Cophonologies by phase

Hannah Sande (Gerogetown) and Peter Jenks (UC Berkeley)

Introduction This paper proposes a model of the syntax-phonology interface which is compatible with a central assumption of mainstream syntax, that phonology and morphology are interpreted from syntactic structures, and mainstream phonology, which models phonological processes by ranked or weighted constraints. The central idea is to combine Cophonology Theory (Ito & Mester 1995, Anttila 2002, Inkelas & Zoll 2005) with Phase Theory (Chomsky 2001, Abels 2012, Boskovic 2014), which allows cophonologies to scope over the spelled-out chunks of syntax.

Cophonologies by phase Inkelas (2014) demonstrates that morphologically conditioned phonology and process morphology involve the same operations at several levels. As process morphology is easily modeled with constraint rankings rather than morphemes, Inkelas's generalization provides a direct argument that both process morphology and morphologically conditioned phonology are due to *cophonologies*, the association of constraint rankings with particular morphemes.

We propose a model of cophonologies where constraint rankings are associated with Vocabulary Items in Distributed Morphology (Halle and Marantz 1994). In particular, we propose that a VI maximally consists of the association of morphosyntactic features with three phonological components: featural content ($\mathcal{F}$), consisting of tonal or segmental features, prosodic content ($\mathcal{P}$), which situates the VI in the prosodic hierarchy, and a subranking of constraints ($\mathcal{R}$) which serve to provide a partial override to a default master constraint ranking (or which combine in a weighted constraint model). $\mathcal{F}$, $\mathcal{P}$ or $\mathcal{R}$ can be null for a particular VI. Consider a hypothetical verbalizing suffix *-ga*, which, with its host, corresponds to a prosodic word and which is associated with the constraint-ranking B≫A:

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

(2) a. Master Ranking (or Weighting): A≫B≫C

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

Phase theory proposes that syntactic structure is transferred to the morphological and phonological components of grammar in chunks or phases (Chomsky 2001). A standard assumption is that C, v, and D are phase heads which trigger spell-out of their complement, hypothetically supplying phonology for domains for phonological processes (cf. Pak 2008, Boskovic 2016, Cheng & Downing 2016). For us, this means that cophonologies take scope in their containing phase by default.

Three case studies involving tone supply evidence for this approach. These studies illustrate three necessary properties of a theory of phrasal phonology which follow naturally from our model: 1) Kuria shows that lexically triggered phonological processes cross word boundaries within a phase, 2) Guebie shows that phonological processes are suspended until the phase is completed, even if triggered by lower elements, 3) Dogon shows that multiple phase-internal cophonologies accumulate, and that conflicts can be resolved with constraint weighting.

Case study one: Kuria *v*Ps In Kuria (Marlo *et al.* 2015) different tense/aspect (TA) are lexically specified for tone patterns, assigning a high tone to either the first, second, third, or fourth mora of the verb stem (underlined below). From that position, tone spreads to the penultimate tone bearing unit:

(3) **Mora-counting H assignment in Kuria verb stems**

$\mu 1$	n-to-**o**-[hó̱ótóótér-a]	FOC-1PL-TNS-[reassure-FV]	'we have reassured'
$\mu 2$	n-to-**oka**-[hoó̱tóóté-éy-a]	FOC-1PL-TNS-[reassure-PFV-FV]	'we have been reassuring'
$\mu 3$	n-to-**re**-[hootó̱ótér-a]	FOC-1PL-TNS-[reassure-FV]	'we will reassure'
$\mu 4$	to-**ra**-[hootoó̱tér-a]	1PL-TNS-[reassure-FV]	'we are about to reassure'

The domain of this process is VP, the complement of v. For example in the $\mu 4$ tenses, the fourth mora of the whole VP receives H tone, which spreads to the object if the verb stem is less than four morae:

(4) **Mora-counting H assignment into object position**

$\mu 4$	to-**ra**-[rom-a eɣé̱tɔ́ɔɔ́ɔkɛ]	'we are about to bite a banana'
$\mu 4$	to-**ra**-[ry-a eɣetɔ̱́ɔ̱ɔ́kɛ]	'we are about to eat a banana'

