be manipulated further, as illustrated in the following section.

In summary, lexical categories like *v* trigger verb-specific process morphology in Hebrew via lexically-specified cophonologies. In CBP, where phonological evaluation occurs at syntactic phase boundaries, the *v*-specific ranking only applies within the phase containing the *v* phase head, and as such does not apply to words in other categories. CBP also extends to category-specific phonological effects in other languages (Smith 2011).

4. Case study 2: Kuria verbal tone melodies

In Kuria (Bantu), tense/aspect prefixes (henceforth TA, in bold below) have lexically specified tone patterns (Marlo et al. 2015). Different TAs surface with H tone on the the first, second, third, or fourth mora of the verb (underlined), and from there, high tone spreads to the penultimate tone-bearing unit (TBU).

(13) *Mora-counting H assignment in Kuria verb stems* (Marlo et al. 2015, 252-253)

μ1	n-to-**o**-[h<u>ó</u>ótóótér-a] FOC-1PL-TA-[reassure-FV]	'we have reassured'
μ2	n-to-**oka**-[ho<u>ó</u>tóóté-éy-a] FOC-1PL-TA-[reassure-PFV-FV]	'we have been reassuring'
μ3	n-to-**re**-[hoot<u>ó</u>ótér-a] FOC-1PL-TA-[reassure-FV]	'we will reassure'
μ4	to-**ra**-[hooto<u>ó</u>tér-a] 1PL-TA-[reassure-FV]	'we are about to reassure'

The domain of this H-assignment process is phrasal, and includes objects.

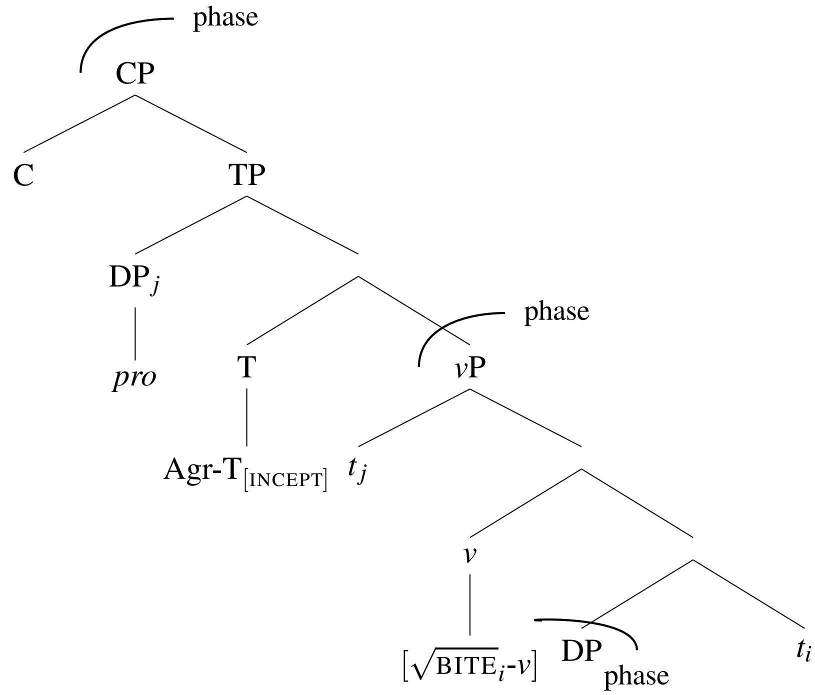
(14) *Mora-counting H assignment into object position (inceptive)*

μ4	to-**ra**-[rom-a eɣ<u>é</u>tɔ́ɔ́kɛ]	'we are about to bite a banana'
μ4	to-**ra**-[ry-a eɣet<u>ɔ́</u>ɔ́kɛ]	'we are about to eat a banana'

This phenomenon and others like it pose problems for theories such as Stratal-OT (Bermúdez-Otero 2008), which assume word-internal levels necessarily precede phrasal phonology. But this cross-word process is easily captured in CBP, which, unlike traditional Cophonology Theory, allows word-internal, morphologically-triggered phonological operations to scope over entire phases, which can include multiple phonological words.

The syntactic structure we assume for Kuria clauses is below. Following proposals for other Bantu languages, we assume the verb undergoes head movement to *v* in Kuria. The final vowel of a verbal word expones the *v* head, which is a phase head (cf. Julien 2002, Cheng & Downing 2016). The *v*P is then spelled out, consisting of the verb stem (enclosed in brackets above) and other *v*P-internal material, including objects. The general importance of the verb stem in Bantu languages as a domain for both phonological and morphological phenomena is well-documented (e.g. Myers 1987, Hyman et al. 2009). Treating the stem as a complex *v* head captures the importance of this domain. Note that we assume that object DPs inside the *v*P are separate phases.

(15) a. *Syntactic structure of the Kuria clause*



The output of the *v*P phase will be a phonological string associated with prosodic structure, accessible to later phases. However, phonological processes specified inside of *v*P will not have access to material which enters the derivation later (see section 6).

The Vocabulary item associated with the inceptive T head is below. We adopt the phonological analysis of Marlo et al. (2015), who account for the mora-counting tone assignment with a class of constraints that enforce the relevant patterns.

(16) $$[\text{T,}\textsc{inceptive}] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & /\text{ra-}^{\text{H}}/ \\ \mathscr{P}_1: & [_{\omega}\ \text{X-} \\ \mathscr{R}_1: & \mu 4,\ \textsc{Spread-(H, R)} \gg \textsc{Ident-Tone} \end{array} \right\}$$

The $\mathscr{P}$-specification of the inceptive marker is nontrivial; it contains the information that the inceptive is a ω-internal prefix. This specification forces prosodic adjunction, leading to a recursive word (Ito & Mester 2007).

Vocabulary insertion into T, including the realization of subject agreement, results in the composed representation below. The verb stem and object have specified prosodic structure and lack internal morpheme boundaries because they were spelled out in an earlier phase.

(17) a. *Output of phonological composition of CP*
/to-ra^{H}-[$_{\omega}$ roma] [$_{\omega}$ eɣetɔ́ɔ́kɛ]/$^{\mathscr{R}_{1,\ldots,n},\mathscr{P}_{1,\ldots,n}}$

b. *Phonological interpretation of CP*

/to-ra^{H}-[$_{\omega}$ roma] [$_{\omega}$ eɣetɔ́ɔ́kɛ]/	μ4	SPREAD-(H, R)	IDENT-TONE
a. [$_{\omega}$ tora [$_{\omega}$roma]] [$_{\omega}$ eɣetɔ́ɔ́kɛ]	*!		
b. ☞[$_{\omega}$ tora [$_{\omega}$roma]] [$_{\omega}$ eɣétɔ́ɔ́kɛ]			*

Because the domain of evaluation of the preverbal aspect marker in Kuria includes previously spelled-out phases, that higher cophonology can override the tone of both the verb stem and the object. CBP thus accounts for the ability of word-internally triggered cophonologies to scope over their entire spell-out domain. These effects are not uncommon for in phrasal tone, and similar analyses could be proposed for other cases detailed by Hyman (2011, 2018).

5. Case study 3: Guébie

In Guébie (Kru), the distinction between perfective and imperfective aspect, realized on T, is marked by scalar tone shift (Sande 2017). This scalar tone shift is realized on the verbal head, or on the immediately preceding phonological word, the final word of the subject DP.

Guébie has four underlying tone heights, marked 1-4, where 4 is high. Tone on a verbal head surfaces one step lower in imperfective contexts than elsewhere.

(18) *Verb tone lowering in imperfective contexts*

a. e^{4} li^{3} ɟa^{31} 1SG.NOM eat.PFV coconuts 'I ate coconuts.'

b. e^{4} li^{2} ɟa^{31} 1SG.NOM eat.IPFV coconuts 'I am eating coconuts.'

When the underlying tone of a verb is already low (tone 1), it does not lower further to super-low. Instead, the final tone of the subject raises one step.

(19) *Subject tone raising when imperfective verb is already low*

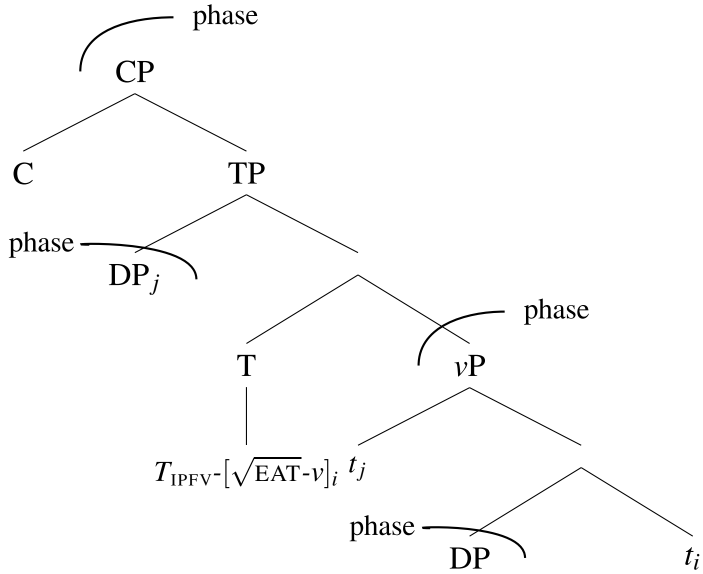
a. ɟaci$^{23.1}$ pa^{1} Djatchi run.PFV 'Djatchi ran.'

b. ɟaci$^{23.2}$ pa^{1} Djatchi run.IPFV 'Djatchi runs.'

c. *ɟaci$^{23.1}$ pa^{0}

Crucially, the tonal shift triggered by the imperfective T-head can affect the subject tone, (19), which is in the specifier position of TP.