In our model, the TA marker before the stem functions as a phase head in Kuria with grammatical features: [v,INCEPTIVE]. This marker spells out its complement VP as a phonological phrase (ϕ). The cophonology hosted by the phase head will apply to the phonological phrase created at spell-out. Adopting a toy constraint $\mu 4$ to capture the fourth-mora pattern, we suggest a lexical entry for *re-*: $\mathcal{F}$=/re/, $\mathcal{P}$=X-[$]_\phi$, $\mathcal{R}=\mu 4_\phi$, SPREAD-H, R $\gg$ IDENT-TONE.

Case study two: Guebie TP/CP Sande (2017) shows that the distinction between perfective and imperfective aspect, realized on T in Guebie, is marked by a tonal lowering process on the verb head. Guébie has four distinct tone heights, marked with numbers 1-4, where 4 is high. Tone on a verb surfaces one step lower in imperfective contexts than elsewhere.

(5) **Verb tone lowering in imperfective contexts**

a. e^4 li^3 ɟa-ɓə$^{3.1}$ 1SG.NOM eat.PFV coconuts-SG 'I ate a coconut.'

b. e^4 li^2 ɟa-ɓə$^{3.1}$ 1SG.NOM eat.IPFV coconuts-SG 'I am eating a coconut.'

However, 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.

(6) **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.'

Crucially the tonal shift, which is triggered by the imperfective T-head, can affect the subject tone, which is in the specifier of TP. While this process is difficult to account for both because of its scalar nature and the fact that it crosses word boundaries, it follows naturally from our model, where cophonologies of vocabulary items are inherited by the phase head containing them, and they apply to the whole spell-out domain, here TP.

The syntactic feature [IMPERFECTIVE] is associated with $\mathcal{F}$=Ø, $\mathcal{P}=\iota$, and $\mathcal{R}$=PITCHDROP $\gg$ IDENT-TONE. Here there is no underlying segmental or suprasegmental content to the imperfective morpheme. However, there is a cophonology associated with the T head, which percolates up to the CP phase containing the imperfective morpheme, and triggers a pitch drop between subject and inflected verb (cf. Sande 2017). This overrides the default ranking of IDENT-TONE $\gg$ PITCHDROP, only in imperfective clauses.

Case study three: Dogon DPs In Dogon, certain modifiers within a DP assign a tone melody to other elements inside it (McPherson and Heath 2016). For example, an inalienable possessor assigns a HL tone to its right (the noun), and an adjective assigns a L tone to its left (the noun, which can spread left to the inalienable possessor, if there is one: [[[Poss] N] Adj]. In such cases, there is a conflict between the cophonology associated with the possessor, and the one associated with the adjective. Different Dogon languages resolve this conflict in different ways, where in Nanga the lower cophonology seems to prevail while the opposite is true in Tommo So.

(7) **Different cophonologies take precedence in different Dogon languages**

Tommo So	Poss N^L Adj	ú **bàbè** mɔ̀ɲjú	2.SG uncle ugly	'Your ugly uncle' (cf. *bàbé*)
Nanga	Poss ^{HL}N Adj	ú **lésî** mɔ̀sí	2.SG uncle ugly	'Your ugly uncle' (cf. *lèsí*)

Both the possessor and adjective trigger cophonologes where tone melody assignment (of HL or L) outranks IDENT-TONE. Both cophonologies are inherited by the higher DP phase, and the relative strength (weight) of the constraints language determines which melody surfaces (McPherson 2014). In Tommo So, adjective tone assignment outweighs possessor tone assignment, but vice versa in Nanga.

Further extensions This model has a number of clear applications beyond cross-word phrasal phonology like the case studies described above. For example, category-specific phonology on nouns and verbs (Smith 2011) follows from the assumption that category forming n and v heads are phases and can be associated with cophonologies. Such an approach can be extended to compound-specific phonological processes contained within n, which are also common. Last, instances of domain-internal morphological counter-cyclicity, such as outward-sensitive allomorphy (Deal and Wolf 2013), portmanteaux, and multiple exponence could all be captured using phase-internal optimization.