(20) *Syntactic structure*



While this process is difficult to account for in most constraint-based models, both because of its scalar nature and the fact that it crosses word boundaries, the latter challenge disappears in CBP: Cophonologies of Vocabulary items are inherited by the phase head containing them, and they apply to the whole spell-out domain, here CP.

In the case of the Guébie scalar tone shift, there is no underlying segmental or suprasegmental content to the imperfective morpheme. However, there is a cophonology associated with the T head, which is inherited by the CP phase containing the imperfective morpheme, and triggers a pitch drop between subject and inflected verb (cf. Sande 2017, 2018). We model this with a PITCHDROP constraint as below.

(21) $$[\text{T,}\textsc{ipfv}] \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & \emptyset \\ \mathscr{P}: & \emptyset \\ \mathscr{R}: & \textsc{PitchDrop} \gg \textsc{Ident-Tone} \end{array} \right\}$$

The locality of the pitch drop is handled via further constraint interaction, left out here for simplicity but discussed in detail in Sande (2018).

The phonological interpretation of the CP above (for 'I eat coconuts') is shown below. The ranking associated with the imperfective T head overrides the master ranking of IDENT-TONE ≫ PITCHDROP, only in clauses with an imperfective T head.

(22) *Phonological interpretation of Guébie CP*

/e^4 li^3 ɟa^{31}/	PITCHDROP	IDENT-TONE
a. [e^4 li^3 ɟa^{31}]	*!	
b. ☞[e^4 li^2 ɟa^{31}]		*

As seen in the Guébie data, it is a benefit of CBP that phonological processes triggered by Vocabulary-specific constraint rankings are suspended until the phase is completed. This allows a processes triggered by T_{ipfv} to apply to the entire CP containing that T, including the subject DP, which originates higher in the structure than T, but is still within the CP. This process is possible because cophonologies triggered by heads lower than the phase head are inherited by the phase head and take scope over their entire spell-out domain.

6. Implications and open questions

Cophonologies by Phase unifies process morphology and morphologically-conditioned phonology within a theory that also encodes prosodic structure and subcategorization, all in the context of a restrictive and mainstream set of assumptions about the relationship of syntax, morphology, and phonology. CBP also has the potential to cover phonological processes that have been analyzed as *syntactically* conditioned (e.g. French liaison (Selkirk 1974, Pak 2008); Luganda and Xitsonga prosody (Hyman et al. 1987, Selkirk 2011)). In CBP, the restriction of certain phrasal phonological processes to specific syntactic domains follows from the fact that the relevant XPs are phases. Additionally, a full version of CBP may be able to eliminate the need for the Match Theory (Selkirk 2009, 2011), which relies on the ability of constraints to explicitly reference syntactic structure, a significant extension of the expressive power of the phonological grammar. If prosodic structure is assembled during spell-out according to the $\mathscr{P}$-specifications of Vocabulary items, phonology may only need to make reference to these prosodic boundaries.

In addition, CBP makes explicit typological predictions about phonological locality. In particular, the theory predicts that lexically or morphologically-conditioned phonological processes can only take scope over the phase that contains them:

(23) *The Phase Containment Principle*
Morphological operations conditioned internal to a phase cannot affect the phonology of phases that are not yet spelled out.

Perhaps more concretely, if a cophonology $\mathscr{R}$ takes scope over a syntactic domain d, it will not apply in a domain d' such that d' contains d. While we see instances of phasal anti-faithfulness in the case studies above, they involve over-writing of previously spelled-out phases, not structurally higher material (cf. d'Alessandro & Scheer 2015). While we have not explicitly shown that the conditioned phonological processes described in the case studies above fail to take scope in higher domains, this constraint does hold for all of them. Concretely, a bisyllabic word size requirement fails to apply in Hebrew DPs, the $\mu4$ pattern only takes place in Kuria clauses with an inceptive prefix, and *PitchDrop* only takes place between an imperfective T head and its local subject in Guébie.

An important question raised by CBP is what happens when multiple interacting cophonologies are active in the same phase (see Rolle (In preparation) for a number of such cases across languages). We see at least three options: the structurally higher cophonology takes precedence, the structurally lower cophonology blocks the higher one, or their effects are combined, an appealing possibility with weighted constraints. The most relevant phonological phenomena we know of are the phrasal tonal override patterns surveyed in Hyman (2018). These cases tend to show the structurally highest tone pattern surfacing, indicating the highest cophonology may tend to take precedence, which is what Inkelas (2014, 202-203) predicts. However, McPherson (2014) and McPherson & Heath (2016) describe different tonal override effects in different Dogon languages: In Nanga, the lower cophonology within a noun phrase seems to prevail, but in Tommo So, the higher cophonology dominates. In either case, we take the correct model of multiple cophonologies within the same phase to be an open question requiring further empirical clarification.

References

Abels, Klaus. 2012. *Phases: An essay on cyclicity in syntax*. Berlin: Walter de Gruyter.

Alderete, John D. 2001. Dominance effects as transderivational anti-faithfulness. *Phonology* 18:201–253.

Anttila, Arto. 2002. Morphologically conditioned phonological alternations. *Natural Language & Linguistic Theory* 20:1–42.

Arad, Maya. 2003. Locality constraints on the interpretation of roots: The case of Hebrew denominal verbs. *Natural Language & Linguistic Theory* 21:737–778.

Bat-El, Outi. 1994. Stem modification and cluster transfer in Modern Hebrew. *Natural Language & Linguistic Theory* 12:571–596.

Bennett, Ryan, Boris Harizanov, & Robert Henderson. 2018. Prosodic smothering in Macedonian and Kaqchikel. *Linguistic Inquiry* 49:195–246.

Benua, Laura. 1997. Transderivational identity. Doctoral dissertation, University of Massachusetts, Amherst.

Bermúdez-Otero, Ricardo. 2008. *Stratal optimality theory*. Oxford: Oxford University Press.

Bermúdez-Otero, Ricardo. 2012. The architecture of grammar and the division of labour in exponence. In *The morphology and phonology of exponence*, ed. Jochen Trommer, volume 41, 8–83. Oxford University Press, Oxford.

Bošković, Željko. 2014. Now I'm a phase, now I'm not a phase: On the variability of phases with extraction and ellipsis. *Linguistic Inquiry* 45:27–89.

Bošković, Željko. 2016. What is sent to spell-out is phases, not phasal complements. *Linguistica* 56:25–66.

Bye, Patrik, & Peter Svenonius. 2010. Exponence, phonology, and non-concatenative morphology. *Ms. CASTL, University of Tromsø* .

Cheng, Lisa Lai-Shen, & Laura J. Downing. 2016. Phasal syntax = cyclic phonology? *Syntax* 19:156–191.

Chomsky, Noam. 2000. Minimalist inquiries. In *Step by step: Essays on minimalist syntax in honor of Howard Lasnik*, ed. Roger Martin, David Michaels, & Juan Uriagereka. Cambridge, Mass.: MIT Press.

Chomsky, Noam. 2001. Derivation by phase. In *Ken Hale: A life in language*, ed. Michael Kenstowicz, 1–52. Cambridge, Mass: MIT Press.

d'Alessandro, Roberta, & Tobias Scheer. 2015. Modular PIC. *Linguistic Inquiry* 46:593–624.

Embick, David. 2010. *Localism versus globalism in morphology and phonology*. MIT Press.

Embick, David, & Rolf Noyer. 2001. Movement operations after syntax. *Linguistic inquiry* 32:555–595.

Embick, David, & Rolf Noyer. 2007. Distributed morphology and the syntax/morphology interface. *The Oxford handbook of linguistic interfaces* 289–324.

Gallego, Ángel, & Juan Uriagereka. 2007. Subextraction from subjects: A phase theory account. In *Romance linguistics 2006*, ed. José Camacho, Nydia Flores-Farrán, Lilliana Sanchéz, Vivianne Déprez, & María José Cabrera, 149–162. Amsterdam: John Benjamins.

Halle, Morris, & Alec Marantz. 1994. Some key features of Distributed Morphology. *MIT working papers in linguistics* 21:88.

Hardy, Heather K., & Timothy R. Montler. 1988. Imperfective gemination in Alabama. *International Journal of American Linguistics* 54:399–415.

Hyman, Larry M. 2011. Tone: Is it different? In *The handbook of phonological theory*, ed. John Goldsmith, Jason Riggle, & Alan C. L. Yu, 197–239. Blackwell.

Hyman, Larry M. 2018. Towards a typology of postlexical tonal neutralizations. In *Tonal change and neutralization*, ed. Haruo Kobozono & Mikio Giriko, 7–26. Berlin: De Gruyter Mouton.

Hyman, Larry M., Sharon Inkelas, & Galen Sibanda. 2009. Morphosyntactic correspondence in Bantu reduplication. In *The nature of the word: Essays in honor of Paul Kiparsky*, ed. Kristin Hanson & Sharon Inkelas, 273–309. Cambridge, MA: MIT Press.

Hyman, Larry M, Francis Katamba, & Livingstone Walusimbi. 1987. Luganda and the strict layer hypothesis. *Phonology* 4:87–108.

Inkelas, Sharon. 2008. The morphology-phonology connection. In *Annual Meeting of the Berkeley Linguistics Society*, volume 34, 145–162.

Inkelas, Sharon. 2014. *The interplay of morphology and phonology*. Oxford University Press.

Inkelas, Sharon, Orhan Orgun, & Cheryl Zoll. 1997. The implications of lexical exceptions for the nature of grammar. In *Optimality theory in phonology: A reader*, ed. J. J. McCarthy, 542–551. Oxford: Blackwell.

Inkelas, Sharon, & Cheryl Zoll. 2005. *Reduplication: Doubling in morphology*, volume 106. Cambridge University Press.

Inkelas, Sharon, & Cheryl Zoll. 2007. Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology. *Linguistics* 45.1:133–171.

Ito, Junko, & Armin Mester. 2007. Prosodic adjunction in Japanese compounds. In *Formal approaches to Japanese linguistics 4*, MIT Working papers in Linguistics 55, 97–111.

Jenks, Peter, & Sharon Rose. 2015. Mobile object markers in Moro: The role of tone. *Language* 91:269–307.

Julien, Marit. 2002. *Syntactic heads and word formation*. Oxford: Oxford University Press.

Kastner, Itamar. to appear. Templatic morphology as an emergent property: Roots and functional heads in Hebrew. *Natural Language and Linguistics Theory* .

Köhnlein, Bjorn. 2016. When less is more and more is less: Subtractive morphology as prosodic affixation. *NAPhC9, Montreal* .

Kratzer, Angelika, & Elisabeth Selkirk. 2007. Phase theory and prosodic spellout: The case of verbs. *The Linguistic Review* 24:93–135.

Kurisu, Kazutaka. 2001. *The phonology of morpheme realization*. University of California, Santa Cruz.

Marlo, Michael R, Leonard Chacha Mwita, & Mary Paster. 2015. Problems in Kuria h tone assignment. *Natural Language & Linguistic Theory* 33:251–265.

Marvin, Tatjana. 2002. Topics in the stress and syntax of words. Doctoral dissertation, Massachusetts Institute of Technology.

McPherson, Laura, & Jeffrey Heath. 2016. Phrasal grammatical tone in the Dogon languages. *Natural Language & Linguistic Theory* 34:593–639.

McPherson, Laura Elizabeth. 2014. Replacive grammatical tone in the Dogon languages. Doctoral dissertation, University of California Los Angeles.

Myers, Scott. 1987. Tone and the structure of words in Shona. Doctoral dissertation, University of Massachusetts.

Orgun, Cemil. 1996. Sign-based morphology and phonology with special attention to Optimality Theory. Unpublished dissertation, UC Berkeley.

Pak, Marjorie. 2008. The postsyntactic derivation and its phonological reflexes. Doctoral dissertation, University of Pennsylvania.

Rolle, Nicholas. In preparation. Grammatical tone: Typology, theory, and functional load. Doctoral dissertation, UC Berkeley.

Sande, Hannah. 2017. Distributing morphologically conditioned phonology. Doctoral dissertation, UC Berkeley.

Sande, Hannah. 2018. Guébie morphological scalar tone shift without underlying representations. Ms.

Selkirk, Elisabeth. 1974. French liaison and the X notation. *Linguistic Inquiry* 573–590.

Selkirk, Elisabeth. 2009. On clause and intonational phrase in Japanese: The syntactic grounding of prosodic constituent structure. *Gengo Kenkyu* 136:35–73.

Selkirk, Elisabeth. 2011. The syntax-phonology interface. *The handbook of phonological theory* 2:435–483.

Smith, Jennifer L. 2011. Category-specific effects. *The Blackwell companion to phonology* 4:2439–2463.

Trommer, Jochen, & Eva Zimmermann. 2014. Generalised mora affixation and quantity-manipulating morphology. *Phonology* 31:463–510.

Wolf, Matthew. 2007. For an autosegmental theory of mutation. *University of Massachusetts occasional papers in linguistics* 32:315–404.

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